D3.3 Handbook for Researchers

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Document Control Information

Document Title:	Handbook for Researchers
Deliverable Number:	D3.3
Project Title:	CIRCULAR - Circular Economy Living Laboratories supporting Social Innovation in Southeast Asia
Project Number:	101082209
Document Author:	University of Almeria (UAL)
Document Version:	V1.0
Date:	30/04/2024
Dissemination Level:	☐ Public ☒ Sensitive

Document History

Version	Date	Change(s)	Created by	Page(s)
V1.0	30/04/2024	Initial Version	UAL	42

The Authors are authorised to make the following types of changes to the document without requiring that the document be re-approved:

- Editorial, formatting and spelling;
- Clarifications.

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Module 1. Introduction to the Circular Model

Unit 1.1. Theoretical framework

The increasing global demand for natural resources driven by the consumption pattern of developed economies, and the industrialization of emerging economies pose a threat to the planet. Living standards in developed economies will continue to rise, and by 2060, GDP per capita in emerging countries is expected to reach OECD levels (OECD,2019). Different studies have projected that total resource use could more than double by 2050 if these trends continue. Therefore, it is urgent to improve the efficiency with which resources are used maximizing their value and to prevent the increase in globalized demand for resources from leading to a shortage of supply that would lead to an increase in input costs.

In this context, the challenge of sustainable development has become increasingly important. The United Nations Brundtland Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." (WCED, 1987). In 2015, the United Nations presented 17 sustainable development goals (SDGs) in the Agenda 2030 for this challenge. The circular economy (CE) model is presented in this program as one of the key components to move the world closer to sustainability and help achieve the proposed goals. According to the definition of the United Nations Environment Assembly CE model refers to: *"one of the current sustainable economic models, in which products and materials are designed in such a way that they can be reduced, reused, recycled or repaired (4-R) and thus maintained in the economy for as long as possible, along with the resources of which they are made, and the generation of waste, especially hazardous waste, is avoided or minimized, and greenhouse gas emissions are prevented or reduced"*. Opposed to the traditional linear model, which is based on a 'take-make-consume-throw away' pattern, that is, raw materials are extracted, goods are produced, consumed and discarded. The circular economy seeks to close the life cycle of products, minimizing waste and maximizing resource efficiency, through reusing, repairing, refurbishing, and recycling existing materials and products.

CE can contribute to meeting the SDGs but it is important to understand the different dimensions of sustainability to analyse whether the CE is an effective instrument to achieve sustainable development. The concept of sustainability is a holistic approach that includes three fundamental pillars: environmental, social and economic dimensions. In this sense, the definition of CE proposed by Kirchherr et al. (2017, p. 229) is appropriate: "an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers".

Several studies have already demonstrated the positive impacts of the circular economy into the three dimensions of sustainability such as generating economic growth, creating jobs, and improving environmental performance (Ellen Macarthur Foundation, 2015-a). First, in economic terms, the circular economy seeks to create

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value through the optimization of resources and the reduction of costs associated with the extraction and processing of raw materials. When the reuse and recycling of materials is fostered, new business opportunities are generated and innovation in production processes is stimulated. Second, from a social perspective, the circular economy seeks to promote equity, inclusion and participation of all actors involved in economic processes. This involves guaranteeing fair working conditions, promoting equal opportunities, and promoting social cohesion in communities. Finally, from an environmental perspective, the circular economy seeks to minimize the negative impact of human activities on the environment, reducing waste generation, controlling pollution, and preserving natural resources for future generations.

In recent years, a large number of authors have defined the concept of CE. While there is still no consensus on a clearly accepted definition, The Circle Economy Foundation developed the Key Elements (KE) Framework highlighting and classifying the elements of the CE into two groups (Circle Economy, 2021):

Core Elements: activities directly handling product or material flows. The main objectives are to extend the useful life of resources, prioritize regenerative resources, and use waste as a resource.

Enabling Elements: actions that remove obstacles for core actors. For instance, the design focused on stretch the lifetime; rethink the business model towards regenerative models that provide well-being for society; work together throughout the entire supply chain, within stakeholders to rise transparency and create value; foster innovation networks and research development, structure; and include digital technology that provides information to track and optimize resource usage, strengthen connections between supply chain participants, and enable the implementation of CE models.

This framework can be translated into threes principles proposes by The Ellen Macarthur Foundation:

Principe 1. Preserve and enhance natural resources by controlling finite stocks and balancing renewable resource flows.

Principle 2. Optimize resources efficiency following circular production models, maximizing the utility of components and materials in both technical and biological cycles.

Principle 3. Foster production effectiveness systems by revealing and eliminating negative externalities.

In turn, these three principles can be translated into six concrete actions to move towards the circular economy. Figure 1 introduces and explain the ReSOLVE framework:

Figure 1. The ReSOLVE framework: six action areas

ACTION	DESCRIPTION
REGENERATE	A series of actions aimed at preserving and improving the biological capacity of the Earth. That requires the shift to renewable energy and materials; reclaim land, retain, and regenerate health of ecosystems and return recovered biological resources to the biosphere, through composting for example.

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SHARE	Sharing products among different users (peer -to-peer sharing of privately owned products or public sharing of a pool of products), maximize the use out of goods and eliminates waste and duplication through maintenance, repair, and design for durability. It also includes reusing products through their entire technical lifetime (second hand).
OPTIMISE	Improve performance of products; remove waste in the entire supply chain (from sourcing and logistics, to production, use phase, end-of-use collection, etc.) encouraging investment in technological innovations that optimize processes.
LOOP	The essence of the circular model is based on the idea of a loop: resources are processed, circulated, and returned to the economy, rather than being lost to landfills.
VIRTUALISE	This concept means making use of virtual tools when they can improve the productivity of resources.
EXCHANGE	Replace old ways of doing things applying new technologies (e.g. 3D printing or electric engines) and choose new products/services (e.g. multimodal transport).

SOURCE: Own elaboration based on Ellen MacArthur Foundation (2015-b).

When comparing linear and cyclical economic approaches, Braungart et al. (2008) distinguish between "cradle to grave" material flows and "cradle to cradle" cyclical flows. Aligned with other common frameworks, a commonly adopted taxonomy encompasses four resource flows which provides a holistic, regenerative and resource-efficient CE system: Regenerate, Narrow, Slow and Close (Bocken et al., 2016).

Regenerate. Regenerate resource flows, prioritizing the use of renewable energy sources, minimizing reliance on fossil fuels, and eliminating the use of toxic materials in the different stages of life cycle management.

Narrow. Reduce the number of materials used in production processes, optimizing material and energy use, and reducing greenhouse gas emissions. This can be achieved by transitioning towards circular business models. In this sense, the best way to reduce flows is to stop using unnecessary goods or services, such as fast fashion clothing.

Slow. Using resources for longer optimizes the use of resources. At this stage it is important to focus on the design with durable materials, and service circuits that extend the useful life of the product, such as repair, maintenance, refurbish, and remanufacture.

Close. Includes actions that aim to close production and waste loops. This implies make the most of resources at their end-of-life stage by creating circular flows; improve the collection and reprocessing of materials; upcycle rather than downcycle; and design products for recyclability and for disassembly.

In summary, in the figure 2 we show the link between the key core elements and the frameworks mentioned in this section commonly applied in circular economy literature.

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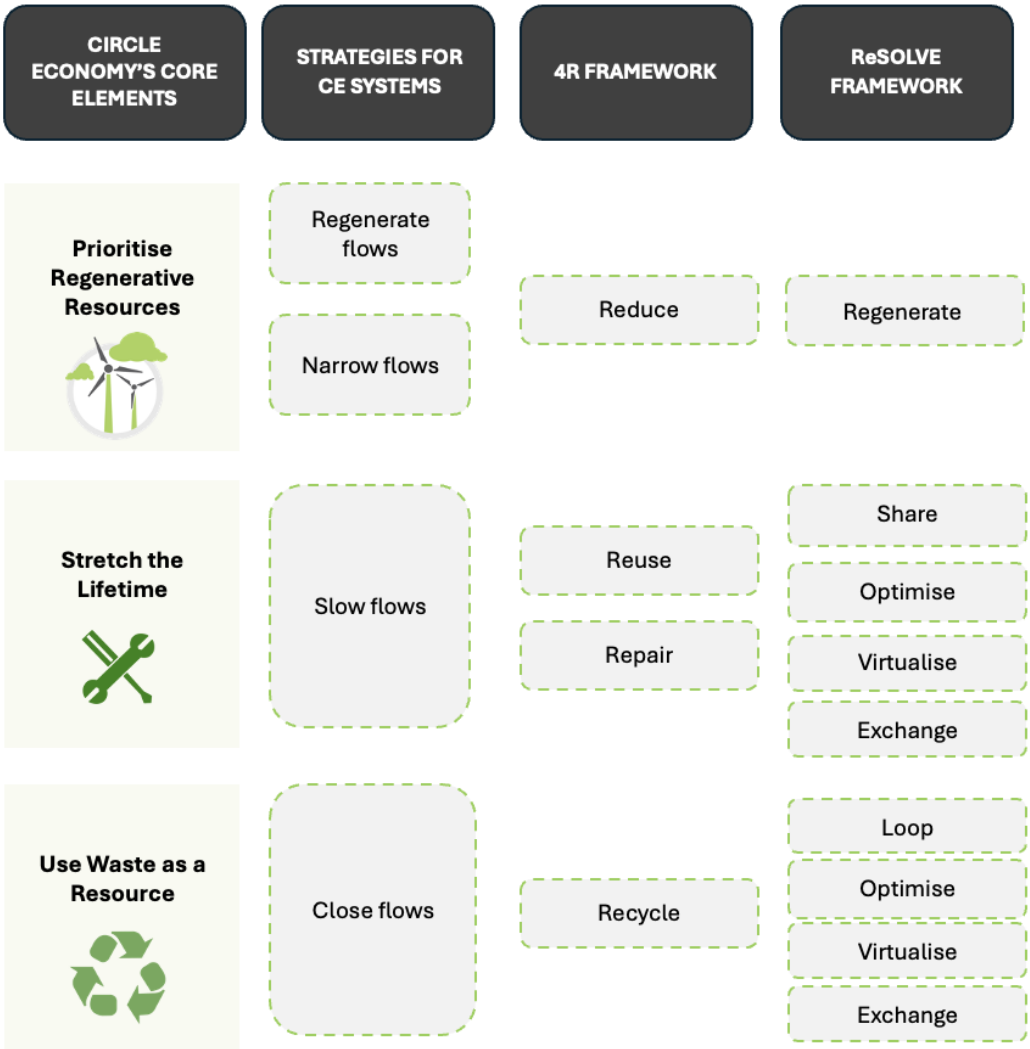
Figure 2. Links between principles and frameworks of CE models



SOURCE: Own elaboration based on Circle Economy (2021).

