

Project Acronym: Cradle-Alp
Project number: ASP0100003

D.2.1.2

Transnational sectoral working groups (TSWG)

WP n°:	2
Activity n°:	2.1
TSWG:	Polymer
Author(s):	Roxane Girard / Polymeris
Contributors:	Adrien Simon/ Polymeris Tobias Scharzmüller / Chemie Cluster Bayern Sabine Reising / Chemie Cluster Bayern
Dissemination level:	Public
Revision:	FINAL
Due Date:	30/04/2024
Date of submission:	30/04/2024

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1. Introduction to Cradle-ALP project

Cradle-ALP aims for mainstreaming cradle to cradle (C2C) approaches, circular design and circular substitutions (from the alpine region) for linear products in industrial processes, in different industrial sectors. The Alpine Space has many natural resources and the technologies to substitute fossil raw materials and toxic substances from production with circular and environmentally friendly alternatives. This should lead to the fact that materials and products can be led back into a healthy cycle after use. The focus of this project shall be on the substitution of chemical and fossil based/unsustainable materials with more circular, sustainable and bio-degradable ones.

First, the partners will build a broad awareness and understanding in the public, the relevant industries as well as among stakeholders from policy and innovation intermediaries, for the opportunities, barriers and mechanisms of the transformation of industrial products towards higher circularity by means of C2C approaches, circular design and circular substitutions. Business support providers shall be trained to accompany the transformation of businesses along more circular value chains.

In a second step, the partners will explore in details and test opportunities for implementing C2C approaches, circular design and circular substitutions along specific value chains in the chemistry/plastics and wood/forestry sectors supported by digital technologies. Building on a thorough multidimensional (technology, policy, economy, etc.) roadmapping exercise, transnational groupings of stakeholders – including businesses – will be installed, with the aim to transfer the C2C roadmaps into industrial practice along exemplary value chains.

Finally, the partners will work towards ensuring a transnational policy convergence towards transnational S4 strategies in the priority sectors of the project and initiate common cross border funding instruments for the industrial C2C transformation.

2. Objectives and scope of the sectoral Cradle2Cradle industrial transformation roadmaps

By the end of period 2 (April 2024) the Cradle-ALP partners will elaborate **5 circular transformation roadmaps** for the 5 industrial sectors identified as key sectors for the Alpine space:

- Chemistry/Materials
- Polymers/Composites
- Packaging
- Textiles/Fibres
- Wood/Furniture

The roadmap methodology was prepared by Chemie Cluster Bayern, leader of WP2 **Roadmaps to Cradle2Cradle transformation**, and Polymeris, leader of Activity 2.1 **Develop sectoral Cradle2Cradle industrial transformation roadmaps in five selected sectors**, with the support of all Cradle-ALP partners.

Roadmapping is a process that generates information on the status of products and technologies in an innovation context at a specific point in time and on the type, speed and

direction of possible research and technology developments, aggregating possible challenges and translating them into activities, requirements and milestones. The goal of the Cradle-ALP Transformation roadmaps is to have a structured guidance on how to foster the transformation of industrial practices towards circularity & cradle-to-cradle approaches in the 5 key industrial sectors for the Alpine Space.

The first step of the Cradle-ALP roadmapping process was to define a vision that aligns the stakeholders from each of the 5 industrial sectors (businesses, public authorities, academics etc.) on a joint understanding of what is the ideal scenario for the future in their industrial sector, in a given timeframe. It refers to a clear and inspirational description of the future state that an industry aims to achieve to become more circular.

To do so, the partners first worked on analyzing their industrial sector ecosystem in the Alpine Space region with respect to circular economy in general and the cradle-to-cradle principles in particular. Based on the information collected by each partner within its region, the TSWG leader elaborated a sectoral ecosystem analysis that was then presented to the experts during the expert's workshops in order to engage discussion and collect input and recommendation (for more information see D2.1.1). Experts from each sector gave input and recommendation on the ecosystem analysis but also on the definition of an overall and realistic goal that the Cradle-ALP partners could set for each of the 5 transformation roadmaps.

