



United Circles

Networked industrial-urban symbiosis value chain demonstrators for biomaterials, C&DW, circular water loops & WWTPs, driven by Hubs4 Circularity

H4C Community of Practice - 26th March 2025



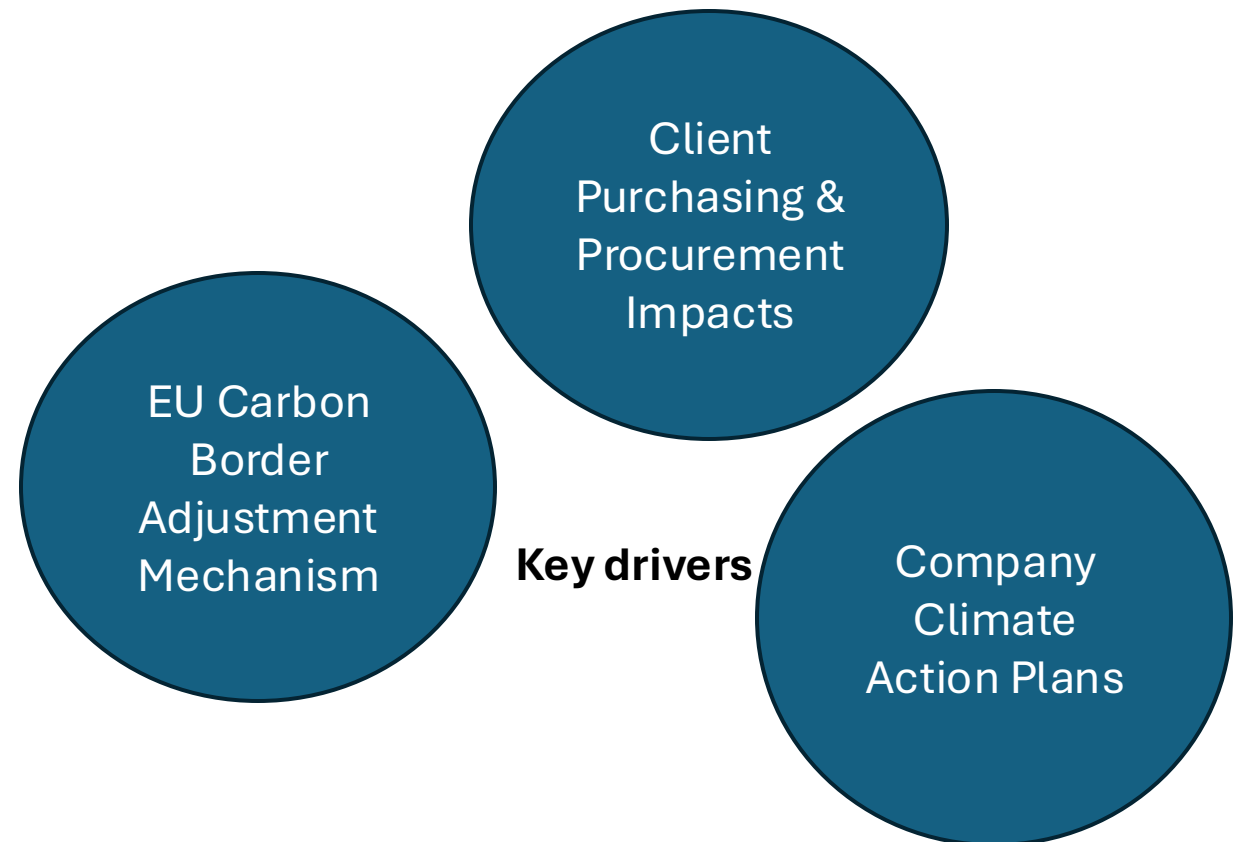
**Funded by
the European Union**

Content

- ✓ *The need – Why United Circles?*
- ✓ *United Circles' approach.*
- ✓ *Hub overview.*
- ✓ *Facilitation frameworks.*
- ✓ *Digital tools.*

The need - decarbonisation

Process industries need to decarbonise their input feedstock and processes to achieve carbon neutral steel, cement, chemicals, plastics, ceramics and other products.



The need – making it work

This is not happening today because of two major challenges

Due to **lack of constant quality + processing costs** to sort, filter and upgrade



