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# A methodological framework for the implementation of urban living lab on circular economy co-design activities

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Circular Economy (CE) has the potential to tackle many of the challenges we are facing nowadays. It represents nothing less than a paradigm shift, as closing and shortening material loops means adopting completely new ways of producing and consuming. In the European Union, CE is a key strategy to achieve climate neutrality target by 2050, to face the biodiversity crisis, to guarantee economic growth and social wellbeing, within planet boundaries, in accordance with the UN Sustainable Development Goals. Stakeholders' engagement is a crucial point of the transition pathway based on a systemic approach through a co-creation process. Urban areas are the main field of the circular transition process in which all the urban actors, i.e., public institutions, academic and research bodies, economic operators, citizens and civil organizations, are involved. An effective operational tool to realize stakeholders' involvement and co-creation processes is the methodological approach of Urban Living Labs (ULLs). Although ULLs have already been tested and implemented worldwide, there is no description of a step-by-step methodology to implement ULLs aimed at co-creation of project ideas on CE, to be realized in a specific territory. This paper aims to define a methodological framework for implementing ULLs focused on co-designing CE activities. The proposed methodology is based on four main phases: (i) scouting and analysis of the territorial context, (ii) listening and exploration, (iii) participation, (iv) execution. A detailed description of each phase as well as the first application of this framework in different urban communities are presented.

## KEYWORDS

urban living lab, circular economy, co-creation, co-design, urban transition, urban community

## 1 Introduction and objectives

The launch of the European Green Deal in 2019 placed the concept of the Circular Economy (CE) at the heart of efforts to transform the European Union into a fair and prosperous society, where economic growth is decoupled from resource depletion and environmental damage (European Commission, COM, 2019b, 640 final). In 2020, the European Commission adopted the New Circular Economy Action Plan (European Commission, COM, 2020, 98 final), as part of the European Green Deal, announcing initiatives throughout the whole product life cycle and promoting CE processes as a prerequisite for achieving Europe's climate neutrality target by 2050 and halting the loss of biodiversity. CE actions can also ensure progress toward compliance with international framework programs such as the UN Sustainable Development Goals and the Paris Agreement (OECD, 2020).

For a successful transition to CE, as also emphasized by the European Commission since in its first Action Plan for the Circular Economy in 2015 (European Commission, COM, 2015, 614 final), stakeholders' engagement through the adoption of a systemic approach is of paramount importance (Farmer, 2020). Even the European Commission's Report on the Implementation of the Circular Economy Action Plan (European Commission, COM, 2019a, 190 final) mentioned the stakeholders' engagement as one of the key points to accelerate the transition to the CE. Moreover, according to the European Commission, COM, (2020), the evolutionary path toward a CE must be made in a co-creation perspective, through the cooperation between different actors: public institutions, economic actors, citizens and civil organizations. Hence, the involvement of communities and individual citizens is a prerequisite to implement the CE paradigm in specific territorial contexts (Suárez-Eiroa et al., 2021).

Urban areas are the main field of experimentation for tackling economic and environmental challenges (Vandecasteele et al., 2019). Consequently, cities should become a creative ground for collaboration between different stakeholders: public institutions, economic operators, citizens and civil organizations (UN Sustainable Development Goal #11). A massive experimentation with collaborative processes has already been promoted all over the world to improve the urban environment while preserving the environment and the health of citizens (Mukhtar-Landgren et al., 2019; UN DESA, 2023). Also at the European level, with the aim of accelerating the urban transition to CE, the empowerment of urban communities has been encouraged and promoted, through their involvement in collaborative decision-making processes (Cerreta et al., 2020). The operational tool that can help to achieve greater stakeholders participation and social cohesion is the Urban Living Lab (ULL) (Aernouts et al., 2020). Since 2006, the European Commission has promoted a common European innovation system based on Living Labs (LLs) (ENoLL, 2006) in order to strengthen Europe's economic competitiveness. The ULLs can be considered as the urban projection of LLs able to respond on the specific needs, challenges and

opportunities of urban environments. The ULLs are proliferating across Europe and around the world as a means for testing innovations in buildings, transport, and energy systems, by using an approach for intentional collaborative experimentation of researchers, citizen, companies, and local governments in order to promote the co-creation process.