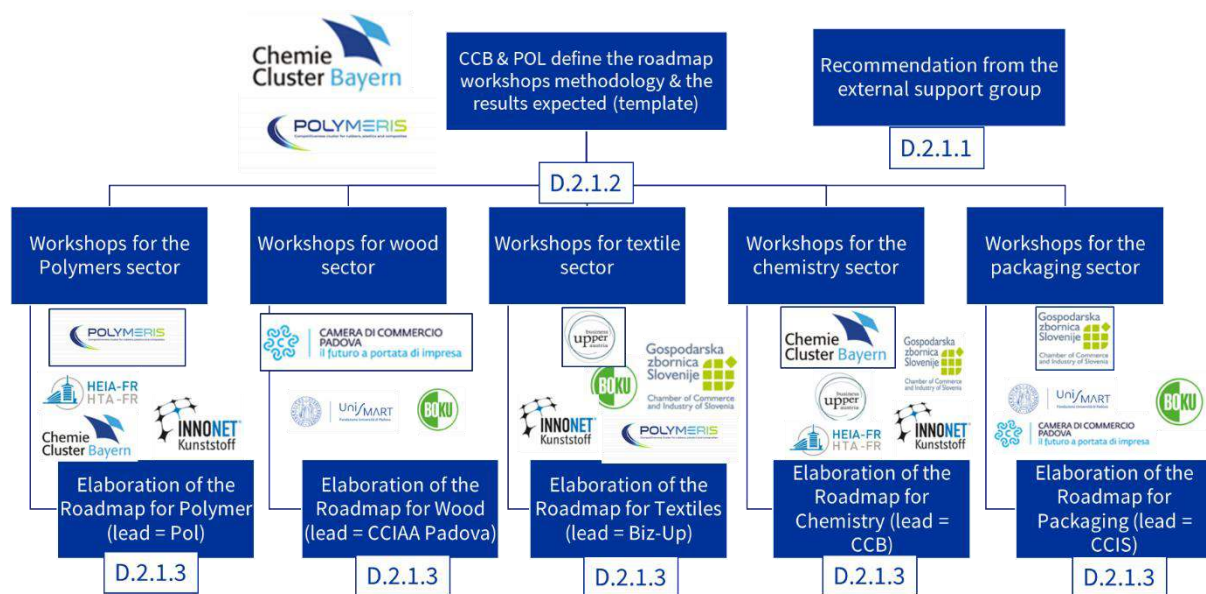
Following the exchanges and collection of input from the experts, each TSWG gathered to reflect and identify, based on the information collected, a common vision to set for their industrial circular transformation roadmap. It was also decided to organize 3 roadmapping workshops focusing on the 3 main level of the industrial value-chain: the first workshop was dedicated to materials & resources, the second one to circular product design and the third one to value-recovery & the management of the products' end-of-life.

The 3 workshops followed the same roadmapping process and engaged the participants on 3 key exercises:

- 1) Identifying potential gaps and barriers in knowledge, technology limitations, market structural barriers, regulatory limitations, public acceptance or other gaps and barriers preventing the industry to achieve the vision set out following the experts' workshop.
- 2) Defining solutions and key activities to implement to overcome the gaps and barriers previously identified. Those key activities must concern each component of the industrial sector, including technology development and deployment, development of business models and market opportunities, development of regulations and standards, policy formulation, creation of financing mechanisms, and public engagement.
- 3) Assigning the solutions and key activities according to their field (Technology, Business Model, legal/political) and their timeframe (short-term, mid-term, long-term) and voting on the activities that are the most important to implement and achieve.