Ceramics



Steel



Concrete

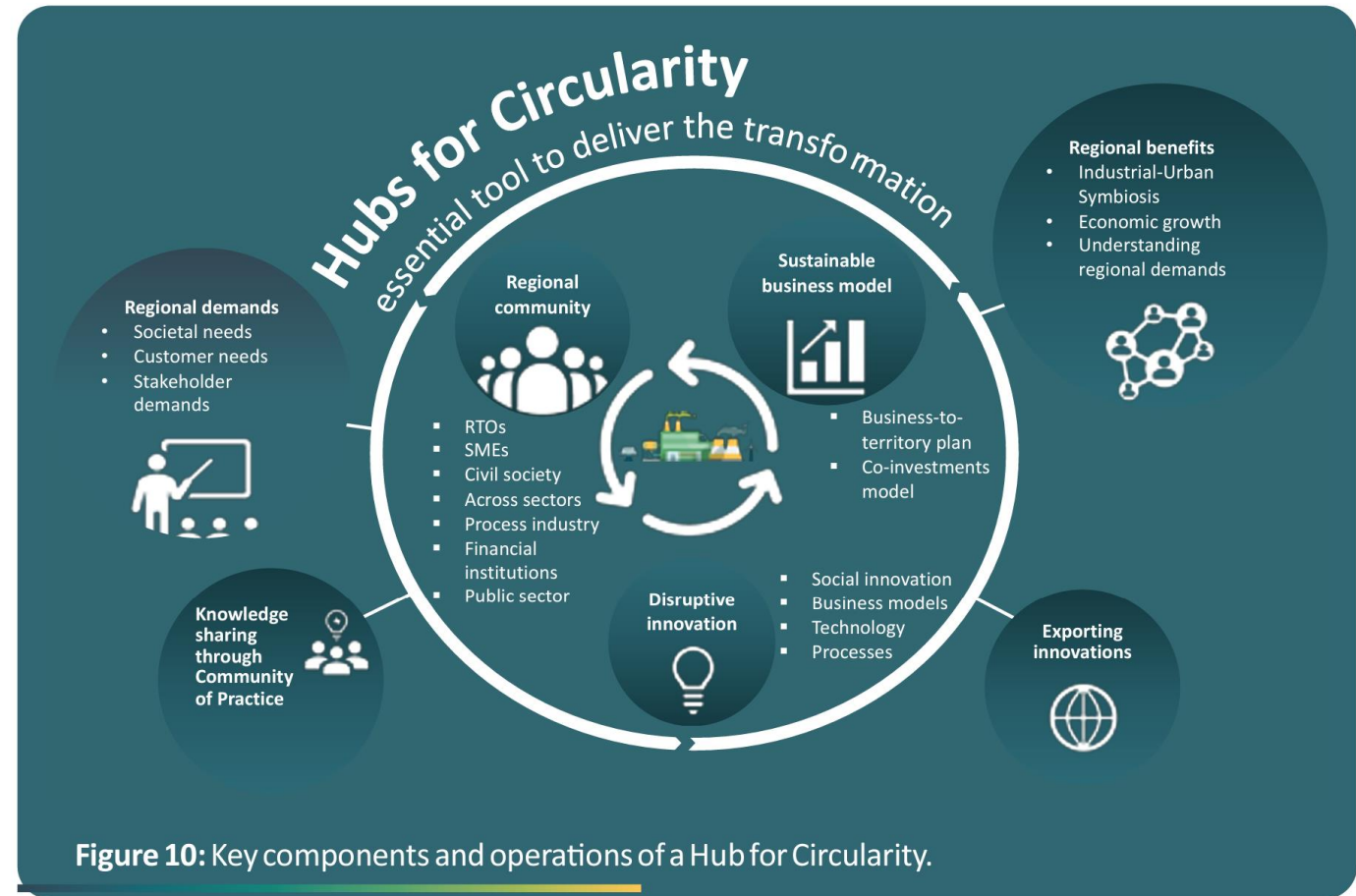


Glass

The need - collaboration

Industry and regional governments and other actors need to collaborate to achieve circular value chains, which has led to the concept of a Hub for Circularity.

- **A Hub for Circularity** is a network of organisations & individuals, that seeks to create the regional industry-society collaboration necessary to develop industrial and industrial-urban industrial symbiosis solutions within local and industrial contexts.
- Their objective is to contribute to significantly reduce CO₂ emissions, increase energy and resource efficiency and shift towards zero waste materials management.



Hubs for Circularity concept of the Processes4Planet partnership

United Circles partnership approach



- **Ankara, Salamanca and Veneto** will each form a Hub 4 Circularity around technology demonstrator efforts for scaling to a mature circular value change.



- Four further regions will setup a '**Mirroring Hub**' to strengthen their partnerships, explore the potential for replication of 1 or more of the demonstrators at full scale, and work towards bringing industrial investment to the region.



Each of the Demonstrator H4C will be followed by four Mirroring Hubs for replication



Southern Transdanubia, Hungary, starting H4C hosted by Digital Innovation Hub INM & water tech company Grunwald (GRUN), with commitment by City of Pecs.



Eastern Macedonia & Thrace, Greece. Starting H4C hosted by the regional authority (EM&T) and Technical Univ. of Athens (NTUA).

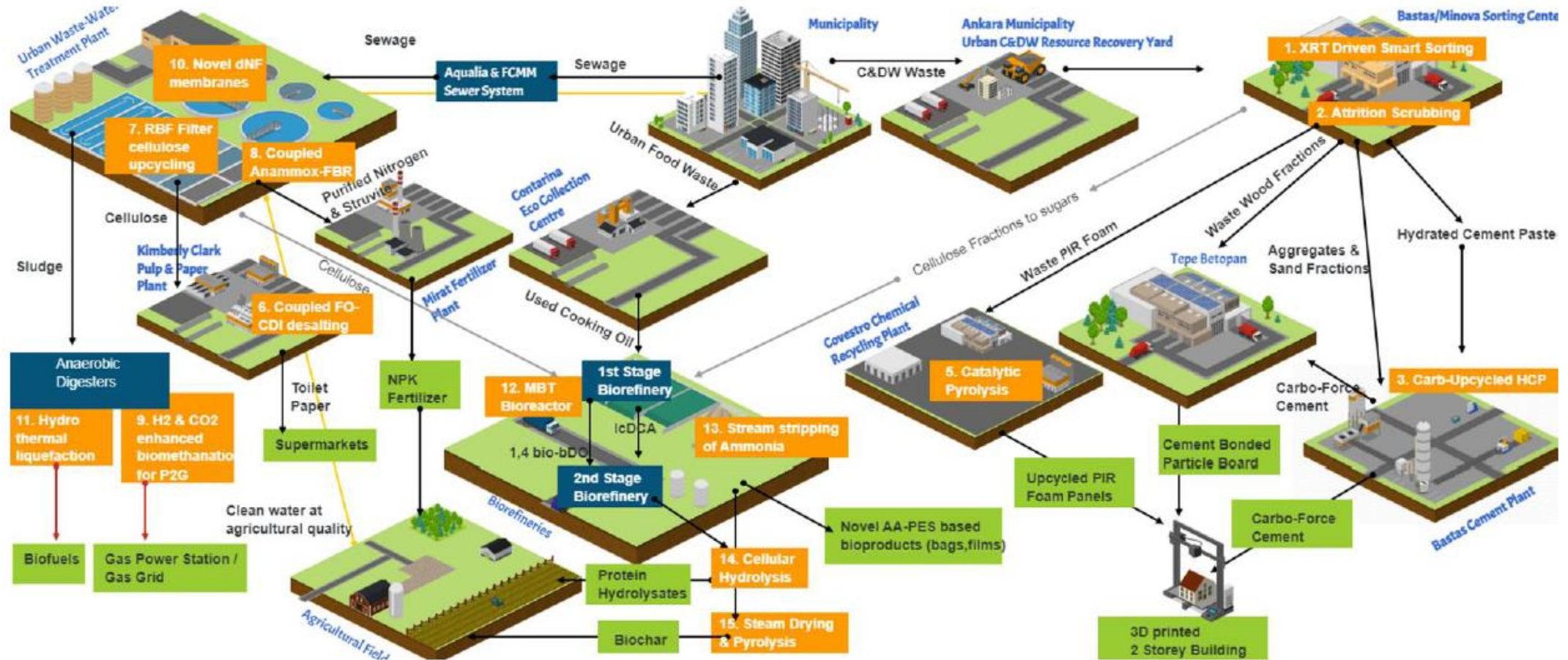


Gauteng, South Africa. Starting H4C hosted by University of Johannesburg (UoJ) with commitment from the City of Johannesburg & Gauteng government.















South-East England, UK. Starting H4C hosted by the community actor Tech Take-Back (TTB) & Kent County Council (KENT).