At the Italian national level, a broad systemic and coordinated participation process involving all relevant stakeholders was recommended in the National Strategy for the Circular Economy (Ministerial Decree N° 259 of 24 June, 2022). ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, has successfully applied the ULL approach to different European local contexts, within three projects: RECiProCo,<sup>1</sup> Basilicata Heritage Smart Lab,<sup>2</sup> Biocircularcities.<sup>3</sup>

To the best of our knowledge, there is no reference methodology in the literature for implementing ULLs focused on co-design of CE actions and activities, based on the specificities and needs of the involved urban community. To fill this gap, this paper presents an *ad hoc* methodological framework for a correct co-design process of CE at the urban level. This framework is based on a comprehensive literature review of LLs and ULLs and the lessons learned from various national and European research projects. The framework is described step-by-step.

## 2 Literature review

### 2.1 Living labs

The tradition of cooperative and participatory design can be traced back to the 1960s and 1970s when the so-called user center design approach came to the fore. A second line of proto-living lab started in 1980s when, all over Europe, various social experiments with information technology were started. Academic studies on LLs date back over a decade (Ballon and Schuurman, 2015; Leminen et al., 2017; Hossain et al., 2019). Some studies suggest that the LL concept was elaborated by Mitchell from Massachusetts Institute of Technology (Bergvall-Kareborn and Ståhlbröst, 2009; Budweg et al., 2011; Schuurman et al., 2011). Reflecting on the innovation possibilities offered by Information and Communications Technology (ICT), Mitchell (Le Hub, 2008) suggested that living spaces, such as a city or a building, can be laboratories for generating and testing hypotheses by monitoring users' interactions with new technologies (Dutilleul et al., 2010). Other studies identified Abowd (1999) and colleagues from Georgia Institute of Technology as pioneers of the LL concept (Følstad, 2008b; Leminen and Westerlund, 2016).

1 <https://www.reciproco.enea.it/>

2 <https://www.heritagesmartlab.it/smartlab/home>

3 <https://biocircularcities.eu/>

TABLE 1 Living lab definitions.

Living Lab definition	Source
User-centered open innovation ecosystems based on a systematic approach to user co-creation, integrating research and innovation processes in real-life communities and settings.	European Network of Living Labs (ENoLL) ( <a href="http://openlivinglabs.eu/aboutus">openlivinglabs.eu/aboutus</a> )
Physical regions or virtual realities in which stakeholders form public-private-people partnerships of firms, public agencies, universities, institutes, and users all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts.	<a href="#">Leminen et al. (2012)</a>
A user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts.	<a href="#">Eriksson et al. (2005)</a>
Experimentation environment in which technology is given shape in real-life contexts and in which (end) users are considered “co-producers.”	<a href="#">Ballon et al. (2005)</a>
A systemic approach to innovation in which all stakeholders in a product, service or its application directly participate in the development process.	<a href="#">Feurstein et al. (2008)</a>
Public-Private-People-Partnerships (PPPPs) aimed at generating open and user-centered ecosystems, capable of accelerating the large-scale adoption of innovative technologies and services co-created with the users themselves.	<a href="#">European Commission (2009)</a>
A Living Lab is a sociotechnical platform with shared resources, collaboration framework, and real-life context, which organizes its stakeholders into an innovation ecosystem that relies on representative governance, open standards, and diverse activities and methods to gather, create, communicate, and deliver new knowledge, validated solutions, professional development, and social impact.	<a href="#">Westerlund et al. (2018)</a>