3. Transnational Sectoral Working Groups implementation

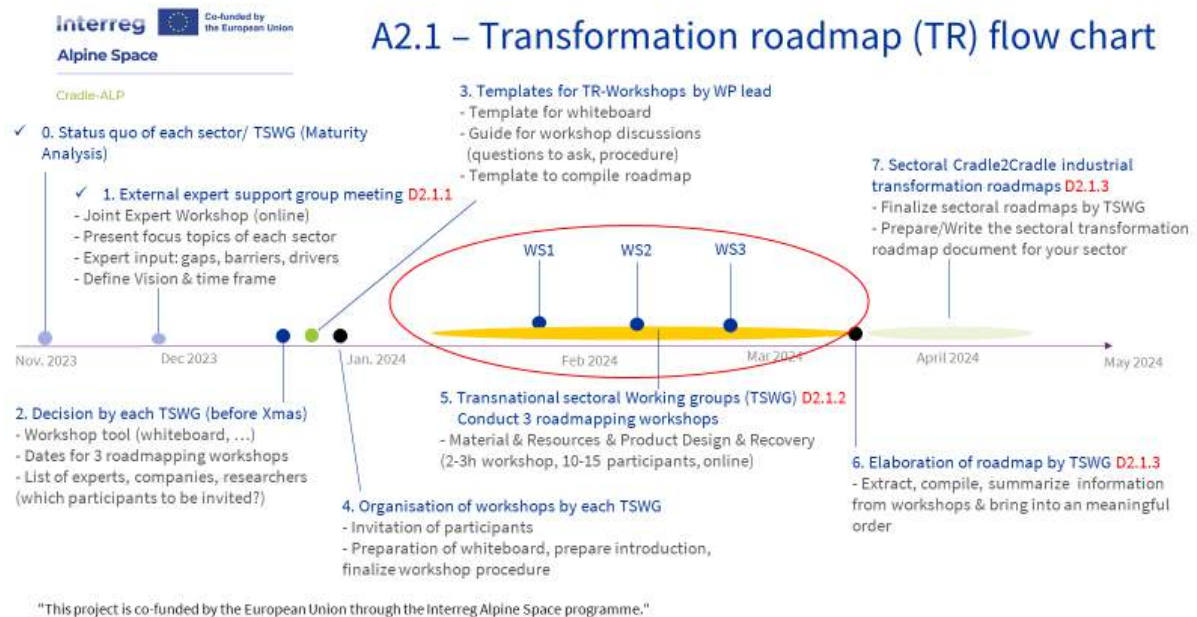
In order to implement the roadmap methodology, 5 transnational sectoral working groups were established and composed of partners with an expertise on the industrial sectors. The composition of the 5 TSWG is illustrated below, in figure 1.



Each industrial sectoral group is composed of partners from at least 3 different regions in order to insure cross-regional exchanges in the elaboration of the Transformation roadmap workshops. The only exception was for the Wood/Furniture sector which gather partners from Italy and Austria, so the Cradle-ALP partners agreed to all participate in participating to the TSWG and promoting the workshops within their own ecosystem in order to gather enterprises from different Alpin Space regions. The lead partner in charge of implementing the TSWG methodology is framed for each industrial sector. This composition of each TSWG was definitively validated by all partners during the Ljubljana project’s meeting in July 2023.

Alongside the roadmap methodology, Chemie Cluster Bayern and Polymeris elaborated a workflow process with key deadlines and activities to follow by each TSWG in order to implement the roadmapping methodology in their industrial sector.

The TSWG roadmap workflow and methodology is schematized in the figure below.



Each TSWG had to follow the same methodology in order to define joint procedures for the elaboration and testing of the industrial transformation roadmaps.

4. TSWG Polymer-based composites

4.1 Composition

This TSWG is composed of :

- Polymeris PP08
- Chemie Cluster Bayern PP03
- Technology Center Horb Innonet Kunststoff PP02
- School of Engineering and Architecture of Fribourg PP09

Through the 4 partners, the Polymers/composites TSWG covers the Auvergne-Rhône-Alpes (FR), Bourgogne-Franche-Comté (FR), Bavaria (DE), Karlsruhe (DE) and Swiss region in the Alpin Space.