Critical technology innovations at scale



Critical technology innovations at scale

No.	Description	IUS Value chain
1	XRT-Driven Smart Sorting for enhanced lower capital cost separation of C&DW fractions	 C&DW   
2	Attrition Scrubbing for liberation from waste concrete of Cement Paste, Sand and Aggregates	
3	Carb-Upcycled HCP™ carbonation of Cement Paste to obtain low-carbon upcycled cement	
4	Alkali reactor for full upcycling of waste wood fractions in Cement Bonded Particle Board	
5	Catalytic Pyrolysis incl. chemical pre-treatment for PIR foam upcycling to pyrolysis oil	
6	Coupled FO-CDI desalting for 100% circular water use in Pulp & Paper industry	 Waste-water   
7	RBF filter cellulose upcycling to obtain purified cellulose from Urban Waste-Water (UWW)	
8	Coupled Anammox-FBR to extract nitrogen & phosphorus from UWW into NPK fertilizer	
9	H2 & CO2 enhanced methanation for P2G for UWW sludge to AD to syngas for P2G grid load balancing	
10	Novel dNF membranes for tertiary UWW purification incl. PFAS removal for agricultural water reuse	
11	Hydrothermal liquefaction of bio stabilized waste to obtain value-added biofuels	 Food waste   
12	MBT bioreactor for converting Used Cooking Oil to lcDCA biochemicals for bio polyesters	
13	Steam-Stripping of Ammonia from AD sludges for recirculation in biorefinery fermentation	
14	Cellular Hydrolysis of biorefinery call debris to obtain Protein Hydrolysate plant biostimulants	
15	Steam Drying and Pyrolysis to convert Anaerobic Digestion sludges into biochar for agriculture	

Demonstrator



Mirroring



Circular value chain delivery

Related Project actions	Hub for Circularity potential achievements
H4C & Industrial-Urban Symbiosis Community of Practice building	Network mapping & outreach to initial interested parties
H4C Charter Development	Define the mission & vision for the Hub for Circularity with involved parties
H4C Setup, governance and decision-making processes and seed hubs	Setup the Hub for Circularity with a governance structure and decision-making, enable membership structures, setup activities, work on further funding for Hub operations.
H4C Membership extensions, business model, and continuous delivery	Continue to seek further memberships, enrich the business model and make it possible for the Hub to become a permanent network.
H4C wastes mapping and screening	Map the wastes in the region for the chosen waste(s) including their quality where needed (e.g. laboratory tests) to match with technologies
H4C Industrial-Urban Symbiosis flow and process design	Create a scenario on how the urban-industry feedstock creation scenario would look like technically.
H4C Economic, Environmental and Social Sustainability analysis	Carry out assessments on job creation, carbon emissions impacts, and economic impacts from a broader perspective (for all parties)
H4C Demonstrator replication agreements, pre-technical design and financial prospectus	Formalise collaborations with parties in the Hub including industry partners, create the investment plan.
H4C FOAK Financing outreach and lobbying	Reach out to financial institutions and financiers to become a part of the Hub and support with investment following the investment plan.

Hub's philosophy



H4C Governance & Operations



H4C institutional structure development & fundrasing

1	Feasibility toward financing methodology	1	Financial lobbying	3	Advisory boards	1	AI recommender
2	Financial prospectus	2	Hubs' charter	4	Vertical integration with EU CoP	2	Clustery digital ecosystem builder



H4C Social Environmental innovation



Local and regional capacity building & social change

3	H4C Social & Environmental Evolution framework	5	Young people workshops	7	Creation of CoP	4	H4C Evolution dashboard
4	Life cycle sustainability assessment (LCA, LCC, Social-LCA)	6	Testing social acceptance	3	Green targets tool (GRETA)		



H4C Products & Material observatory



Value creation for technology innovation & markets

5	Digital Product & Material observatory framework	5	TRACID for Material & Product Passport	7	Regenerate explorer tool		
6	H4C Waste mapping methodology	6	IUS flow catalogue for data exchange	8	IUS designer		

Horizontal methodologies

Hubs' actions

Digital tools

Knowledge and impact transfer

Seed Hubs



Seed Hubs



Seed H4C

Starting from scratch with 1-3 organisations to setup a starting hub

Approx. €50k/year investment available, seeking €500k+ funding for 2 years of starting hub stage

Mirroring Hubs



Starting H4C

Governance structure + business plan for setting up FOAK value chains

Commit partners to develop initial B2T strategy.

Seeking €1.5+ million invest/year to establish IUS demonstrators

Demonstrator Hubs



Intermediate H4C

At least 1 FOAK value chain demonstrator (TRL7)

Focus on advancing B2T strategy, FOAK value chain demonstration.

Seeking €10+ million invest/year for scaling to TRL8



Advanced H4C

At least 1 FOAK operational value chain (TRL8)

Actively implementing B2T plan to accelerate IUS network and implementing their TRL8 FOAK value chains

Seeking €30+ million invest/year for scaling to TRL9.



Mature H4C

Multiple FOAK commercial value chains (TRL9).

Continuous IUS network improvement, lighthouse for export replication to other regions.