Despite the growing interest and development of policies aimed at the transition towards a circular economy, there are still obstacles to its implementation. The main barriers are the economic incentives provided by traditional and linear production models. The following figure represents the obstacles that may arise in each challenge and proposes an action plan to address each issue.

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Figure 3. Challenges, barriers and action plan for the transition to the circular model

	CHALLENGE	BARRIER ADDRESSED	ACTION PLAN
CORE ELEMENTS	**Prioritize Regenerative Resources**	**The cost to shift:** the transition requires a significant investment of time, knowledge, and resources.	Design **regulatory frameworks** adaptable, scalable, and flexible to address the complex challenges facing different industries.
	Stretch the Lifetime	**Profitability of short life cycle products**	Encourage investment in production models that support sustainable consumption. **Fiscal support**, e.g., tax
	Use Waste as a Resource	**Lack of innovation and development** to recover value from waste and reuse materials.	Promote the development and application of new knowledge and technologies to **encourage innovation in processes, products, services and business models.** Foster **public-private collaboration**. Favoring business **investment in R&D&I (e.g. subsidies).** Funding for **training, research, and development.** **Awareness raising** of stakeholders (e.g. education) Disseminate and **transfer** findings with integrity.
ENABLING ELEMENTS	**Design for the Future**	**Lack of skills to recover or reuse** components due to lack of knowledge or legislation. **Absence** of **shared interest** among supply chain participants. **Fear of disruption** of existing business model system or value chain. **Asymmetric information** and disaggregated and unstructured knowledge.	
	Rethink the Business Model		
	Strengthen and Advance Knowledge		
	Incorporated Digital Technology	The **lack of information systems** on the location and status of assets leads to the impossibility of optimizing the use of resources.	Encourage investment in **digital platforms and technologies** that provide insights to track, strengthen connections between supply chain actors, and enable the transition towards CE models.
	Team up to Create Joint Value	**Conflict of interests** and misaligned objectives between stakeholders in the value chain could obstruct progress and/or generates wasted resources.	**Work together** throughout the entire supply chain, within stakeholders to rise transparency and **create joint value.**

SOURCE: Own elaboration based on Circle Economy (2021).

These challenges require **specific, measurable, assignable, realistic, and time-related goals** to provide a framework with clear direction and maximize the benefits of monitoring and evaluation. The policies and actions directed at each level must be closely intertwined and aimed at the same commitment to the transition to the circular economy. All areas of society are important in the transition towards circular models, among others, finance and investments; industry and commerce; energy;

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agricultural and food systems; public health; social affairs and employment; education, science and technology; and finally, digitalization. In addition, governments should establish guarantees that this is a lasting commitment with both short- and long-term actions. Furthermore, there is ample space for peer learning, the exchange of experiences and the transfer of knowledge from the most advanced countries in circular models to countries in which linear production systems predominate.

Unit 1.2. Stakeholder engagement and Living lab design

The commitment made by nations regarding the Sustainable Development Goals and the 2030 Agenda has propelled the transition of economies towards increasingly sustainable models, knowledge-intensive based, where innovation is a key driver. In order to face the transition to sustainable economies, policy measures supported innovation and strategic knowledge assets based on sustainable, trans-disciplinary and hybridized approaches. The initial triple helix model, composed of governments, universities, and businesses, has evolved into a quadruple helix model where the participation of civil society becomes highly relevant, in this way, concepts such as social robustness, inclusivity, and sustainability are included in innovation ecosystems. Living labs are, in this context, platforms for quadruple helix innovation, which offers opportunities for testing, validation, development and co-creation at all stages of a design and commercialization process by synchronizing the innovation processes among the actors of the QHM (Compagnucci et al., 2021).

There are many perspectives on LLs definitions in the context of the CIRCULAR project, where academics and researchers play a leading role, we can approach LLs as the definition of the European Commission(2009): "a user-driven open innovation ecosystem based on a business-citizens-government partnership which enables users to take active part in the research, development and innovation process"; LL are "user-centred, open innovation ecosystems based on a systematic user co-creation approach, integrating research and innovation processes in real-life communities and settings. They act as intermediaries between citizens, research organizations, companies, cities and regions for joint value co-creation, rapid prototyping or validation to scale up innovation and businesses. LLs operate as an open and dynamic research and innovation ecosystem involving solution developers contributing with technology, research labs and universities contributing knowledge and technology, local authorities and policy makers contributing inclusion and social wealth, and user communities seeking applications.

In the CIRCULAR project, universities will act as enablers and providers institutions, to promote research and knowledge creation. The network forms around a provider organization (e.g. university), but information is collected and used together, and knowledge is co-created in the network; knowledge is utilized in the network to help the user community. It is important to highlight the role of Universities participating in CIRCULAR to guarantee that LL acts as a bridge between open innovation and user innovation within the QHM. LLs are able to develop the iterative process of experimenting and learning from year to year. This means that they are able to provide a coherent basis for action over time.

To do this, LLs must involve the creative and innovative potential of users, so as to gain better insights into the possibilities, opportunities and restrictions of innovations. Users are not anymore "consumers" with the role of observed subjects for testing products

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or services but are co-creators. User knowledge offers a valuable resource for innovation because it fosters understanding of real-life situations where products and services are involved.

A good example of how users act as co-creators and knowledge providers is the Living Labs of the Circular Bioeconomy Alliance in the Amazonia with the aim of combining modern innovation with ancient wisdom: "learning from indigenous communities how to translate our science into generating wiser decisions, into a wiser humanity". The project aims to accelerate rainforest restoration while creating new forest-based value chains around cocoa, vanilla, medicinal plants and eco-tourism.

Given the importance of involving the users, we should consider how to foster its participation in the living labs, considering a range of methods and tools such as:

- Focus groups,
- Workshops,
- Platforms,
- Online and or face to face questionnaires,
- Laboratories on entrepreneurship and innovation,
- Business ideas contests

The involvement of users in the LL can be difficult considering different degrees of commitment, getting stakeholders interested in participating can be an easy task but achieving a higher degree of commitment can be difficult.

The role of universities as enablers and providers would facilitate the identification and engagement of stakeholders to varying degrees. For instance, among the reasons for businesses to facilitate their engagement with the LL is to meet different set of needs:

- Business plan development
- Funding opportunities for innovation activities
- Ideation events
- Development of products and services
- Access to innovations,
- Access Technologies,
- Internationalization
- Talent recruiting.

Governments and public bodies generally look on the LLs as a support mechanism to implement practices in the LL's domain. The guidelines proposed by the policy document of the United Nations Economic Commission for Europe (UNECE, 2022) introduces three essential levels of collaboration to achieve a successful transition to a CE:

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- Collaboration across policy areas: the circular economy requires a transdisciplinary approach involving multiple policy areas, including, but not limited to, the ministries of environment and economy.
- Collaboration across policy layers: national, regional and municipal governments play an important role in implementing countries' circular economy. Given economic globalization, international cooperation is essential, for example, to exchange information between value chains and facilitate mutual learning and capacity-building.

Universities play a significant role in Living Labs as they have access to a young population, for example. Activities that attract students and young people to commit in LL are for example organises.

- Industrial and innovative
- Ph.D. courses,
- Supports student ideas
- Involving undergraduate students in multidisciplinary research teams
- Promoting employment opportunities,
- Entrepreneurship competitions for young people

The inclusion of senior citizens in LL is interesting to include traditional and ancient knowledge and practices. This group of population brings interesting perspectives on sustainability issues that can be applied together with advanced technologies and new processes. Finally digital tools are essential to facilitate communication and data management. The access to scientific databases, technologies, sustainable practices, innovation projects, patents and processes is needed to build-up the knowledge-intensive based open innovation ecosystem.

The Living Lab approach follows a cyclical approach, where different scenarios, the possible 'future states' are tested in a real-world context, and solutions evolve through multiple iteration rounds in a participatory process (Figure 4.). The Living Lab approach helps to improve the pivotal multi-stakeholder collaboration within CE ecosystems. These collaborations involve scientists, companies, cities and other public authorities and policymakers, as well as civil society (a.k.a. citizens and various types of consumers) and third-sector organizations contributing to the joint knowledge, innovation and value creation processes. As a result, the Living Lab approach is considered to be an open innovation development approach in which in-house and external resources are combined to deliver novel solutions. The Living Labs engage diverse actors and stakeholders across the CE process starting from the identification and definition of a challenge, the concept or prototype design and the experimentation, towards the pre- and post-launch of a novel CE solution.

While Living Labs can be described in many ways and serve several purposes, the following five key elements described in Figure 4 are forming the foundation for Living Lab activities (EnoLL, 2017).