The concept of LL was soon adopted in the United States and Europe by the corporate sector, and by ICT companies, with the aim of innovating products and services by including end-users. Initially, the goal of LL was to test technologies in a familiar, built environment, but more recently the concept has expanded to include the real-world context, with the goal of not only producing technical innovation, but also starting to promote the citizens' engagement ([Brask, 2015](#)). Moreover, the LL concept appeared in the academic debate in the 1990s, when Europe began funding various large-scale LL projects ([Følstad, 2008a](#); [Veeckman et al., 2013](#); [Leminen et al., 2017](#)). More recently, in order to support the objective of the Lisbon Strategy and to strengthen the economic competitiveness of the Old Continent ([European Commission, 2009](#)), the European Commission has created the European Network of Living Labs (ENoLL) organization, reaching more than 150 active LLs, in 2019. Numerous definitions of LL were provided by the scientific community ([Table 1](#)).

The concept of LL can be viewed as a methodology, organization, system, environment, and/or systemic innovation approach to the development of pathways for new services.

The LL is both an innovative approach and an infrastructure for experimenting with innovations and new sustainable technologies, in real conditions, in a circumscribed geographical context and in a limited period, with the aim of understanding and testing their feasibility as well as the degree of usefulness for end users, be they citizens, entrepreneurs, etc. ([Bergvall-Kareborn and Ståhlbröst, 2009](#)). In general, the LL provides a platform for innovation ([Westerlund et al., 2018](#)) and acts as a catalyst in terms of:

- strategy, by supporting the definition of the strategic lines of innovations;
- competitiveness, by calling on the entrepreneurial fabric to cooperate with the territory;
- organization, by coordinating and stimulating the different actors and the different instances;

- “distilling” initiatives and bringing them back to a concept of innovation.

The LL involves heterogeneous stakeholders such as research and educational (schools and universities) world, companies, public institutions, citizens and users driven by the desire to improve their daily lives ([Nyström et al., 2014](#)). Within the LL, the heterogeneous stakeholders jointly explore, design and validate products, new and innovative services, solutions and business models ([Schuurman et al., 2011](#); [Leminen et al., 2012](#); [Ballon and Schuurman, 2015](#); [Cappellaro et al., 2018](#)).

According to [Malmberg et al. \(2017\)](#), gathering many perspectives is a key element of every LL where the natural diversity of the involved stakeholders can be valorized, by encouraging and stimulating mutual contamination and joint participation to develop innovative solutions for local and global problems ([Gonella et al., 2019](#)). Indeed, through a high level of openness among stakeholders, their wealth of knowledge and experience becomes available to the community, helping to eliminate the existing barriers to knowledge transfer. Therefore, the involvement of heterogeneous stakeholders (multi-stakeholder participation) is of paramount importance. This requires that the lab's sponsoring partners actively invite public, private, and civic stakeholders to participate in the LL ([Steen and Van Bueren, 2017a](#)). In particular, [Eriksson et al. \(2005\)](#) and [Bergvall-Kareborn and Ståhlbröst \(2009\)](#) pointed out the added value from citizens and civil societies to the innovation process, in LLs. Citizens can be involved at different levels and scales ([Juujärvi and Pessa, 2013](#)). The first classification was already proposed in 1984 by [Ives and Olson \(1984\)](#) and identified the following six main categories of involvement:

- “No engagement,” when there is no involvement and when citizens are not willing or invited to engage in the development of solutions.
- “Symbolic engagement,” when citizens' input is requested, but is not used.

- “Advisory engagement,” when citizens are asked for advice with the help of interviews or questionnaires.
- “Engagement through weak control,” when citizens bear the primary responsibility for solution developing. However, they retain the ability to “empower” themselves at any time in the solution development process.
- “Engagement through action,” when citizens are active participants in the solution development process and influence the process at all stages.
- “Engagement through strong control,” when citizens have the power to condition the decision-making process, from the process of developing the solution in an urban life lab to the outcome that will be strongly influenced by citizens’ ideas, needs and expectations.