4.2 Internal preparatory meetings

Each TSWG leader was responsible of organising a virtual “kick-off” meeting with all the partners involved in its sectorial group before the 15th of September. The goal of this meeting was to identify the sub-sectors on which each TSWG will focus for the roadmapping activities (ACT2.1) and the Pilot action (ACT2.2), to identify a list of tools that would be of interest for assisting SMEs in the Pilot action and to start the reflexion on potential SMEs and experts to involve in the roadmapping workshops and Pilot actions.

Cradle-ALP – D2.1.2 Transnational sectoral working groups (TSWG)

The TSWG had its first meeting on the 13th of September, online, to discuss about the sub-topics of focus for the Polymer TSWG and exchange views on pilot tools that could be of interest for SMEs in the frame of Activity 2.2. One participant per partner was present at the meeting.

The main sub-topics of focus were identified below:

Main topics of focus:

- Bio-based Polymers & additives, biodegradable polymers
- Collecting, identifying & sorting industrial polymer waste
- Recycling processes & technologies with a focus on next generation technologies (chemical recycling, digital passport etc)

Topics excluded:

- No sectors directly addressed in the transformation roadmap.
- Pilot Groups (Act 2.2) will focus on the specific sectors: constructions, building, Sports & outdoors equipment in link with mountains activities, industrial packaging.

The main pilot tools were identified by the partners to support the SMEs in testing the circular transformation roadmap in pilot actions:

Workshop methodologies to support companies in their circular strategy:

- Design Thinking
- Prototyping Lego Serious Play
- Circularity compass
- Prospectives games

Activities for networking/collaborative projects:

- Matchmaking with stakeholders with similar barriers
- Matchmaking along the value-chain
- Support in building collaborative/innovative projects.

Activities for knowledge transfer:

- Showcases opportunities/technologies.
- Expert talks on next generation technologies (academics, innovative enterprises etc.)
- List of next generation technologies established in collaboration with academics, technological centres.

The results of the kick-off meetings were presented during the Cradle-ALP project meeting organized in Linz on the 23rd and 24th of October 2023.

Considering the broadness of the sub-topics, the partners decided during the Linz' project meeting to narrow down the topics of the transformation roadmap. A follow-up meeting was then organized on the 13th of November 2023 to identify a specific sector for the TSWG Polymer Transformation roadmap

One participant per partner was present at this second meeting. As the TSWG partners did not wish to focus on a specific sector given the difficulty to find a sector or market in which each partner had companies' members, the Composites sector was identified as the main sector of focus for the TSWG Polymer Transformation Roadmap. The partners agreed that the sub-topics previously identified during the first meeting would be the main topics of focus to analyze and define the Transformation Roadmap for the Polymer-based composites sector.

4.3 Sectoral ecosystem analysis

Following the identification of sub-topics of focus for the Transformation roadmap and in line with the D1.2.1 ecosystem analysis conducted by each partner in their regional ecosystem., CCB and POL organized a workshop during the Linz project meeting to develop a sectoral ecosystem analysis. Each TSWG gathered gaps, barriers, drivers and potential for their industrial sector and the TSWG leader was in charge of elaborating a transnational sectoral ecosystem analysis taking into consideration the input from each region and partner. This analysis enabled the partner to better define the scopes and objectives of the Transformation roadmap and served as a basis for discussion with the external support group workshop in order to define a vision for each sector.

Below is a picture of the results of the Linz' workshops done with the TSWG Polymer members on the analysis of gaps, barriers and potential for the circular transformation of the Polymer/Composites sectors.



The results were shaped by Polymeris, as TSWG leader, into an statu-quo analysis document that was sent out to the experts prior to the expert workshop to prepare the workshops discussion on potential missing information and on elaboration of a vision for the transformation roadmap. The status quo analysis can be found below and is further described in D2.1.1.

Gaps: What is missing from our regional ecosystems to achieve circularity in the Polymer/plastics industry?

- Lack of clear legal requirements/better understanding of the requirements
- Lack of acceptance from customer
- Lack of enough funding for scaling up advanced technologies
- Lack of cooperation between competitors working on the same sector
- Lack of mature technologies to sort & recycle complex materials
- Lack of implementation/expertise on eco-design from the businesses
- Lack of expertise on circular business models

Barriers: What are the current obstacles that prevent the actors from our regional ecosystems to achieve circularity in the Polymer/Plastic industry?