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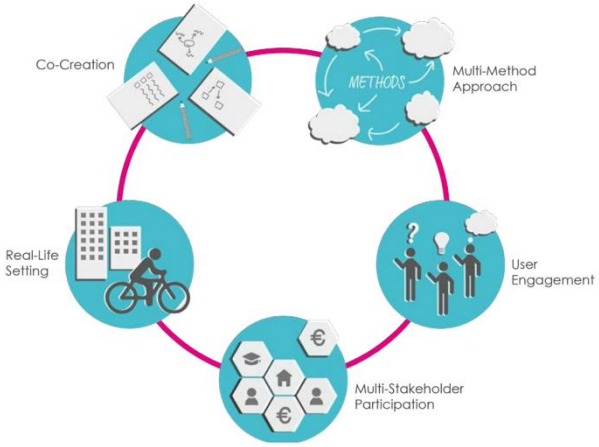
Figure 4. Key elements in Living Labs implementation (ENoLL, 2017)



Real world context: Living Lab activities are occurring in simulated or in real-world contexts. In practice this means that the various solution alternatives for the new product and service ideas are co-created, tested and validated from early on in the development process, by their potential users in their natural usage-environments.

Multi-stakeholder participation: A wide ecosystem of actors, consisting of all relevant stakeholders from end-users to employees and value chain partners, are involved throughout the innovation process. The harmonized participation of all the main stakeholder groups includes the following four main stakeholder groups, which each are able to benefit from the Living lab process in different ways.

1. **Business / Companies** such as manufacturing and services within the value chain, primary sectors, financial sector, creative industries, social sector, large companies, SMEs, cluster and business organizations, business driven associations, etc.
2. **Research and education** (Academia) including public and private research bodies, primary schools, universities, public and private education and training, science and technology centres, technology transfer officers, etc.
3. **Public Sector** including government, EU regulators, municipalities, public procurement officers, incubators.
4. **Civil society and consumers** including NGOs, citizens and users related to the three circular economy business models, as well as current and possible future customers of the demonstrating companies.

User-engagement: Living Labs seek to identify user-centric solutions, opportunities and challenges. Involving the users already in the beginning of the development activities and across the whole innovation process is a key element of the Living Lab process.

Multi-method approach: As all Living Labs are unique, there isn't a single Living Lab methodology that can be replicated and applied. This means that co-creation methods that best fit their purpose are selected and implemented during the different Living Lab phases, as the requirements and solutions evolve during multiple iterative development rounds.

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Co-creation: Co-creation is identified as the central process of the Living Lab approach. It can be defined as a cooperation between different actors or stakeholders who share the same overall objective or goal. It is about planning, developing and innovating new solutions through a specific iterative development process while utilizing various methods, techniques and tools. Through a co-creation approach, diverse teams together with end-users can collaboratively identify needs, ideas, experiences and opportunities and generate fast prototypes to be tested and validated by the real users and other relevant stakeholders.

There exist three main building blocks within Living Lab projects, following the innovation development phases (Figure 5):

- *Figure 5. Open innovation phases (ENoLL, 2017)*

1. Exploration: getting to know the 'current state' and designing possible 'future states'

2. Experimentation: real-life testing of one or more proposed 'future states'

3. Evaluation: assessing the impact of the experiment with regards to the 'current state' in order to iterate the 'future state' In the following chapters, the different stages are represented and the impact of these is described on the nature of the user activities taking place at each stage

Exploration:

The first phase within an innovation project, following the Living Lab approach, can be labelled as 'exploration'. In terms of the New Product Development (NPD) process, this consists of moving from idea towards concept or prototype of the solution. In the language of entrepreneurs, this is the 'problem-solution fit' stage, as you identify the problem and fit your solution as good as possible with the problem. The main goal of this stage is to understand the 'current state'. This means getting an overview of the current habits and practices of users you want to target. A specific focus is put on the current problems they still face, taking into account the specific contexts in which these problems occur. This is done by means of methods and techniques like observation, participation and in-depth interviews.

After understanding the users and their context, one engages in the process of discovering latent needs and wants of the users. Here sensitizing techniques are used to dig into the users' deeper levels of knowledge, uncovering tacit and latent needs and wants. This leads to the definition of opportunities for improvement of the users' 'current state'. These materialize in possible 'future states' that are thought of. This is

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done by means of brainstorming, ideation and co-creation techniques. All the ideas and options are then materialized into concrete concepts that can be co-designed.

In terms of Open Innovation, this phase can be labelled as involving mainly 'exploration' processes. Exploration is defined as purposive inflows of knowledge or technology, aimed at capturing and benefiting from external sources of knowledge to enhance current technological developments. First, exploration is used to understand the current solutions people use, the current habits they display and the current context in which people use these solutions and have developed these habits. Subsequently, exploration is used to develop and share ideas for solutions to these needs, in order to come to concrete innovation concepts.

This exploration stage also provides you with a certain benchmark of the 'current state'. This is important, as it allows the measurement of potential impacts and effects of the experimentation stage in order to measure the effects of the innovation. Therefore, this stage also can be considered as the 'pre-measurement' before the intervention, which takes place in the experimentation stage.

Experimentation

The second stage within an innovation development process can be labelled as 'experimentation'. In the previous stage a certain solution or 'future state' materialized into a concept, this stage puts it to the test by developing and experimenting with a prototype. Specific for a Living Lab approach is the 'real life' setting in which the testing takes place. The degree in which 'real-life' can be attained is linked to the maturity of the design. Prototypes can take on many forms, from tangible MVPs (Minimum Viable Products) to intangible services or experience design prototypes, but their main goal is to facilitate testing of the possible 'future state'. In the experimentation stage, the innovation itself is presented as a prototype to the users in the form of a new solution, which potentially triggers new habits and new contexts of use.

The goal of this 'intervention' is to understand user reactions and attitudes to the proposed solutions, and to also capture behaviour, which is made possible by having the testing take place in "as-real-life-as-possible" contexts. Depending on the maturity, the interventions can be labelled as proxy technology assessments, User Experience testing, or actual field trials.

When a prototype is stable enough, the experimentation can take the form of an actual field trial. Depending on the possibilities, this testing can be short to longer term, involve a few to large amounts of users, and can include some specific to all aspects of the solution. In terms of techniques, one should focus on unobtrusive techniques to capture the concrete user behaviour with the solution ('doing') and avoid only relying on what people 'say'. Summarizing, the experimentation stage puts the designed solution to the test, as much as possible in a real-life context, and allows a decision to be made on whether to head back to the exploration stage to iterate your solution, or whether to proceed to the evaluation stage.

Evaluation

The third and final stage consists of evaluating the innovation. As the exploration stage provided a benchmark regarding the 'current state' of the end-users, the experimentation stage simulated an envisioned 'future state' by means of an intervention. The evaluation stage enables to generate a 'post-measurement' of the intervention and compare it to the 'pre-measurement' benchmark, illustrating potential impact and added value created by the innovation.

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In terms of Open Innovation processes, this stage is aimed at exploitation. Exploitation entails purposive outflows of knowledge or technology, implying innovation activities to leverage existing technological capabilities outside the boundaries of the organization. Related to the entrepreneurship literature, this stage can also be labelled as the 'product-market'-fit.

In the experimentation stage, ideas can be enabled to mature into a tested prototype or design, which can now be mapped into a target market and user population. The goal is to launch and implement the innovation into these target markets, based on a go-to-market strategy. The focus is on understanding the potential market, which can be done through techniques such as market research, user toolkits for customization or conjoint analysis for defining a concrete offering. This also involves preparing a coherent marketing communication and strategy. By combining the pre- and post-measurement of the intervention, it should be possible to quantify your value proposition. A key question at this stage is: what advantages is the 'future state' able to deliver in terms of the 'current state' of your envisioned user population? This also facilitates determining pricing levels, as this is much easier when it is possible to quantify the impact of your solution. This stage can also consist of the post-launch activities, where actual adoption and usage of the innovation is monitored in order to re-design or add new functionalities according to the needs of existing or new market groups.

Unit 1.3. Intercultural competence: set of knowledge and skills necessary to act in an intercultural way in diverse contexts

In an increasingly interconnected world, intercultural competence is no longer a luxury, but a necessity for navigating diverse environments when implementing like living labs. This competence encompasses a set of knowledge and skills that empower us to communicate, work, and build relationships respectfully and effectively with people from various cultural backgrounds (Peng et al., 2016). Throughout this section, we'll delve deeper into the essence of intercultural competence, exploring its significance within living labs and unpacking strategies to cultivate it for successful collaboration in these dynamic settings. Moving beyond simply acknowledging differences, the "diversity advantage" approach actively leverages the richness of a diverse environment to fuel progress. This approach to governance, management, and decision-making recognizes that a variety of perspectives and experiences can lead to better outcomes.

Here's a breakdown of the key aspects of the diversity advantage (Council of Europe, 2024):

- Intentional Impact: Planning goes beyond just including diverse voices. It involves actively harnessing the strengths of that diversity to achieve positive results.
- Inclusive Decision-Making: Diversifying decision-making bodies ensures a wider range of viewpoints are considered, leading to more well-rounded solutions.
- Broader Participation: Encouraging active participation from everyone, regardless of background, fosters a sense of ownership and unlocks the full potential of the group.

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- Promoting the Advantage: Building awareness and understanding of the benefits of diversity is crucial for widespread adoption of the approach.
- Global Perspective: An international outlook fosters a broader understanding of issues and opportunities, leading to more effective solutions with a wider reach.

Intercultural cities thrive on interaction – the everyday exchange between people from diverse backgrounds. It's this interaction that fosters understanding, breaks down stereotypes, and unlocks the true potential of a multicultural society. However, simply being in the same space isn't enough. Meaningful interaction requires creating conditions for constructive dialogue across cultural and other differences. This is especially important when prejudice and discrimination can thrive in environments lacking contact and open communication.