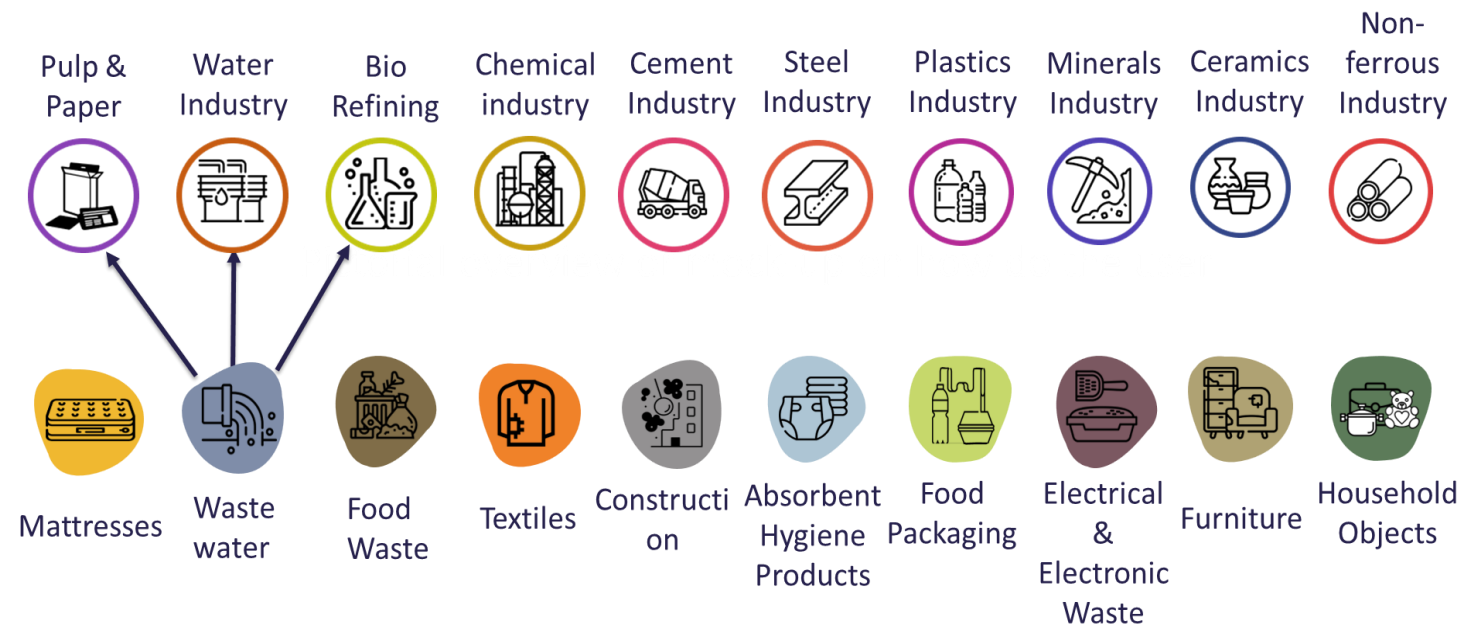
Seeking €100+ million invest/year for expansion + export

Salamanca HUB



- Located in the autonomous community of Castilla y León in western Spain.
- Population: 145.000 people.
- Key industries include food processing, chemical manufacturing, leather, metal, and furniture production. Additionally, tourism plays a significant role, driven by the city's rich historical and cultural heritage.

United Circles Demonstrator Value Chains of focus for the Hub



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Hub Lead: AQUALIA



- Water management company. It is part of the FCC Group.
- Serves over 45.2 million users across 18 countries.
- Specializes in the integral water cycle management, which includes the capture, treatment, and distribution of water for urban areas.



Hub Partner

- FCC Medio Ambiente
- Division of the FCC Group, specializing in environmental services.
- Serves over 67 million people across 5,400 municipalities in 11 countries.
- Expertise includes the collection, treatment, recycling, energy recovery, and disposal of solid urban waste.



Hub Partner

- Electrochaea
- Energy storage solutions. It focuses on commercializing a grid-scale power-to-gas (P2G) technology1.
- Has approximately 64 employees.
- Converting renewable energy and carbon dioxide into renewable methane



Hub Partner

- Kimberly-Clark
- American multinational corporation that produces mostly paper-based consumer products.
- Employs approximately 41,000 people worldwide.
- Personal care and consumer products.



Hub partner

- Private, non-profit research and technology centre.
- Based in Spain, Castilla y León region.
- Founded in 1994.
- Employs over 150 people.
- Expertise spans several fields, including energy, food, industry, construction and infrastructures, health, and environment.



Hub Partner

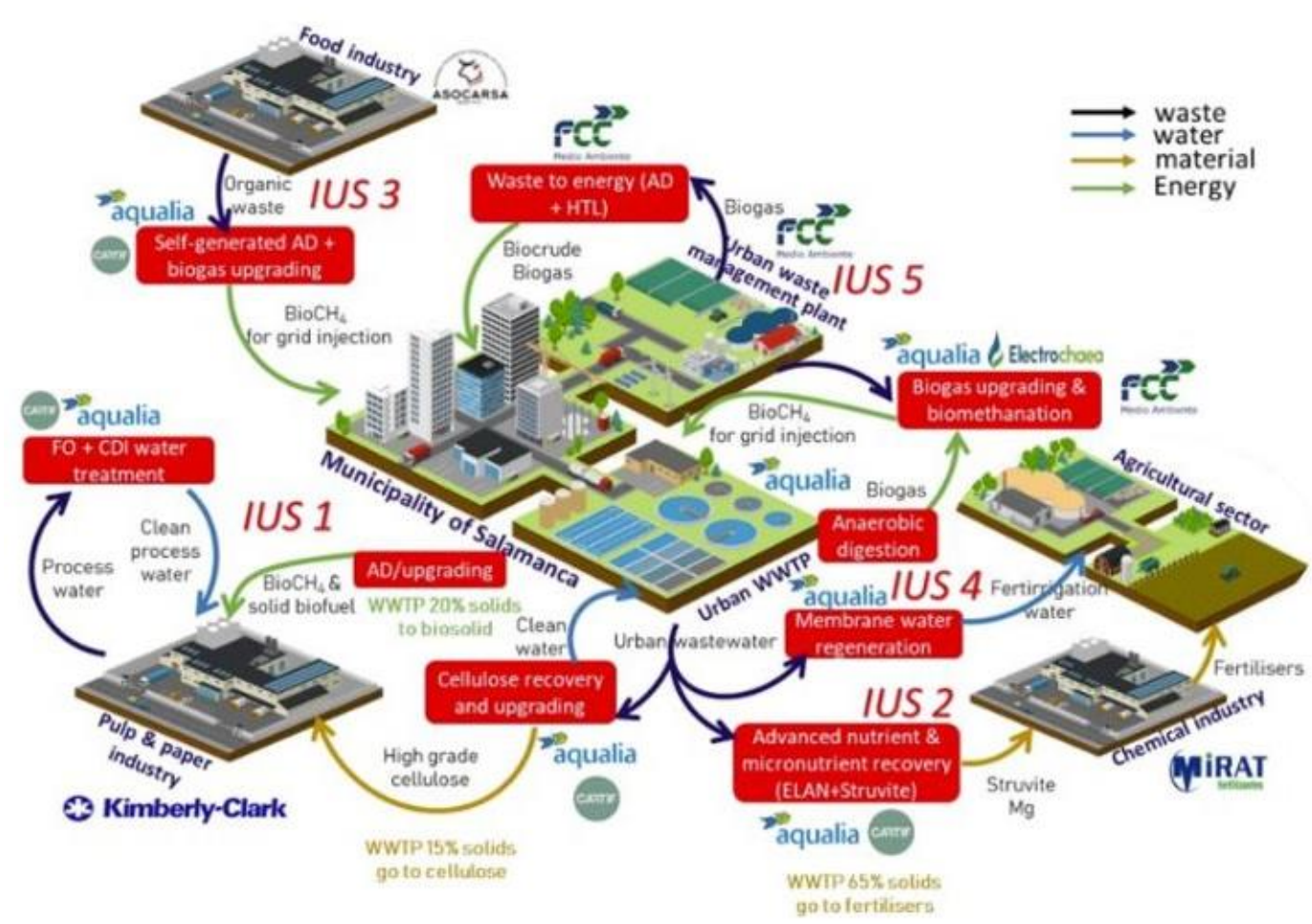
- Mirat
- Group of companies primarily involved in the agricultural sector.
- Presence with over 20 delegations and work centers across Spain
- Specializes in the manufacture and distribution of fertilisers and organic-based inputs for agriculture, including certified products for organic farming.