- High price of bio-based materials & fluctuant price of recycled material
- Regulatory hurdles
- Negatives stereotypes toward sustainable plastics properties
- Material/products specifications are unpredictable.
- High investment cost with a limited growth potential
- Fragmented value-chains
- Mismanagement of waste
- Difficulties to identify waste streams/composition.

Drivers/Potential: What are the main challenges to focus on in the future to allow our regional ecosystems to achieve circularity in the Polymer/Plastics industry?

- Public awareness towards environmental issues/ growing market demand
- Up-coming legal requirements (strong focus on polymer industries)
- Corporate identity
- Common resources available for SMEs (eg : Recycling pilot platforms to prepare for recyclability)
- Reduce CO2 food print for incineration.
- Reduce use of natural resources

4.4 External expert support group workshop

The external expert support group workshop was organised online on Dec 7th 2023 with the objective to discuss with experts the roadmap vision for the five sectors and to cross check if any gaps, barriers, drivers and potentials are missing. The following aspects were added for the Polymer/Composites ecosystem analysis:

4.5 Organization of the TSWG roadmapping workshops

Once the vision was elaborated, the TSWG decided on the dates and organization of the 3 roadmapping workshops for the Polymer/Composites sector.

A MURAL template was designed by CCB to provide guidelines and roadmapping exercises to the TSWG, CCB and POL organized a training session the 31st of January 2024 for all the partners to present the template, the exercises and provide guidance in the roadmapping methodology. The session was recorded and is available on the project internal collaborative tool (Trello).

The TSWG partners started communicating and promoting the 3 workshops from the 12th of January through articles on the partner's website, emailing, newsletters and social media post.

4.5.1 Workshop 1

The [Workshop 1](#) was organised on the 7th of February 2024, from 14.00 to 16.30 and focused on Materials & Resources analysis for a more circular Composites industry.

The agenda was the following one :

Topic	Duration
Introduction to project and workshop	10 min
Introduction of participants & Instructions on whiteboard	20 min
<ul style="list-style-type: none">• Vision of the Circular Transformation Roadmap• Discussion of sector-specific gaps, barriers, (drivers, potentials)	30 min
Brainstorming: <ul style="list-style-type: none">• What is needed to support circular transition of sector?• What is needed to overcome gaps and barriers?• What measures/activities need to be taken?	45 min
Coffee break	15 min
Define milestones/targets & time scope of activities	30 min

Concerning the participation, 33 participants, from Germany, France and Switzerland registered and 20 participated. The workshop was moderated by the 4 TSWG partners, with 7 persons connected.

Participants came from the automotive (manufacturers, technological platforms) sector, furniture sector, renewable/bio-based materials, with expertise focusing on smart composites and circular economy. Participants first worked on identifying the gaps and barriers that prevent the industry from becoming more circular by focusing on material & resources (picture below). Then the participants brainstormed on the solutions and ideas for technologies, business, and political framework to overcome the gaps and barriers (picture below). Those solutions were then clustered into the different timeframe.

4.5.2 Workshop 2

The [Workshop 2](#) was organised on the 20th of February 2024, from 14.00 to 16.30 and focused on Circular product design for the Composites industry.

The agenda was the following one:

Topic	Duration
Introduction to project and workshop	10 min
Introduction of participants & Instructions on whiteboard	20 min
<ul style="list-style-type: none"> • Vision of the Circular Transformation Roadmap • Discussion of sector-specific gaps, barriers, (drivers, potentials) 	30 min
Brainstorming: <ul style="list-style-type: none"> • What is needed to support circular transition of sector? • What is needed to overcome gaps and barriers? • What measures/activities need to be taken? 	45 min
Coffee break	15 min
Define milestones/targets & time scope of activities	30 min

Concerning the participation, 23 participants, from Germany, France and Switzerland registered and 12 participated. The workshop was moderated by the 4 TSWG partners, with 7 persons connected.