Here's how we can cultivate this vital interaction:

- Everyday encounters: Encouraging positive, everyday interactions across differences is the foundation. This can involve community events, cultural exchange programs, or simply promoting spaces where people come together naturally.
- Partnerships: Building bridges requires collaboration. Fostering interaction and working in partnerships between diverse groups strengthens understanding and breaks down barriers.
- Understanding challenges: Recognizing and addressing fears and anxieties people might have about interacting with different cultures is crucial. Open dialogue and addressing concerns pave the way for positive interaction.
- Proactive conflict resolution: Challenges and conflicts are inevitable. Developing strategies to proactively address them fosters open communication and strengthens intercultural bonds.
- Sustained interaction: Creating opportunities for sustained interaction, not just one-off events, is key. Building long-term relationships across cultures deepens understanding and fosters a more inclusive society.

By promoting meaningful interaction and tackling barriers, we can create truly thriving intercultural cities where diversity becomes a source of strength and enrichment. Given the complex web of global relationships, the success of the circular economy hinges on navigating the intricate tapestry of cultural contexts across the globe. Diverse values, social norms, and economic realities influence how people approach consumption, waste management, and resource use. Ignoring these differences can hinder the adoption and effectiveness of circular practices.

To bridge this gap, intercultural competence emerges as a critical skillset. It refers to the ability to effectively interact with individuals and groups from different cultures. This includes:

- Cultural awareness: Understanding the underlying values, beliefs, and traditions that shape cultural behaviours.
- Cultural empathy: Developing empathy and respect for diverse perspectives on resource management and consumption patterns.
- Cultural knowledge: Acquiring specific knowledge about the cultural context where you plan to implement circular initiatives.

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- Cultural skills: Skilfully communicating and collaborating across cultures to foster a shared understanding of circularity.

By cultivating intercultural competence, we can build more inclusive and successful circular economy strategies, one that embraces cultural diversity as a source of strength and innovation.

Living Labs are real-world platforms where stakeholders collaborate to test and refine circular solutions. Establishing a culturally-conscious Living Lab requires a deep understanding of the local landscape. This includes:

Cultural Values and Consumption: Research prevailing attitudes towards waste, resource use, and product ownership. Consider factors like:

- Is there a strong emphasis on "newness" or a tradition of repairing and reusing goods?
- Are there cultural beliefs that influence consumption patterns (e.g., religious dietary restrictions)?

Traditional Practices: Identify existing practices that align with circular principles, such as local repair shops or community composting initiatives. These practices can serve as a valuable foundation for building a circular economy.

Cultural Barriers: Acknowledge potential roadblocks to implementing circular practices. These might include:

- Stigma associated with used goods in certain cultures.
- Lack of trust in repair services or second-hand markets.

Digital Landscape Assessment:

Technology plays a crucial role in enabling a circular economy. Analyse the digital access and literacy within the local context:

- Infrastructure: Assess internet availability, mobile phone penetration, and access to digital devices.
- Literacy Levels: Evaluate digital literacy skills of the target population.
- Bridging the Divide: Develop strategies to address the digital divide and ensure inclusive participation in the circular economy. This could involve:
- Offering workshops on basic digital skills.
- Utilizing low-tech or offline alternatives for information dissemination.

Collective Brainstorming:

By fostering open dialogue and collaboration, we can identify and address potential challenges arising from cultural differences. Here's how:

- Workshop-style Sessions: Organize workshops where participants can discuss potential challenges like:
    - Communication gaps between stakeholders from different cultural backgrounds.
    - Differing approaches to collaboration and decision-making.
    - Scenario Planning: Explore potential scenarios where cultural variations could impact: Stakeholder engagement strategies.

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- Business model design for circular products.
- Waste management practices.

Collaborative Solutions: Encourage participants to develop solutions that leverage cultural diversity as a strength. This could involve:

- Designing culturally relevant communication materials.
- Adapting business models to local preferences and consumption patterns.

The following real-world examples demonstrate how circular economy initiatives can be adapted and implemented across diverse cultures:

Case Study 1: The Humblemend Project, India

In India, a culture of resourcefulness thrives. The Humblemend Project capitalizes on this by empowering women in underprivileged communities to become skilled repair technicians. They collect and repair discarded clothing, extending product lifespans and creating a sustainable livelihood for women. The project's success hinges on its deep understanding of the local culture's emphasis on resourcefulness and its ability to address the digital divide by providing training in basic repair techniques.

Case Study 2: The Maasai Mara Leather Project (Kenya):

In the Maasai Mara, a region steeped in tradition, a community-based project upcycles discarded leather scraps from tourism into high-value handbags and accessories. This initiative not only generates income but also aligns with the Maasai's long-held respect for resourcefulness and utilization of all parts of an animal.

Key Takeaways:

Cultural emphasis on resourcefulness provided a fertile ground for circular practices.

Community ownership and participation ensured the project's cultural relevance.

Case Study 3: The Restart Project (Europe):

The Restart Project extends the life of electronic devices through repair workshops and online resources. This initiative addresses the growing trend of e-waste in developed nations and caters to a cultural shift towards mindful consumption and environmental consciousness.

Across Europe, consumer trends are shifting towards mindful consumption. The Restart Project addresses this by creating online platforms connecting consumers with repair services.

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Module 3. Capacity-Building for researchers

Unit 3.1. Key steps in circular economy research implementation

Introduction to rules for creating healthy research labs.

Starting a new research lab and being able to guide, mentor and collaborate with trainees / students, stakeholders, the community and other researchers is a huge step that can be quite challenging. One key aspect is to create a healthy and supportive lab environment, which can be achieved respecting the following rules for healthy and supportive research labs when guiding students and citizens to carry out field work, data collection and lifecycle inventory and analysis:

1. **Encourage critique but not competition**: Creating a conducive environment for scientific discussion and collaboration is crucial for the success of research projects. The best laboratories foster a culture that welcomes input from all members, formalising avenues for discussion while also encouraging informal exchanges. Curiosity and questioning should be embraced, with feedback focused on improving research rather than personal critique. Recognising the drawbacks of excessive competition in science, there is a growing appreciation for the benefits of collaboration in driving progress. While changing the overall culture of science may be challenging, individual lab leaders can cultivate an atmosphere of mutual respect, support, and celebration within their teams. Setting clear expectations and norms, such as outlined in a lab manual, can help establish this positive tone.
2. **Model "failure" and celebrate honesty:** Being transparent about the realities of academia, including grant rejections and paper submissions to multiple journals, helps junior scientists develop a realistic understanding of the academic environment. Acknowledging failures can reduce the sense of isolation and discouragement when experiencing setbacks. One approach for researchers is to share a "failure CV" with trainees, listing rejections alongside successes. Embracing failure also extends to day-to-day research mistakes, such as errors in experiments or analysis code. A supportive lab culture values honesty, integrity, and the pursuit of accuracy and replicability in scientific work.
3. **Be approachable:** Encourage open communication in lab meetings, allowing trainees to discuss scientific topics, work-related issues, and future career paths. Addressing problems early helps prevent unmanageable situations and allows for timely adjustments. Offer unbiased advice and practical support to trainees regarding job applications, career paths, and interviews. Maintain long-term mentorship relationships with trainees even after they have left the lab, providing support and advice regardless of personal benefit or alignment with your own career goals.
4. **Facilitate communication and ensure there are minimal barriers to asking questions:** Effective communication within a team is essential for productivity and innovation. Trainees often prefer direct in-person communication for both big and small queries, as informal conversations foster creativity and idea generation. Optimising communication involves ensuring regular physical presence, organising regular meetings, and utilising inclusive online platforms.

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Encouraging open communication among all lab members fosters a sense of teamwork.

5. **A supportive lab is a social lab:** To foster a sense of community and approachability, lab leaders can organise regular social events that cater to the diverse needs of lab members. These events provide opportunities for bonding outside of work. Lab leaders should ensure that planned events are inclusive and considerate of cultural, religious, and caregiving responsibilities.
6. **Give timely (and constructive) feedback:** Trainees rely on timely feedback, especially when deadlines are involved, such as job applications or paper submissions. Lab leaders should work with their trainees to establish reasonable feedback deadlines and communicate any scheduling constraints. When providing feedback, it's essential to acknowledge achievements alongside areas for improvement. Additionally, soliciting feedback from trainees helps lab leaders grow and fosters a collaborative environment.
7. **Respect others' time and expertise:** Respecting the expertise and time of all lab members is crucial for fostering a collaborative and efficient work environment. Acknowledging the diverse skills and experiences of trainees promotes effective problem-solving and prevents micromanagement. Encouraging independent thinking and trusting trainees' judgement can lead to scientific progress. Additionally, respecting everyone's time by being punctual and considerate of schedules demonstrates value for each individual's contributions and promotes smooth progress.
8. **Have career conversations that cover both academic and non-academic paths, prioritising individuals' career goals and aspirations**: It's important for lab leaders to recognise that pursuing careers outside of academia is a valid and valuable choice for many individuals. Additionally, lab leaders should prioritise the individual needs and goals of their trainees, which may differ from their own academic pursuits.
9. **Keep track of, suggest, and create (tailored) opportunities for trainees:** Great mentors ensure that all trainees have access to appropriate opportunities tailored to their career goals, while being mindful of biases that may lead to unequal treatment. It's important to keep records of opportunities provided, such as meetings, project involvement, conference support, and career assistance, and ensure that budgets for research, travel, and conferences are allocated equally among trainees regardless of performance or funding source. When resources are limited, prioritise underfunded students with departmental or institutional support.
10. **Promote the well-being of your lab members:** Lab leaders should prioritise the well-being of lab members, recognising that happy individuals tend to work more efficiently and creatively. Strategies for fostering a positive environment include empathising with lab members, practising kindness, prohibiting harassment and discrimination, and being supportive of personal, family, and health matters. Actively listening to lab members and offering assistance when needed can significantly enhance their well-being and productivity within the lab.
11. **Gratitude is the sign of noble souls:** Showing gratitude to lab members for their contributions, whether it's administrative support, technical work, or research efforts, has positive effects on their work and personal well-being. Rapid feedback to their requests, questions, and manuscript drafts is appreciated and boosts motivation, particularly among graduate students and postdocs. This acknowledgment of their importance fosters confidence and compromise

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among lab members, contributing to the smooth running of the research group. While providing quick feedback may not always be feasible during busy periods, making it a priority demonstrates appreciation and support from lab leaders.