Hub Partner

- Fundación Patrimonio Natural de Castilla y León.
- Circular Economy Strategy of Castilla y León coordinator and leader of the regional participation as a pilot in CRRI.
- Has approximately 150 employees.
- Founded in 2005

Salamanca HUB

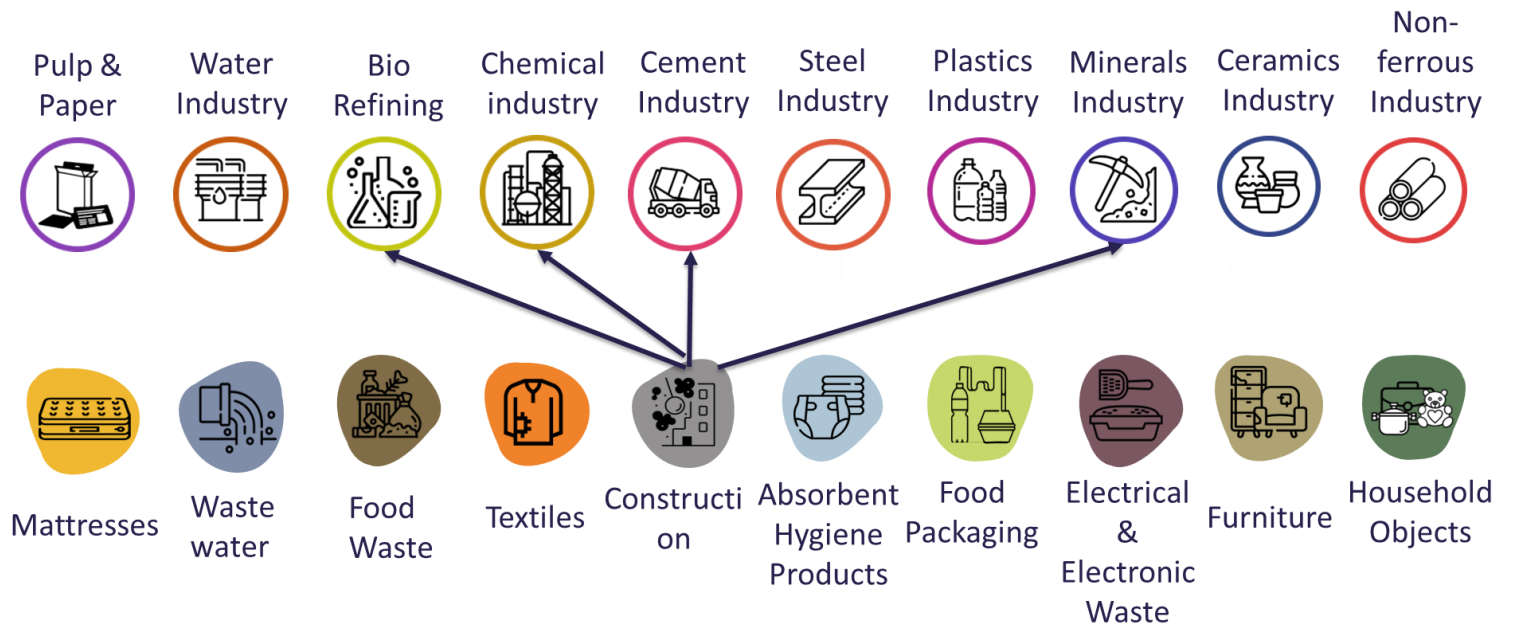


Ankara HUB



- Region of the Hub: Ankara Province, Turkey
- Population: 5.8 million
- Capital city of the region: Ankara
- Main industries/economy: Defense and Aerospace, Machinery and Metal Products Manufacturing, Information and Communication Technology (ICT), Construction and Real Estate

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Hub Lead:



- Ekodenge is a team of sustainability experts providing consultancy, engineering, architecture, and software solution services.
- Country / region: Turkey / Ankara
- Founded in 1996; Employees: 20
- Expertise: Sustainable Urban and Regional Planning, Circular Economy and Resource Efficiency, Digital Solutions for Environmental Management, Life Cycle Assessment (LCA), Industrial Symbiosis and Resource Optimization, Digital Product Passport Development

United Circles Ankara Hub network



Members of the consortium



Hub Partner

- BAŞTAŞ Cement
- Large Industry
- 1,438 employees
- Cement and concrete production



Hub Partner

- Tepe Betopan
- Large Industry
- 200 employees
- Cement particle board and fiber-reinforced cement board production



Hub Partner

- Minova Minerals Processing
- SME
- Smart sorting



Hub Partner

- Türkiye İMSAD
- Association
- Umbrella organization for construction materials producers