The active and constant involvement of users is crucial in the LL (Mulder et al., 2008), since the key to success is closely linked to the ability to identify users’ needs and translate them into technical/functional characteristics of new products and services (Bergvall-Kareborn and Ståhlbröst, 2009). Brankaert et al. (2015) emphasized the importance of actively involving end-users from the early up to the late stages of the innovation process, thus making them contributors and co-creators rather than study subjects (for co-creating user-oriented solutions). In fact, through the user’s constant feedback, at all stages of the design and implementation process, a fine tuning of new products and services can be achieved (Cappellaro and Bonoli, 2014; Buhl et al., 2017; Leminen et al., 2017). It is worth noting that there is no single methodology, but all LLs combine and customize different user-centered Multi-Method Approaches, to best suit their purpose (Malmberg et al., 2017).

Følstad (2008b) identified several characteristics of LLs: context (familiar context, real-world context), users (as co-creators), activities (co-creation, technical testing, evaluation), challenges (discovery), and innovative outcomes (e.g., large-scale solutions). Mulder et al. (2008), in turn, proposed six elements of LLs: user involvement, service creation, infrastructure, governance, innovative outcomes, methods and tools. Ståhlbröst and Holst (2012) highlighted five key components in the LL: ICT and infrastructure, management, partners and users, research and approach. The “ICT and Infrastructure” component outlines the role that new and existing ICT technologies can play in fostering new ways of cooperation for innovation between stakeholders. “Management” represents the ownership, organization, and political aspects of a LL. The “Partners & Users” implies making their wealth of knowledge and experience available to the community, helping to eliminate the existing barriers to knowledge transfer. The “Research” symbolizes the collective learning and reflection that takes place in the LLs. Finally, the “Approach” includes the methods and techniques emerging as the best practices within the LL environment.

The LLs Multi-Method Approaches (Malmberg et al., 2017) is based on several steps. The first one is the initiation, implying actions to identify the theme of the LL, make the problem explicit and form a partnership with stakeholders interested in solving the identified problem (Steen and Van Bueren, 2017b). Afterwards, a detailed analysis of the problem is performed to identify the main critical issues and possible solutions, based on the different perspectives, experiences and needs of the involved stakeholders and in accordance with the territory vocation and characteristics. Different methods are applied in LL, including ethnography and main user

innovation. Participants in living workshops produce drawings, images, figures, and other representations to illustrate solutions to a particular problem (Guzman et al., 2013). Then, the most promising solution, i.e., the most apparently feasible from a technical, economic, regulatory, logistical and environmental point of view, is established. Generally, the space for testing the identified innovative solution is made available by one or more stakeholders involved in the LL. For example, the municipality could grant a plot of land, or a company or knowledge institute could offer an operational space as an arena for implementing the solution(s) identified through the LL.

## 2.2 From living labs to urban living labs

Although the distinction between the terms LL and ULL is not well defined in the literature, there are some important elements that characterize each of these two user-centered Multi-Method Approaches. Essentially, the ULLs can be considered as the urban projection of LLs. The key difference lies in the ULLs’ need for a physical location in the investigated area and in a focus on the “urban” sustainability (Steen et al., 2017a; Menny et al., 2018).

Chronéer et al. (2019) identified seven key components of ULLs:

1. Governance models including management structure, politics and policies.
2. Financing and business models.
3. Physical representation taking place in a real-life setting in the urban context.
4. Innovation to experiment with.
5. Partners and end-users, including citizens, public and private actors, and academic institutions (i.e., a quadruple helix).
6. Approaches to engage diverse stakeholders and collect data.
7. ICT and infrastructures such as IoT devices, sensors, and tools.

According to Massari (2019), ULLs are both a methodology and a place where different energies of the territory meet, consolidated skills aggregate and local knowledge is combined, with the aim to deliver innovative and transformative improvements across the urban environment. ULLs often follow the quadruple helix model approach, bringing together stakeholders from academia, business community, public sector, and civil society (Delosrios-White et al., 2020).