12. **See your lab members as your teammates:** Establishing hierarchies and "top-down" approaches in labs can lead to toxic relationships and stifle critical thinking among lab members, particularly graduate students and technicians. While lab leaders have the responsibility to set research priorities and make final decisions, it's essential to treat lab members as colleagues with valuable insights and opinions. Listening to and considering the input of technicians, graduate students, and postdocs on projects, lab procedures, and day-to-day issues is crucial for improving research and fostering a positive work environment. Delegating important tasks to lab members not only lightens the load for leaders but also encourages engagement with lab projects and research goals, promoting teamwork and collaboration.
13. **Create a collaborative environment within your lab:** Collaboration is essential in modern scientific practice, enabling scientists to undertake ambitious, multidisciplinary projects beyond the capacity of a single lab. As lab leaders, fostering collaboration within your labs promotes learning, professional development, and positive relationships among lab members. This can be achieved by initiating common projects, encouraging inclusive meetings and discussions, supporting side projects, organising retreats, and facilitating interactions. Creating a collaborative environment enhances motivation, productivity, and creativity, preparing lab members for external collaborations crucial for career advancement.
14. **Remember that every lab member is unique:** As lab leaders, it's crucial not to compare our lab members to each other or to ourselves when we were in their position. Such comparisons can lead to increased stress and anxiety among lab members, hindering their performance. Recognizing that every individual is unique, our primary role as mentors is to nurture their capabilities and help them achieve their professional ambitions. This involves identifying their goals and providing appropriate support through project selection and networking. Our aim should be to facilitate their personal and professional growth to their fullest potential, rather than imposing our own expectations on them.

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Identification of on-the-ground topics for implementing a circular economy strategy.

Implementing a circular economy strategy in community-based research requires identifying practical on-the-ground topics where circular principles can be applied effectively.
For example, waste management as one of the key topics of a circular economy strategy can be approached through the framework of community-based research. Local residents, the community, business and organisations can be involved in identifying waste-related challenges and in co-creating solutions. By involving the community, the waste management strategies can be tailored to local needs and preferences.
By conducting research to map the flow of waste within the community helps you to identify key sources of waste generation, as well as opportunities for waste reduction, recycling and reuse. This research information helps to design targeted interventions to maximise resource recovery and minimise waste.
Furthermore, behavioural factors within the community influencing waste disposal can be researched. By understanding the motivations and barriers to recycling and waste reduction, researchers can develop targeted interventions and educational campaigns to promote sustainable behaviours.
Also, community-based research in waste management helps you to explore opportunities for utilising local resources, such as establishment of community-based recycling initiatives or repair cafes.
Continuous adaptation based on the monitoring and the feedback from the community is of high importance. In this way, researchers can assess and evaluate the effectiveness of their initiatives.

Other examples for on-the-ground topics that can be implemented within a circular economy strategy are the following:

- Plastic waste reduction
- Textile recycling
- Utilisation of biomass
- Water management
- Product-as-a-service models
- Sustainable packaging
- Sustainable agriculture
- Green policies
- Local manufacturing
- Sustainable construction/ green buildings
- Sustainable tourism
- Sustainable transport system
- ...

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Methodologies for conducting community-based research:

The combination of community-based research (CBR) and project-based learning provides a rich educational experience. Community-based research involves the collaboration between researchers and the community members. It aims at empowering communities, promoting social change and generating relevant knowledge by adding value generated by this collaboration from academia and citizens. Overall, the establishment of meaningful partnerships with community members is essential in CBR. Researchers involve the community, inviting them to participate in the research process, identify research priorities, and co-design the research. This can include forming community advisory boards, conducting focus groups, or hosting community meetings to gather input and build trust. Among others, the following methodologies can be used in community-based research:

- Participatory Action Research: When researchers engage with communities, they establish relationships that are fundamental to community research. Participatory research emphasises reciprocity and collaboration, drawing from various theoretical frameworks such as feminist theory, critical race theory, and indigenous perspectives. Unlike traditional research where communities are often passive subjects, participatory approaches empower community members to shape all aspects of the research process, from defining research questions to interpreting findings. This collaborative process transforms knowledge into a tool for empowerment and social change, fostering conscientization among participants.
  Participatory research is characterised by collaborative decision-making, shared power, and a commitment to working for the good of others. It is not just a methodology but a philosophy that focuses on building relationships and addressing "ill-structured" problems within the local context. This approach has been widely adopted across disciplines such as community psychology, public health, social work, nursing, and medicine to address health disparities and promote social justice.
  Community participation in research goes beyond mere consent; it entails deep collaboration between researchers and community stakeholders. The nature and level of partnership can vary depending on the specific context, research question, and needs of the community. While different forms of partnership may yield varying benefits, the overarching goal is to foster meaningful engagement and empower communities to address their own challenges.
  Action research encompasses a wide array of social issues and disciplines, requiring a multifaceted approach to design and implementation. While a basic cyclical model of assessment, planning, action, and reflection is often cited, the complexity of action research necessitates deeper consideration of key principles.
  One principle involves bridging the gap between research and action, ensuring that action research contributes both to scientific literature and social change efforts. Effective action research builds bridges between theory and practice, creatively leveraging strengths from both domains for improved outcomes.

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Another principle emphasises interdisciplinary collaboration to address complex community problems comprehensively. By drawing upon diverse disciplinary perspectives and methodologies, action research can provide more meaningful insights and solutions.
Finally, building powerful partnerships is essential for impactful action research. Researchers should seek partnerships with organisations and communities capable of enacting social change, fostering intentional relationships based on mutual benefit and shared commitment to improving practices through research findings.

- Photovoice: Photovoice is a participatory research method developed with roots in feminist methodology and critical theory. It involves participants taking photographs based on a prompt and then discussing them in a structured format within a group setting. The aim is to engage community members in studying their community and fostering social action.
  Participants, often from marginalised groups, use photovoice to investigate social inequalities and advocate for change. They control the photographic process, selecting images that represent their experiences and comfort levels, which fosters collaboration and empowerment. Critical consciousness is promoted as participants reflect on their lives and societal structures shaping their experiences.
  In the initial photovoice session, participants are introduced to the project and the participatory action research (PAR) approach. They discuss the methodology, potential benefits and risks, confidentiality, and technical aspects of using cameras ethically. A prompt is then provided to guide participants in taking photos, which they subsequently discuss in group sessions using the SHOWED method (See, Hear, Our lives, Why, Educate, Do). These discussions help participants interpret the images and their relevance to their lives, facilitating critical reflection and dialogue.
  Throughout multiple photovoice sessions, participants categorise their photos and narratives into themes emerging from their discussions. They then plan activities, often culminating in photo exhibitions where selected images are displayed. These exhibitions serve as a platform for participants to share their perspectives with stakeholders and the broader community, potentially sparking dialogue and action on the issues depicted. While exhibitions are common, other forms of action such as guerrilla art or skits may also be employed for community intervention and social change.
  Photovoice offers numerous benefits for individuals and groups, such as fostering relationships across diverse backgrounds by sharing photographs and narratives, facilitating dialogue on sensitive topics, and empowering community members to engage in social action. It encourages active community engagement and helps envision possibilities for social change. However, conducting photovoice projects presents challenges, including the significant time commitment required from participants, limited financial support, and potential difficulties in navigating power dynamics and group interactions. Language barriers, power hierarchies, and cultural sensitivities can also hinder effective collaboration and community engagement. Moreover, researchers must navigate their own biases and power dynamics to ensure respectful and transparent interactions with participants. Despite these challenges, building rapport, transparency, and accountability within the community can help overcome barriers and ensure the success of photovoice projects.

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- Concept Mapping: Concept mapping is a research approach that combines qualitative and quantitative methods to visually represent the thoughts or ideas of a group. It involves techniques like brainstorming, card sorting, and ratings, along with statistical analysis to create a data-driven visual representation. Concept Mapping differs from other methods that share the same name, as it integrates both qualitative and quantitative elements.
  This methodology is well-suited for community research within a participatory framework for several reasons. Firstly, it allows researchers and community members to collaborate in study design, data collection, and interpretation of results. Secondly, while it involves community members, CM is not about consensus-building but rather about capturing diverse individual perspectives. This makes it effective in eliciting and including varied viewpoints within a community. Lastly, the results of CM can inform evidence-based action planning or policy development, co-created with the community.
  The Concept Mapping methodology involves several key steps, each interacting with the target community or group.
    - Preparation: This step involves defining the community, developing research questions, and identifying who needs to be included. A focus prompt, an incomplete sentence, is created to elicit diverse ideas from participants.
    - Idea Generation: Participants from the community provide their individual perspectives by completing the focus prompt. The goal is to gather independent viewpoints from multiple participants.
    - Structuring: This step involves sorting and rating the generated ideas. Participants sort ideas into groups and rate them based on criteria like importance and feasibility.
    - Representation: The data collected is used to create visual representations using multidimensional scaling and hierarchical cluster analysis. Multidimensional scaling converts sorting data into a visual map, while cluster analysis identifies patterns or clusters of ideas.
    - Interpretation: The community is oriented to the maps, and discussions are facilitated to qualitatively review the concept map and assess alignment of viewpoints. Patterns of value across clusters or constituencies are emphasised.
    - Utilisation: The maps and ladder graphs are used to inform further action, such as promoting dialogue, developing strategies, or planning interventions based on the identified issues. The community may take responsibility for decision-making and action planning based on the results.
- Network Analysis: Social Network Analysis is a valuable approach for community-based research, focusing on understanding the patterns of relationships among actors within a system. Unlike conventional data analysis, which emphasises individual attributes, Social Network Analysis quantifies the structure of relationships between all actors in a setting, whether they are individuals or organisations.
  At its core, Social Network Analysis involves a set of actors (such as individuals or organisations) and the relationships between them (like friendships or collaborations). Rather than focusing solely on individual actors, Social Network Analysis takes a structural perspective, which is particularly relevant for community-based research. It emphasises the importance of capturing whole networks to inform social action.