Hub Partner

- Intract
- SME
- IPR support

Prospective Partner

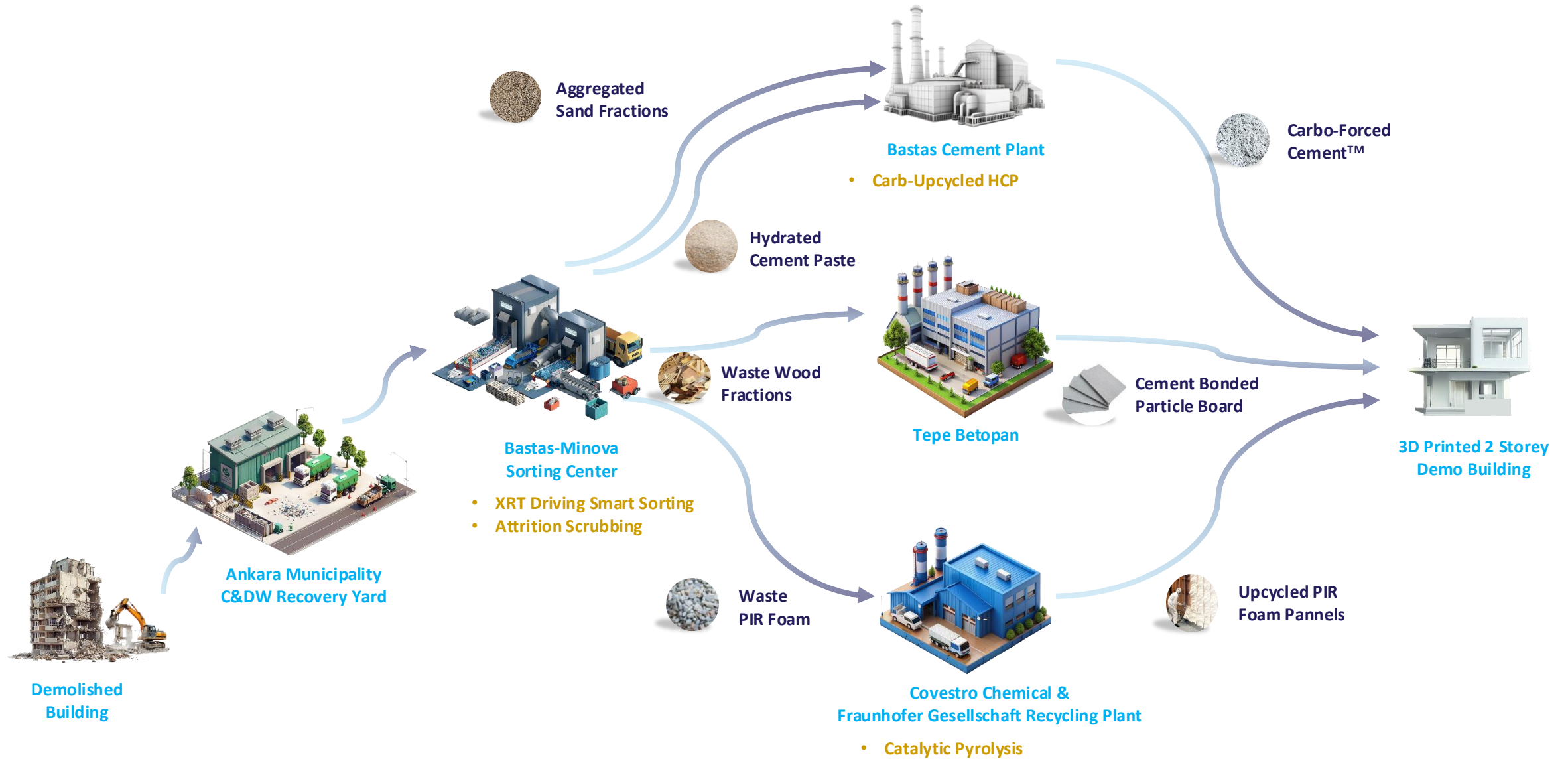
- Ministry of Environment, Urbanization and Climate Change



Prospective Partner

- Greater City Municipality of Ankara
- Municipality
- Urban CDW collection, storage and management

Ankara HUB

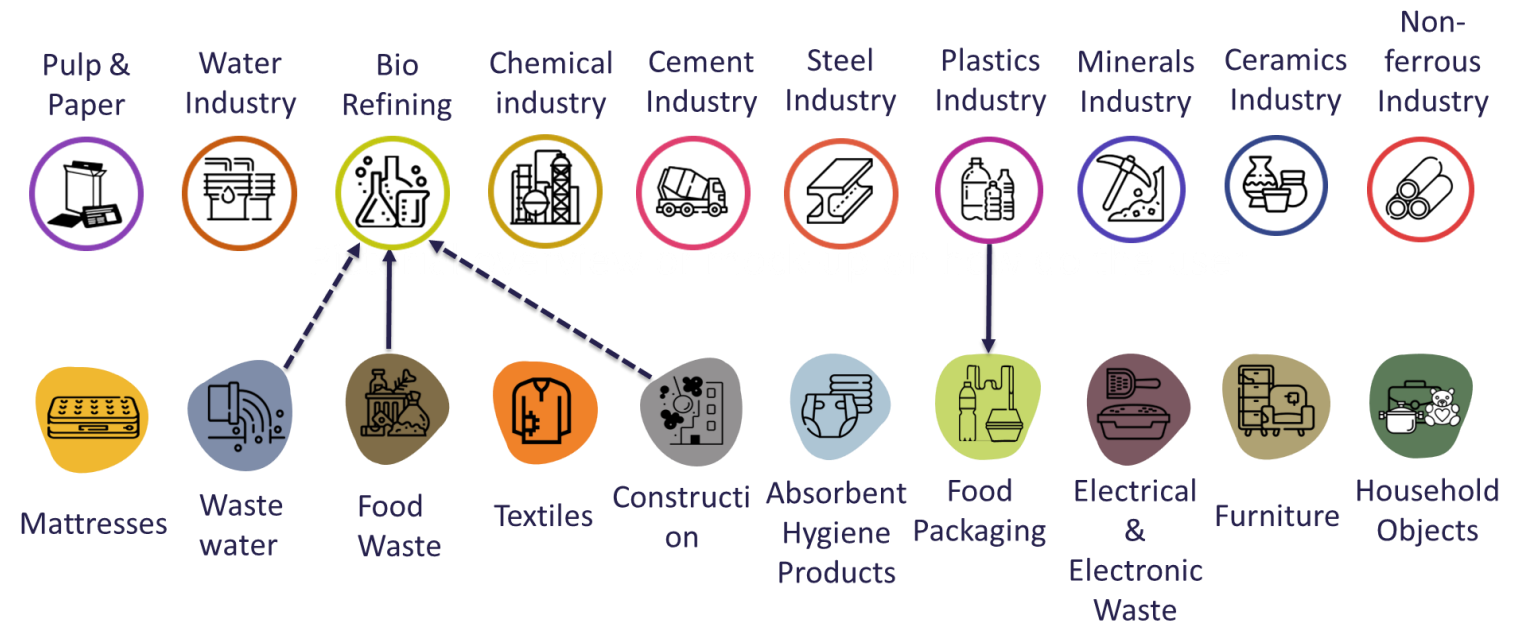


Veneto HUB



- Veneto Region
- 4.8 million inhabitants
- Capital City: Venice
- Main industrial sectors: Agro-food, textile, footwear and furniture sectors