The participants came from the following sectors: automotive & mobility, aerospace & defence, glass-fibres composites, data, circular economy.

Below is a screenshot of the brainstorming on gaps and barriers concerning the circular design of polymer-based composites conducted with the participants during the workshop.

4.5.3 Workshop 3

The [Workshop 3](#) was organised on the 14th of March 2024, from 14.00 to 16.30 and focused on Value recovery (Collecting, Sorting, Recycling) of Polymer-based composites.

The agenda was the following one:

Topic	Duration
Introduction to project and workshop	10 min
Introduction of participants & Instructions on whiteboard	20 min
<ul style="list-style-type: none"> • Vision of the Circular Transformation Roadmap • Discussion of sector-specific gaps, barriers, (drivers, potentials) 	30 min
Brainstorming: <ul style="list-style-type: none"> • What is needed to support circular transition of sector? • What is needed to overcome gaps and barriers? • What measures/activities need to be taken? 	45 min
Coffee break	15 min
Define milestones/targets & time scope of activities	30 min

Concerning the participation, 36 participants, from Germany, France and Switzerland registered and 15 participated. The workshop was moderated by the 4 TSWG partners, with 7 persons connected.

Below is the list of the participants:

Below is a screenshot of the last exercise (clustering of main solutions provided by the participants on how to ensure a higher value-recovery of Polymer-based composite waste), conducted in collaboration with the participants of the workshop.

5. Conclusion

Below are the main lessons learned and recommendation on the roadmapping process based on the TSWG Polymer-based composites roadmapping workshops.

Participation:

- Several persons participate to the 3 workshops, showing a high interest for the topic and the format of the exercise.
- **Brainstorming of gaps & barriers:** Participants tend to mention general ideas (for e.g.: lack of recycling solutions for composites) if they are not guided through this exercise and are not always in link with the WS topics of focus. During the third workshop, the Cradle-ALP partners prepared a list of main topics on which contributions of the participants were needed (see screenshot of WS 3) to guide them through the many different topics on value recovery of composites waste (identifying, collecting, sorting, re-use/second life etc.). This ensures a higher participation and contribution on the whole spectrum of the topics identified.
- **Brainstorming of solutions:** The participants might give general solutions or reformulate their gaps and barriers. To avoid this, partners in charge of conducting this exercise asked the participants to explain and give example of solutions suggested. Some solutions were still too broad (e.g.: considering end-of-life for design of products) or mentioned several times. Participants encounter some difficulties to define in clear steps the solutions found and to explain when asked “on the spot”. It could be interesting to focus on a few solutions suggested by the participants and to develop them in smaller group, to give enough time to the participants to formulate their ideas and brainstorm the different steps to lead to a concrete and applicable solution.

Moderation:

- More time should be dedicated to the brainstorming of solutions (1 hour) and less to the clustering/voting activities (10 min) or gaps & barriers (20 min)

- Knowing in advance the type of participants could allow to deep-dive into sectors/specific topics in link with their expertise (for e.g.: automotive sector for composites TSWG, eco-materials)
- It is challenging for the moderators to read all the post-it added, ask for precision and launch discussions on input from the participants all at the same time, which can also result in a lack of participation from the majority of the audience. The idea to create smaller group with one moderator for each of them to brainstorm on one specific solution could allow a more fluid and insightful discussion.

Results and output collected:

Results and output collected were not always directly related to the subject of the workshop (for example participants contributed on end-of-life challenges in the first workshop dedicated to Materials & Resources) which means that a greater work about defining the scope and boundaries of the discussions would need to be done in the communication and promotion phase. It would also be of added interest to further work on profiling the participants for each workshop to collect input in line with the workshop topic. But the input collected throughout the three workshops, even if some of them were repetitive, allowed us to better grasp what were the main challenges and solutions discussed in the industry now and understand the priorities that need to be set in the roadmap, and to eventually adapt the roadmap layout to the workshops' output rather than the contrary, to reflect more closely the industry's challenges and main topics of focus concerning circular transformation.