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In conducting Social Network Analysis, researchers analyse whole networks within a finite group of actors, known as a system (for example, students in a classroom or organisations in a coalition). This allows for the measurement of system-level characteristics, individual actors' positions within the network, and the relationships between pairs of actors. These measures offer valuable insights into interconnectedness, power dynamics, centrality, and individual actors' perceptions of their community.

Social Network Analysis offers significant benefits for community-based research by addressing the challenge of assessing the structure of settings and communities, which conventional methods often overlook. Unlike individual-focused approaches, Social Network Analysis explicitly measures the relationships within a community or setting, making it inherently contextual and aligning with ecological theories that emphasise interdependence among actors.

The relational focus of Social Network Analysis allows researchers to measure interdependence between actors, providing insights into community dynamics. Additionally, Social Network Analysis' whole network data are flexible, enabling researchers to analyse multiple levels of the network, from the entire setting to individual actors and their relationships.

However, Social Network Analysis also has drawbacks. It requires near-complete data on relationships between actors, making it sensitive to missing data. Even small amounts of missing data can lead to distorted results. To mitigate this, researchers must prioritise efforts to boost response rates or use alternative data collection methods like cognitive social structures for settings with low response rates.

Ethical considerations also pose challenges for Social Network Analysis in community-based research. Since Social Network Analysis requires knowing who is related to whom, data collection cannot be anonymous. Additionally, secondary participation is common, where data are collected about actors who do not directly participate in the study. Protecting confidentiality and obtaining explicit consent are crucial in Social Network Analysis studies, requiring special attention to ethical considerations.

The methodologies presented above are only some examples of methodologies that exist in community-based research. For a further introduction and a more detailed and extensive explanation of community-based research methodologies, we recommend “The Handbook of Methodological Approaches to Community-Based Research” edited by Leonard A. Jason and David S. Glenwick (https://doi.org/10.1093/med:psych/9780190243654.001.0001), for further reading.

Reviewing current research trends in circular economy and identifying research gaps and opportunities.

Reviewing current research trends in the circular economy and identifying research gaps and opportunities involves several steps:

1. **Literature review:** The first step is to conduct a comprehensive literature review of recent studies, articles and reports related to circular economy and other relevant topics. This helps you to understand the current state of research, key concepts and methodology used in circular economy research. This literature review can be done with the help of databases that are listed and explained in the next subchapter.

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2. **Identify key topics:** When you review the literature, studies, articles etc., identify the key themes and topics that are recurrently explored in the field of circular economy.
3. **Emerging trends:** Within the reviewed literature and the identified key topics, look for emerging trends, e.g., new methodologies, technologies or approaches that are used by researchers in the field of circular economy. Also, at this step look for shifts and developments of approaches and methodologies.
4. **Gap analysis:** Identify the gaps where further research is needed, e.g., topics that have received less attention in the reviewed research, unanswered questions or conflicting areas. Consider gaps in knowledge, methodology, geographical focus, or sectoral coverage.
5. **Evaluation of research opportunities:** Based on what you have found out in the previous steps (review, key topics, trends and gaps) consider and evaluate your potential research opportunities within the field of circular economy. This could involve proposing new research questions, methodologies, or approaches to address existing gaps in the literature. Look for areas where your expertise or interests align with research needs.
6. **Engage with stakeholders:** Engaging with stakeholders in the circular economy ecosystem, such as businesses, policymakers, NGOs, and academic researchers can provide valuable insights and collaboration opportunities. Particularly, engaging with the community and the citizen should be a focus in community-based research in the CIRCULAR project.
7. **Synthesise findings:** Lastly, synthesise and summarise your findings into an analysis that highlights research trends, identifies gaps and opportunities, and provides recommendations for future research directions in the field of circular economy.

Introduction to local and international databases that shed lights on existing research such as-Scopus, Web of Science and public databases.

As mentioned above, in the world of research, and especially when starting literature review, accessing reliable and comprehensive databases is crucial for scholars, scientists, researchers, and professionals. These databases serve as repositories of published research, providing access to a wealth of information that is invaluable for conducting literature reviews, identifying trends, and generating new insights. Among the multitude of databases available, various prominent ones stand out that will be introduced in continuation. Each offers unique features and advantages, catering to the diverse needs of researchers across various disciplines. By leveraging these databases, researchers can effectively navigate the vast landscape of academic literature and contribute to the advancement of knowledge in their respective fields.

- Scopus: Scopus is one of the largest abstract and citation databases with enriched data and linked scholarly literature. It covers over 330 disciplines, including science, technology, medicine, social sciences, environmental science, engineering, economics, and management and arts and humanities. With over 70 million records, including journal articles, conference papers, books, and more, Scopus offers extensive coverage of scholarly literature. State-of-the-art search tools and filters enable quickly to discover relevant sources, identify trends in research or emerging topics and uncover potential research collaborators. Researchers can access to a wide range of journals and conference papers relevant for research in circular economy and waste management. Furthermore, to gain a deeper understanding of your research

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topic, Scopus offers an AI-powered tool that helps to navigate the amount of information.

- Web of Science: Web of Science is another widely used citation database encompassing various scholarly disciplines. It comprises several citation indexes, such as the Science Citation Index Expanded, Social Sciences Citation Index, and Arts & Humanities Citation Index covering disciplines such as environmental science, ecology, engineering and other disciplines that are relevant for research in circular economy and waste management. Main features of the database include citation indexing, research analytics and highlighting cited papers and therefore providing insights into research trends in the field of sustainability and other relevant disciplines.
- GreenFILE: GreenFILE is a free research database that covers research related to the human impact to the environment. It covers the connections between the environment and a variety of disciplines such as agriculture, education, law, health and technology. GreenFILE focuses specifically on environmental studies and sustainability-related literature, including research on recycling, waste management policies, and sustainable resource utilisation. It offers a wide range of scholarly and general interest articles, reports, and government documents pertaining to environmental issues and circular economy principles.
- Science Direct: Science Direct provides wide access to a large collection of peer-reviewed journals and books covering environmental science, sustainability, resource management, and related topics. It has advanced search functions, access to full-text articles and a diverse range of research material in the field.
- PubMed: This database offers a wide range of scholarly articles, conference proceedings, and reports relevant to circular economy initiatives and waste management practices mostly in the disciplines of Biomedical and life sciences literature, including research on environmental health, pollution, and public health aspects of waste management.

Practical example on the Scopus database: Step-by-step reviewing current research trends in circular economy and identifying research gaps and opportunities.

Find here the step-by step process of reviewing and identifying research trends and gaps detailed above using the Scopus database as an example.

First, define the **scope of your research** in the field of circular economy. This can include specific aspects such as waste management, sustainable production or circular business models.
Now, **log in to the Scopus database** and develop a **search strategy** to find relevant literature. Depending on the scope of your research, use **keywords** such as “circularity”, “sustainable consumption” or “resource recovery” etc. By combining your keywords with Boolean operators, you can refine your search.
Next, **retrieve relevant literature** by filtering the results. Now, **screen** the search results to **identify articles relevant** for the scope of your research. Read the abstract and the keywords to get an idea on its relevance.
You will then conduct a **thorough review** of the selected articles which is the step of the actual **literature review**. **Summarise** key findings, methodologies, and trends in the field of circular economy research. Pay attention to **emerging topics**, methodologies, and areas of consensus or disagreement among researchers. For

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the **identification of gaps**, topics with limited coverage, contradictory findings or unanswered questions, analysed the reviewed literature.
Based on this review and analysis, assess the **opportunities for your future research**. Consider areas where your expertise aligns with unmet research needs or where there is potential for innovative approaches or methodologies.
In the last step, **synthesise and summarise** your findings into a research report that summarises the current research trends, identifies gaps and presents opportunities for future research. This analysis can be organised by thematic areas and topics. This report does not only present a summary but should also include a **discussion** of the key trends, gaps identified and proposed research opportunities.

Introduction to the implementation of a local living lab, including the role of facilitator, stakeholder engagement, and transdisciplinary dynamic process

Living Labs (LLs) are presented as platforms that **facilitate Quadruple Helix innovation**, allowing stakeholders to collaborate in co-creating knowledge, products, and services. LLs are proposed as **mediators** between innovation stakeholders, aiming to bridge the gap between knowledge production and commercial success. Additionally, LLs are aligned with sustainability goals, engaging users in designing and testing solutions to sustainability challenges.

User engagement within LLs is highlighted as crucial for achieving sustainability outcomes. LLs facilitate user-driven innovation by involving users as **active co-creators** rather than passive consumers. This approach not only accelerates development processes and reduces costs but also harnesses users' knowledge to better understand real-life situations and foster innovation.

Overall, LLs are positioned as instrumental in promoting Quadruple Helix innovation, addressing sustainability challenges, and fostering user engagement to drive meaningful innovation outcomes.

LLs are seen as a promising avenue to **engage local communities in research and experimentation**, but achieving inclusiveness poses significant challenges. Projects must actively reach out to stakeholders to ensure representation and diverse perspectives. Time is crucial, influencing trust-building, stakeholder involvement, and the design, implementation, and evaluation stages of LLs.

During the design phase, **discussions with local stakeholders** shape the project's themes and starting points. In the implementation phase, stakeholder agreement on needs and methods is essential. **Trust and transparency** are critical, requiring time and sustained communication. Building trust evolves through relationship-building and transparent **communication**, ensuring stakeholders understand project goals and their level of involvement.