United Circles Demonstrator Value Chains of focus for the Hub



Veneto HUB

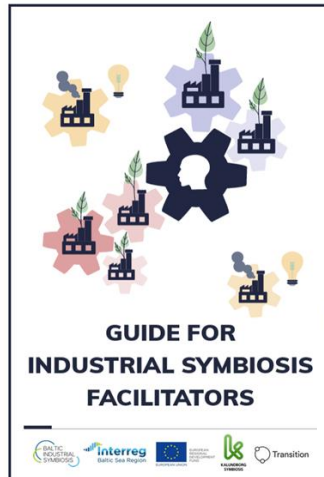


- **NOVAMONT**: producing bioplastics; developing biochemicals and bioproducts of renewable origin
- **MATER BIOTECH**: Industrial Plant for the production of butanediol (1,4 BDO) by biotechnological processes
- **NOVAMONT IBERIA**: sited in Barcelona, since 2020 has worked to develop and enhance the presence of Novamont Group in the Spanish market
- **CONTARINA**: managing the waste collection system and waste disposal in Veneto Region
- **SHERPA**: spin-off of the University of Padua (IT) to support territorial development by applying scientific social technologies
- **LEGACOOP**: Legacoop is a national apex organization representing cooperatives in Italy that works to promote the development of cooperatives and to promote the diffusion of cooperative values and principles

Hubs 4 Circularity Facilitation frameworks

How to initiate & facilitate the realisation of circular value chains based on industrial-urban symbiosis?

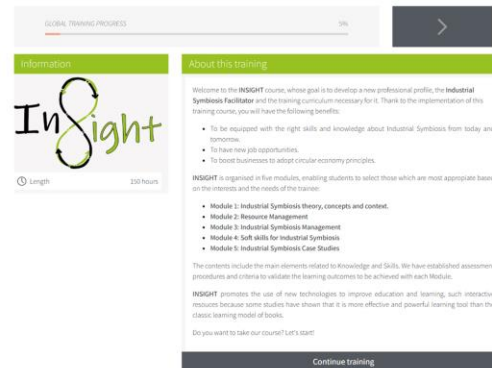
Existing framework examples



Kalundborg guide

Insight project course

INSIGHT course - Fostering Industrial Symbiosis through the development of a novel and innovative training approach



United Circles frameworks and guidance

Circular Value Chain
Infrastructure
Feasibility to attracting
Financing framework

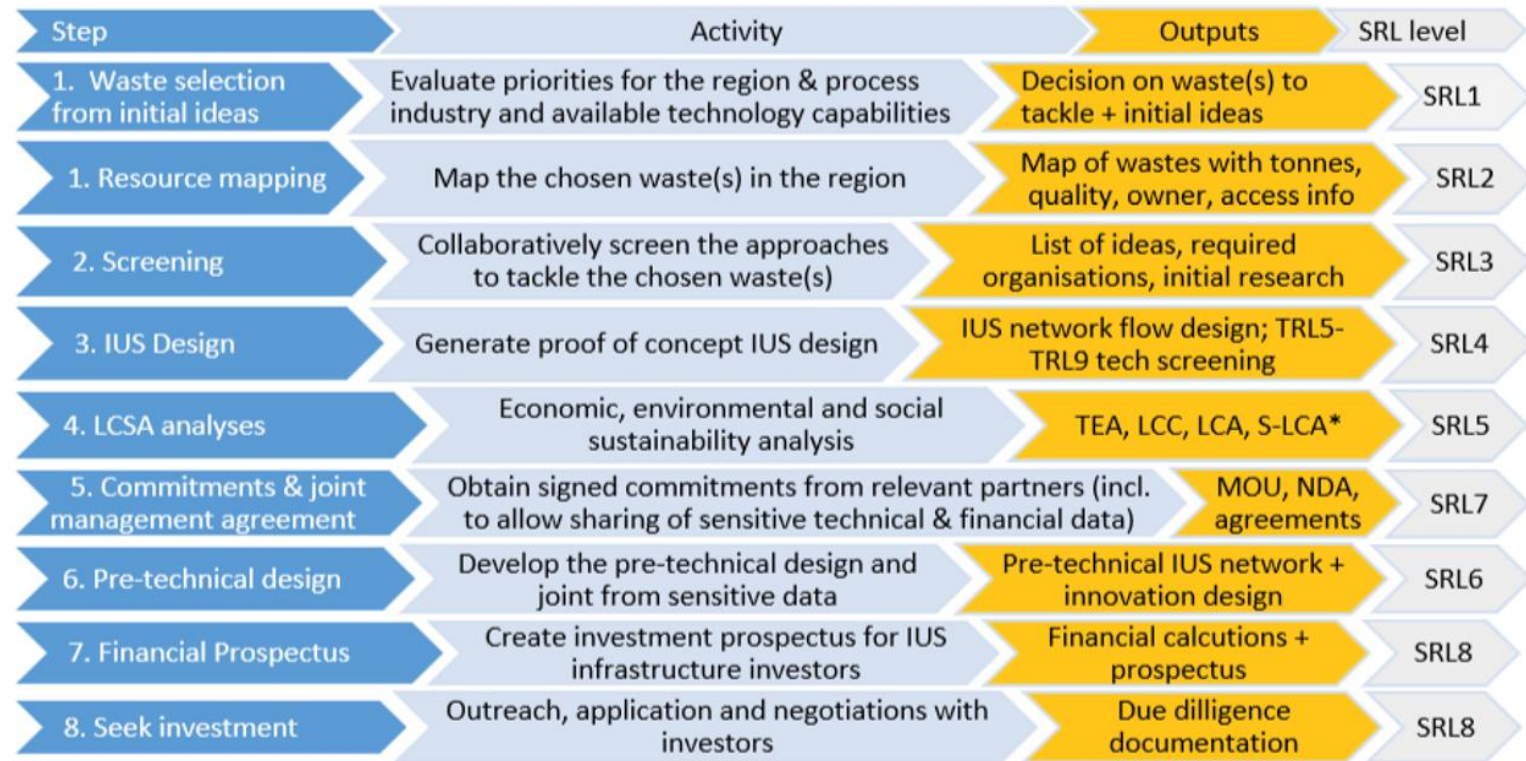
Citizen Social Impact
Assessment &
Community
Engagement
Framework

Waste Mapping
Framework

Training programme for
Hub4Circularity
Facilitators

Hubs 4 Circularity Facilitation frameworks

- Providing guidance for industrial-urban symbiosis facilitators
- What studies are needed to get TRL7 demonstrators or TRL8 large scale circular value chain pilots off the ground.
- End goal: raising €5 to €200 million of investment
- The framework will be developed in a pre-standard (CWA).



Hubs 4 Circularity Facilitation frameworks



Create an **analytical framework to evaluate social impacts** of a Hub 4 Circularity with a focus on **employment, equitability and equality** in relation to achieving a healthier environment.