ULLs appear particularly promising in urban environments to address sustainability challenges, such as energy efficiency, food poverty, waste management, urban flooding, etc. (Veckman and Temmermann, 2021; Cuomo, 2022). Although ULLs have the basic principles of promoting innovations in common with traditional LLs, they tend to place more emphasis on the co-creation based on a governance model. Indeed, the activities carried out by the initiatives must be supported by policy makers in order to be sustainable, both at a managerial and financial level. ULLs, therefore, have a more prevalent political dimension than LLs. Another distinguishing feature is that city representatives are often the promoters of the initiative, creating a vision and providing strategic leadership, whereas in traditional LL this role is often played by research institutes or organizations (Juujärvi and Pessa, 2013).

The presence of public-private-people partnerships is more widespread than in traditional LLs, leading to closer



collaborations between public administrations, universities and citizens (Chronéer et al., 2019). Therefore, a pivotal role in the co-construction of a successful ULL is covered by the collaboration between public administrations and citizens, who together can effectively help to support and develop the best solutions for the territory. Thanks to the participation of heterogeneous stakeholders, the focus on the co-creation of public space and the use of ICT and technologies, ULL constitutes an ideal experimentation environment to address urban sustainability issues. In recent years, in fact, they have been widely used, in Europe and around the world, as forms of experimental governance where urban actors develop and test new technologies and ways of living to address a variety of challenges: from climate change to energy and transport systems efficiency, also including social innovation, quality of life and quality of the built environment (Bulkeley et al., 2016). In the current scenario of strong urban competition at national and global level, cities need forms of governance capable of producing innovation and sustainability that connect public institutions, research institutions, associations, private sectors and local communities. To this end, ULLs are often seen not only as “safe spaces” to experiment with new ideas and projects, but also as ways to enable collaborations and gain public support (Marvin et al., 2018). Citizen involvement is considered a central element as they play an important role in the functioning of the lab by providing feedback and being active partners throughout the innovation process, interacting and negotiating with other stakeholders (Nevens et al., 2013). There are numerous examples of ULLs in which citizen involvement has triggered social, economic, and environmental changes in cities (Engez et al., 2021).

ULLs can be considered a multi-actor ecosystem (Aarikka-Stenroos et al., 2021), where collaboration and co-creation processes between various stakeholders promote environmental sustainability through economic value streams, material flows and knowledge (Keeyes and Huemann, 2017). Moreover, Engez et al. (2021) defined ULL as an ecosystem in which actors work with complementary roles in achieving a shared goal.

In 2021, the Horizon “EXPAND II” delved into an advanced concept of ULL. The project supporting the implementation of JPI Urban Europe’s Strategic Research and Innovation (R&I) Agenda 2.0 (SRIA 2.0) aimed to: (i) establish national dialogs and processes, (ii) mobilize national R&I communities dealing with sustainable urban development, (iii) intensify strategic relationships of urban actors at transnational level, and (iv) evaluate national programs and instruments for transnational R&I cooperation. In particular, since transformations toward a sustainable and liveable urban future depend on broad engagement and co-creation activities by a diverse set of actors, the main challenges of ULL become community engagement and capacity building in research and policy, to satisfy the needs of the entire society.

In practice, the implementation of the solutions emerging from ULL, gives life to the advanced concept of urban life laboratory: the solutions become real actions. The highly pragmatic character of a policy instrument, such as the ULL, lies in the actions that are identified and subsequently undertaken through a strongly result-oriented steering group. These are the fundamental steps that enhance the effects and impacts of an ULL. In this regard, an enhanced urban

laboratory could be able to generate and disseminate new socio-technical configurations, largely still ignored, even beyond the immediate borders, thus providing a significant contribute to urban sustainability (Von Wirth et al., 2018).

ULLs are considered promising testing tools to adapt and transfer principles derived from Reike’s model, at urban scale (Cuomo, 2022) and for the development of a systemic approach. Cuomo (2022) analyzed several case studies, showing how ULLs have stimulated relevant initiatives in all 10 Rs of the CE, and in very different cities, from Dublin to Naples. In these cases, the ULLs have been shown to implement collaborative governance configurations capable of triggering positive mechanisms of cooperation between municipalities, companies, research institutions and local communities. ULL is also a powerful tool for the urban transition with a particular attention to social justice and community participation in shared urban governance process (Mahmoud et al., 2021). Finally, ULL also functions as an alternative approach to spatial planning and urban innovation (Garavaglia et al., 2020) to govern the development of local neighborhoods due to its ability to connect a multitude of perspectives and disciplines (Blezer et al., 2024). It has proven to function as a kind of platform that is able to respond to urgent urban short-term needs, while providing project scenarios and long-term development prospects.