Effective **communication, translation, and learning** are key for inclusiveness. Complex topics require targeted communication and visualisations to engage stakeholders effectively. Building on local needs creates value and incentivises participation. Stakeholders should be involved throughout the project, with **ongoing feedback** and follow-up to ensure sustained impact and local ownership.

Continued engagement, resource allocation, and local acceptance are crucial for LL success beyond project completion. Traditional funding models often overlook the

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need for sustained involvement and local ownership, highlighting the importance of skills, resources, and community coordination in facilitating long-term engagement.

Living Labs require **redefined roles and tasks for researchers, citizens, planners, policymakers, and other stakeholders**. Negotiation, co-ownership, and shared problem definitions are essential, considering power dynamics and varying expertise. **Flexibility** in processes and resource allocation is crucial to enable broader stakeholder participation and address knowledge authority relations.

Transformative Transdisciplinary Research of LLs necessitates **changes in funding frameworks** to accommodate co-ownership and coordination roles for non-scientific stakeholders. Traditional research funding models often prioritise scientific outcomes over process-oriented impacts like trust-building and empowerment. Rethink academic qualifications and pathways to value non-scientific outcomes and enhance sustainability literacy.

LLs must be **rooted in local contexts**, addressing **community needs and power dynamics**. Active engagement requires thorough research into community culture and history, identifying comfortable spaces and times for stakeholder involvement. Openness to co-creative problem definition and shifting focus from solutionism to learning are crucial.

LLs need to strengthen their **sustainability and transformative capacity** beyond project completion. Funding mechanisms could enforce stakeholder commitment and support long-term initiatives, enhancing transparency and legitimacy. Long-term labs could provide space and resources for **continuous experimentation** and societal problem-solving.

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Showcasing successful case studies of circular economy / innovation and community-based research.

In the following table, successful case studies of circular economy and innovation research are presented. By doing circular economy research, engaging local stakeholders, fostering collaboration, and promoting innovation, these initiatives are paving the way for a more circular and resilient future. The learnings can be used by researchers as guidelines and tips when conducting their own circular economy research and/or community-based research.

Successful case study	Learnings
Circular Buiksloterham, The Circular Communities Project, The Netherlands	This project aims to create circular neighbourhoods by engaging local residents, businesses, and policymakers in the transition to a circular economy. Through collaborative research and participatory design processes, communities in Amsterdam are exploring innovative approaches to waste reduction, resource efficiency, and sustainable consumption and production. Initiatives include neighbourhood-based recycling schemes, circular business models, and community-led initiatives to repurpose and reuse materials. The project demonstrates how community-based approaches can drive circular economy innovation at the local level and foster social, economic, and environmental benefits for communities.
Interface's Net-Works Programme, Philippines and Cameroon	Interface, a global carpet tile manufacturer, partnered with the Zoological Society of London to create the Net-Works program. This initiative aimed to address the issue of discarded fishing nets polluting oceans while also sourcing recycled materials for carpet production. Local communities in the Philippines and Cameroon were engaged to collect and recycle discarded fishing nets, which were then used as raw materials by Interface. The program not only cleaned up marine environments but also provided economic opportunities for coastal communities, demonstrating the social, environmental, and economic benefits of circular economy practices.
New Plastics Economy Initiative by the Ellen MacArthur Foundation	This initiative brings together businesses, policymakers, and innovators to rethink and redesign the global plastics system. Through research and collaborative projects, the initiative explores circular solutions to plastic waste and pollution, such as designing out waste, promoting reuse and recycling, and transitioning to bio-based and compostable materials.
Zero Waste Communities, San Francisco, USA	This project engages communities in the San Francisco Bay Area in efforts to achieve zero waste goals through circular economy approaches. By working with local governments, businesses, and community organisations, the project promotes waste reduction, resource recovery, and closed-

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	loop systems that minimise environmental impact and maximise resource efficiency. Community-based research initiatives are exploring strategies such as composting, recycling, and product redesign to reduce waste generation and promote circularity in local economies. The project demonstrates how community-based approaches can catalyse circular economy transitions and create more resilient and sustainable communities.
Zero Waste Town, Kamikatsu, Japan	Kamikatsu, a town in Japan, has made significant strides towards achieving zero waste through community-based circular economy initiatives. The town implemented a waste separation and recycling program, aiming to recycle or compost 80% of its waste by 2020. Residents actively participate in sorting their waste into 45 categories, including plastics, glass, paper, and organic waste. The town also operates a "Zero Waste Academy" to educate residents and visitors about sustainable living practices. Kamikatsu serves as a model for other communities in Japan and around the world seeking to adopt circular economy principles to reduce waste and promote recycling following the model of community-based research in circular economy.
Circular Economy Alliance, Taiwan	Taiwan's Circular Economy Alliance is a coalition of government agencies, businesses, and civil society organisations working together to promote circular economy principles and practices across the country. The alliance supports community-based initiatives that promote waste reduction, resource recovery, and sustainable consumption and production. For example, the alliance has launched pilot projects in local communities to promote eco-friendly practices such as upcycling, repair cafes, and community gardens. By fostering collaboration and innovation at the grassroots level, the alliance is driving circular economy transitions and creating positive social, economic, and environmental impacts in Taiwan.
Circular Economy Club, Bristol, UK	The Circular Economy Club is a grassroots organisation that connects individuals, businesses, and community groups in Bristol to advance circular economy initiatives. Through research, education, and advocacy, the network promotes circularity principles such as resource recovery, product repair, and collaborative consumption. Community-based projects include repair cafes, tool libraries, and community gardens that encourage resource sharing and waste reduction.
Circular Economy Initiatives, Imperial College London, UK	The Imperial College London has various initiatives in the field of circular economy connected to research. For example, the Waste to Wealth Initiative is a research program that explores innovative approaches to waste management and resource recovery. Researchers

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	collaborate with industry partners to develop technologies and strategies for converting waste into valuable resources, such as energy, materials, and nutrients. The initiative aims to drive circular economy transitions by demonstrating the economic and environmental benefits of waste valorisation.

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Unit 3.2. Organisational aspects in circular economy research

Engagement of the quadruple helix (industry, researchers, civil society and policy makers)

Behind the approach of the Quadruple Helix lies the idea that innovation is the outcome of an interactive process involving different spheres of actors. Each one of those actors is contributing to this innovation process according to their institutional function in society.

The different actors (helices) of the Quadruple Helix are the following:

- University
- Industry
- Government
- Civil Society

Each of the helixes represents a different component of the model. In this case, university is represented by research performers, the government is represented by non-research & non-development performers, i.e., policy makers. Hybrid institutions or organisations represent the industry and informal groups of users participating in the knowledge exchange and innovation creation process represent the civil society.

Innovation and thereby economic growth are created by knowledge sharing and transfer of know-how. It is an open innovation process that is inclusive and where all stakeholders play an active role in jointly creating and experimenting new ways and processes. All this underlies the general objective of regional development and growth.

Key elements of the Quadruple Helix approach are a focus on innovation generated by citizens (social innovation) with social inclusion, user-centrality and creativity being its core elements.

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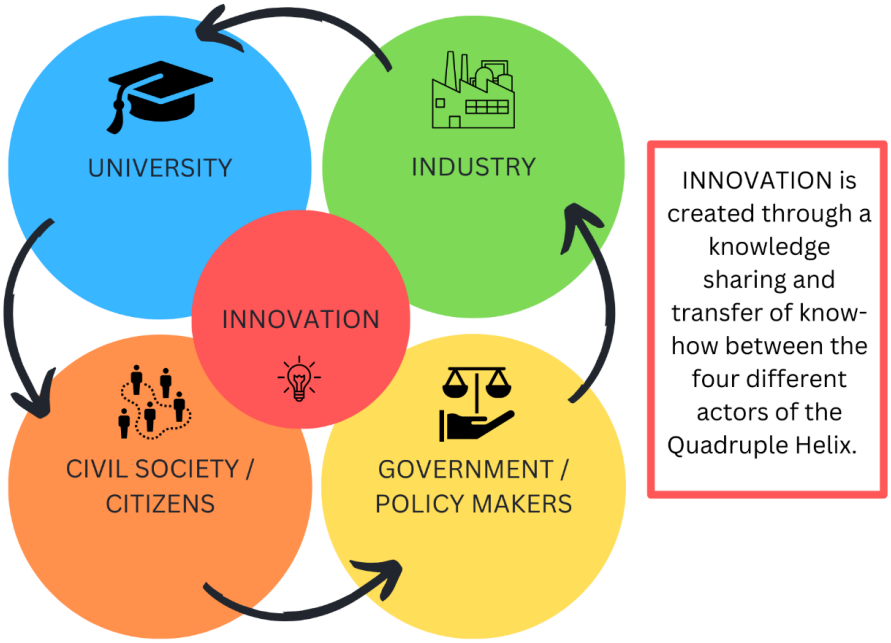
Figure 6. The Quadruple Helix. Source: Own design by the author of the module with Canva.



The following recommendations should be taken not consideration when applying the Quadruple Helix approach on your research and in the implementation and operationalisation of Living Labs:

- Fostering the Quadruple Helix through **practical means** rather than academic discourse is of high importance. It is suggested that sharing successful evidence among territorial authorities, such as best practices and effective interaction mechanisms, is crucial. Additionally, highlighting the positive impact of helix models on territories can further support their adoption and implementation.
- **Civil society and integrating civil society engagement** in helix-based strategies is of great significance for creating innovation. Civil society has a broad innovative potential across sectors, noting its immediate applicability and minimal resource requirements. Involving civil society in innovation processes can facilitate consensus-building in policymaking, thus positively impacting innovation efforts.
- **Clustering data** and analysing them by helix as an operational method to assess a territory's strengths, weaknesses, opportunities, and threats regarding helix approaches. This approach helps decision makers gain insight into the effectiveness of helix strategies and inform strategic planning.
- Identify new **indicators** and enhance the quality of existing ones for measuring knowledge and innovation. The University actor of the Quadruple Helix has a crucial role in defining these indicators.
- The innovation performance of the University helix can be improved by fostering its **entrepreneurial role as a technology transfer actor** (strengthen

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the capacity to reach the market) and as a knowledge transfer actor to the policy makers and the industry actors.