Develop **approaches for community and citizen group integration** in the Hubs Community of Practice



Inform Social Life Cycle Assessment methods.

Urban Wastewater Solids Example

Example:

United Circles Achievement

Waste-water & sewage upcycling;
Ending river discharge of treated waste-water



Healthier environment

- No more sewage discharge in Rivers;
- Conservation of precious freshwater resources;
- Protection of aquatic ecosystems & supporting biodiversity



Citizen benefits

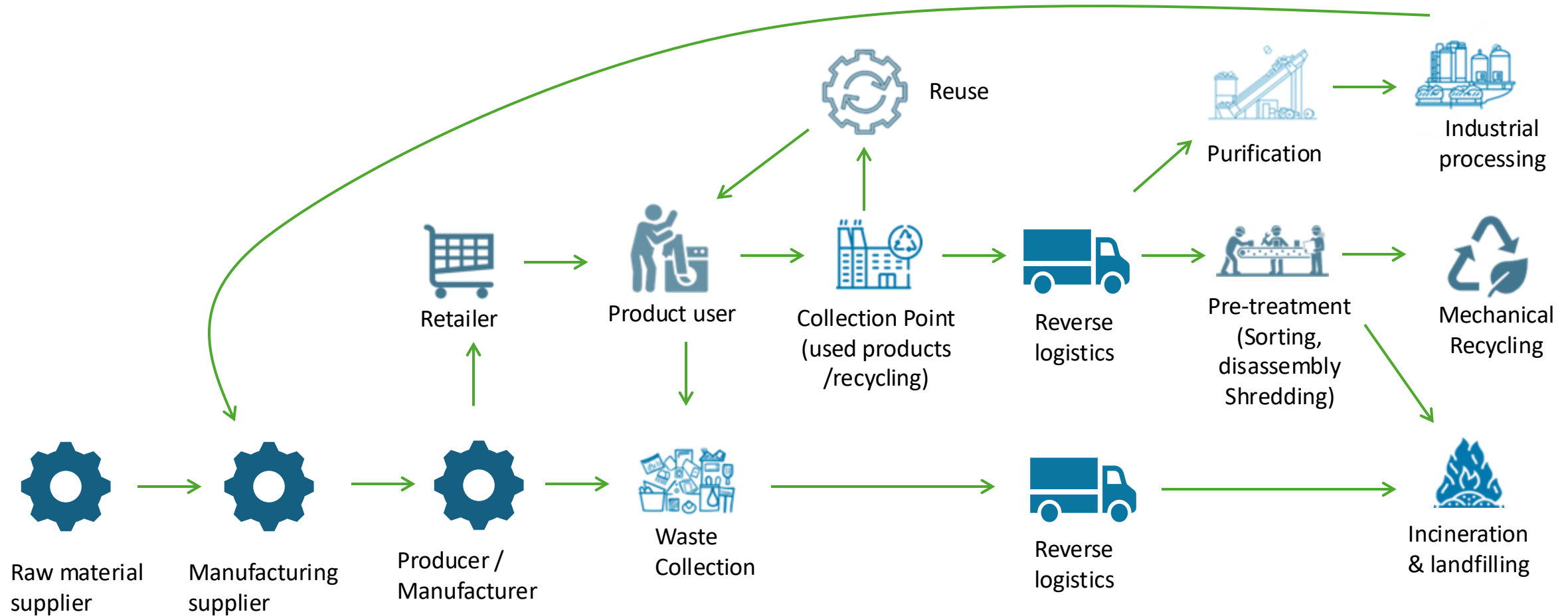
Citizens can swim in the river

Digital toolkit

United Circles Digital Toolkit	
Regenerate Explorer	Mapping resources and sites in a geographical area with an extended tagging and filtering search system. Easy structuring of information on existing available wastes and processing facilities.
AI Recommender	Web scraped database to extract key info using queries focusing on information needs for regions and cities. Will allow to extract technology options, actors, best practices, legislation and skills needs and funding.
IUS designer	IUS design capabilities to create process-flow links with technology innovation evaluation.
GRETA	Designed to assess the sustainability and circularity performances of products, integrating LCA and MFA.
TRACID	Digital Product Passport system for life-cycle events is being developed as part of the CircThread. The solution will be advanced for material passports of batch shipments, considering unique identification & traceability.
IUS Flow catalogue	The catalogue is a centralised repository that will gather exchange flow critical documents and lab & engineering material-process specifications related to IUS flows (peer-to-peer relation among two parties) within a Circularity Hub's network

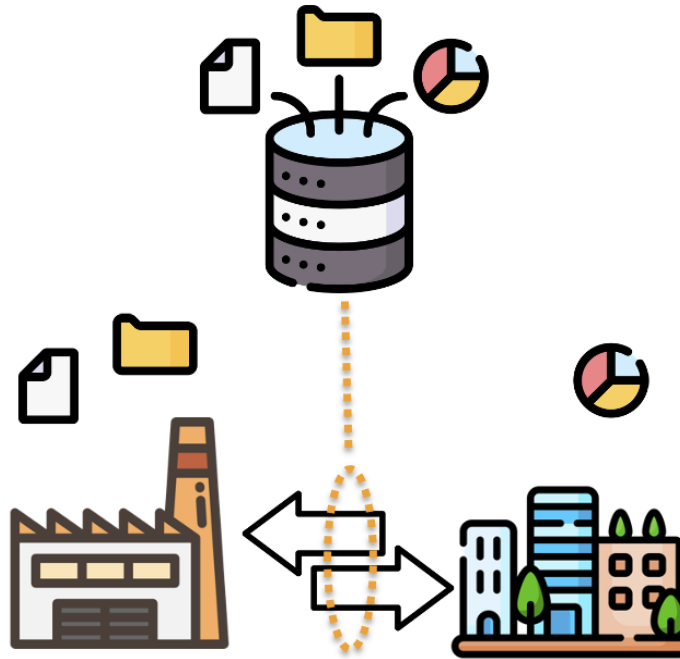
Material & Product Observatory Concept

Create a common platform where for a region a Hub can understand the waste and product flows for particular material(s) for continuous improvement.



IUS information exchange

- Centralized repository
- Enable sharing of critical symbiosis documents
 - Material flow and specifications.
 - Laboratory and engineering processes.
- Applicable within the network of actors in a Circularity Hub.
- Exchange formats.



- A catalogue for each H4C.
- Navigation through the different flows of materials and associated sensitive documents.
- Track based access control.
- Exchange of material and energy quality data.
- Optimize assessments, design and decision making within H4C.
- Real time/event-based/static information.

United Circles' team



THANK YOU



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