- Focus on a **regional specialisation** and boost the innovative potential of the civil society based on social inclusion and a **bottom-up approach**. Furthermore, it should be focused on the **connectivity** of all actors forming part of the Quadruple Helix.
- Instead of solely focusing on universities' direct contribution to innovation, enhancing **interaction opportunities** within the Quadruple Helix approach is crucial. This improvement allows for the **effective transfer and utilisation of high-value knowledge** generated by universities, which are already innovation-oriented, by the industry and civil society spheres.
- Enhancing the **innovation culture among public administrators** to effectively operationalize the helix model is of high importance. This could be achieved by sharing concrete and successful experiences, known as good practices, among administrations, or by involving organisational innovation professionals in the modernisation process of public administrations.
- Government/ policy makers should **facilitate structured environments** that make information sharing between the different actors easier. These environments, whether physical or virtual, should be tailored to the specific information being shared and the stakeholders involved.
- The importance of building **institutional structures** for Quadruple Helix Collaborations (QHCs) is highlighted. Establishing formal procedures for partner selection, reporting, and communication, as well as identifying a common goal, are essential elements of this process. Building structure involves **co-creating a shared vision, ensuring institutional and personal trust, and fostering open cooperation**. It is emphasised that this process requires ongoing efforts and adaptation. Securing funding and establishing a **financial framework** that benefits all partners is crucial for QHCs, often relying on public funding. However, lack of financial resources can lead to individuals performing work beyond their duties or seeking support externally. Partner selection is influenced by financial resources and regional aspects, with trust often driving collaboration among previously cooperating or geographically close entities. Face-to-face meetings are essential for building trust but may not guarantee effective communication, highlighting the need for openness and clear communication channels. **Legal instruments** such as non-disclosure agreements and work plans help define responsibilities and foster trust, particularly in collaborations involving single actors or limited resources. Finally, a common vision and shared goals are essential for QHCs to overcome barriers and create meaningful value, often complementing wider goals such as national research and innovation strategies. These goals may also extend beyond the immediate collaboration to drive cultural change within organisations or foster regional growth.
- To foster interaction, regular **personal meetings**, **face-to-face interaction** events, workshops, and bilateral/trilateral meetings are key resources for aligning goals, fostering trust, and ensuring transparency. These interactions help **overcome communication barriers and power gaps**, ensuring the involvement of all helices and addressing knowledge gaps among partners. **Neutral moderators** play a beneficial role in facilitating communication and ensuring participation across helixes. Management structures, such as formal steering committees or loosely organised decision-making groups, help align and foster interaction across collaborations. Decision rights are formalised to ensure transparency and responsibility allocation, although dominance by a

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single resource-providing partner may lead to frustrations among others. Active involvement of civil society in innovation is often a challenge, with only a fraction of cases actively including civil society in decision-making processes. Civil society is often the last to join QHCs, entering collaborations on established conditions, and facing challenges related to lack of knowledge and resources. Additionally, diverse understandings of civil society and the privileging of certain groups may lead to marginalised voices within QHCs. Citizens entering QHCs require resources and motivation to engage alongside their other responsibilities.

- **Regular reflection** and shared learning processes were described as useful for aligning goals and ensuring the involvement of all helix partners. Reflection extends beyond internal project questions to align with external goals and expectations, gaining new ideas and enriching perspectives of the QHC.
- Quadruple Helix Collaboration (QHC) cases underscore the importance of considering the expectations and goals of **external actors**, who may not be directly involved in project activities but can significantly influence QH practice. Decision-making power often lies outside QHCs, in governance boards of involved entities or even beyond, such as governments or associations. Aligning and interacting with external actors also brings additional perspectives and ideas to stimulate internal collaboration processes. External actors like consultants, advisers, and start-ups seeking funding can play key roles in QHCs. QHCs are dynamic, requiring contingency planning and openness to change within and outside the arrangement for long-term effectiveness.

Research management. Producing engaging reports.

Managing your research and day-to-day aspects related to it can be a challenge. Research management is a broad field that involves the coordination of numerous processes related to our research. In continuation, some practical tips and principles will be shared that help you to manage your research effectively. By following these methodologies, researchers can conduct community-based research effectively, leading to meaningful insights and positive outcomes for the community and stakeholders involved.

- Define **objectives** and **scope**: Establish clear research objectives and define the project scope to provide direction and clarity for the research team and everyone involved.
- **Planning**: Develop a comprehensive project plan that includes tasks, milestones, timelines, and resource allocation to effectively manage the research process.
- **Literature Review**: Conduct a thorough literature review to identify gaps in knowledge and inform the research methodology.
- **Research design**: Select an appropriate research methodology, considering ethical considerations, and obtaining necessary approvals.
- **Data collection**: Implement rigorous data collection methods to ensure the quality and reliability of data gathered.
- **Data analysis**: Choose appropriate analytical techniques to interpret the collected data and strengthen the credibility of findings.
- Project **Monitoring** and control: Monitor project progress closely to identify deviations from the plan and address them promptly.

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- **Risk** management: Identify potential risks and develop mitigation strategies to minimise their impact on the research project.
- **Communication**: Establish clear communication channels among team members and stakeholders to facilitate cooperation and transparency.
- **Budget** management: Manage project finances effectively to stay within allocated budgets and avoid financial discrepancies.
- **Collaboration** and teamwork: Foster a collaborative environment among team members to enhance the quality of research outcomes.
- Documentation and **reporting**: Thoroughly document methodologies, data, and analyses to ensure transparency and reproducibility.
- **Dissemination**: Develop a plan to share research findings with the intended audience through publications or presentations while adhering to intellectual property guidelines.
- **Reflection**: Evaluate the success of the research project against defined objectives and reflect on strengths and weaknesses to inform future improvements.
- **Continuous learning**: By embracing a culture of continuous learning and improvement, researchers can enhance their research management competencies, optimise their performance, and contribute more effectively to their field. Hence, see feedback, reflect on strengths and weaknesses and adopt best practices.

For community-based research, especially networking and collaboration are of utmost importance. Networking opens doors to new opportunities, resources, and insights. Collaborating with others allows you to leverage diverse expertise and perspectives. Collaborating with others can expand your research's reach and visibility, reaching broader audiences and enhancing its impact. Therefore, engage with other researchers, funders, partners, and organisations that share your interests and goals. Establishing meaningful connections fosters mutual trust and respect.

Working with students, trainees, external stakeholders and community members on your research projects can be beneficial. By assigning smaller sub-questions or tangentially related topics to others, they can help lighten the researcher's workload and expedite the research process. Mentoring students, trainees, stakeholders and community members is an essential teaching skill that prepares researchers for future academic careers. It provides opportunities to impart knowledge, guide learning, and foster critical thinking. Collaboration with not only other researchers can bring fresh ideas, new insights and stimulate knowledge exchange.

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Public-private partnerships to boost entrepreneurship and innovation.

Public-private partnerships (PPP) can be defined as the following according to the definite issued by the OECD:

"Public-Private Partnerships (PPPs) are long term agreements between the government and a private partner whereby the private partner delivers and funds public services using a capital asset, sharing the associated risks. PPPs may deliver public services both with regards to infrastructure assets (such as bridges, roads) and social assets (such as hospitals, utilities, prisons)."

The Public-Private Partnership (PPP) framework proves effective in expanding resource recovery projects around the topics of circular economy, such as waste management. However, while such initiatives focus on technological efficiency to reduce waste volume, they often lack market-driven enterprise potential. Establishing an enabling environment within the PPP framework can address this gap by (i) addressing barriers along municipal waste and sanitation management chains, (ii) promoting market-driven waste-to-energy pathways, and (iii) balancing risks between the private sector and government.

Key success factors for resource recovery PPP projects include ensuring an adequate municipal waste supply chain, robust government policies with enforcement, access to financing and subsidies, advanced engineering and equipment, cost-effective operation and maintenance by the private sector, stringent environmental and social compliance, and fostering community support through good public relations.

Potential challenges for PPP projects may arise from financial constraints, institutional weaknesses, lack of technical expertise, or limited municipal capabilities. To mitigate these risks, PPP planning and execution should focus on technical feasibility, financial viability, legal and contractual issues, and communication and awareness. The initiation of the PPP process should prioritise local demand and commitments from both public and private sectors.

A roadmap for successful PPPs in the resource recovery market involves thorough project preparation to ensure technical and commercial viability, early engagement with the private sector and local community, a practical regulatory framework, effective project structuring, and careful selection of private partners based on prequalification and evaluation criteria. Key performance indicators should be established to ensure the quality of the end product or service, extending beyond resource recovery to include sales metrics.

Successful PPPs require collaboration and trust between public and private entities, with a shared goal of bridging waste management and agricultural or domestic reuse sectors. This mutual understanding develops through continuous engagement and exchange, beginning with project preparation.

Additional reading: OECD Principles for PPP https://www.oecd.org/gov/budgeting/oecd-principles-for-public-governance-of-public-private-partnerships.htm

Implementing Circular Economy principles within public sector organisations holds promise for accelerating sustainability efforts beyond current sustainable development endeavours. Given the pivotal role of the public sector in this transition and the unique characteristics of public organisations, it is crucial for them to embed Circular Economy principles into their resource management practices at the

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organisational level. Collaboration, stakeholder engagement, and raising awareness emerge as crucial elements for fostering a substantial shift towards circularity.

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