Summarizing, in Table 2 a comparison among the framework of LL and ULL, developed on the basis of specific reports (García Robles et al., 2015; McCormick and Hartmann, 2017) and dedicated handbooks (Malmberg et al., 2017; Habibipour et al., 2020), is reported.

### 3 Methodology steps and description

The literature review demonstrates that there is no single way to implement ULLs, but there are multiple methodologies that can involve citizens and other stakeholders in bottom-up co-creation processes. To date, there is no methodological reference in the literature for implementing ULLs aiming at the co-creation of project proposals on CE activities to be implemented in an urban area.

This need has been highlighted into the three projects described below (RECiProCo, Basilicata Heritage Smart Lab, Biocircularcities), in which the authors have been involved.

The RECiProCo project was funded by the former Italian Ministry of Economic Development, now the Ministry of Enterprises and Made in Italy, during the years 2021–2022. The aim of the project was to implement CE tools and initiatives for consumers. The project activities were: (i) mapping of good practices already implemented by consumer associations, (ii) development of labels for products and services with reduced environmental impact, and (iii) promotion of participatory co-design processes for CE solutions. In particular, for the latter point, the activities were implemented in three pilot Italian urban areas: Anagnina Sabazia (located in the metropolitan area of Rome), Bologna and Taranto. The three pilot urban areas have been selected in order to have different geographical, economic and territorial characteristics. Indeed, Anagnina Sabazia is a municipality of 19,145 inhabitants (ISTAT, 2023) in the metropolitan area of Rome (center of Italy), Bologna is an Italian city of 389,850 inhabitants (ISTAT, 2023), located in northern Italy, and Taranto, located in southern Italy, is a city of 198,283 inhabitants (ISTAT, 2023). The

TABLE 2 Comparison among the framework of Living Lab (LL) and Urban Living Lab (ULL).

Living Lab (LL)	Urban Living Lab (ULL)
<p><b>1st Step - Exploration and design</b></p> <p>The first goal of this step is to understand the current status, that means getting an overview of the current habits and practices of users to target.</p> <p>It is essential to identify user groups and to find the best way to involve them in the process.</p> <p>Then, this phase consists in the co-production of ideas with users, moving from an idea toward the concept or the prototype design of the solution.</p>	<p><b>1st Step - Exploration and design</b></p> <p>The first goal of this step is the identification of shared vision for the future and the characterization of the needs of the community living in the area of the planned urban lab.</p> <p>It is essential to identify the stakeholder groups and to find the best way to involve them in the process.</p> <p>Then, this phase consists in the co-production of knowledge and ideas thus making urban living labs flexible to multiple ideas and interests and able to produce collective outcomes.</p>
<p><b>2nd Step - Experimentation</b></p> <p>This step tests the new technologies, or solutions in a real-life context, and allows a decision to be made on whether to head back to the exploration state to iterate the solution, or whether to proceed to the evaluation stage.</p>	<p><b>2nd Step - Experimentation (or Operation)</b></p> <p>This step tests the new technologies, or solutions and/or policies in real-life at urban level, in highly visible ways, which can prompt radical social and technical transformation at urban level.</p>
<p><b>3rd Step - Evaluation</b></p> <p>The final step consists of evaluating the impacts of the technologies or solutions, in order to feed back the results, illustrating the impact and the added-value created by the innovation.</p>	<p><b>3rd Step - Evaluation</b></p> <p>The final step consists of evaluating the impacts of the technologies, or solutions and/or policies, in order to feed back the results, illustrating the impact and the added-value created by the innovation at urban level.</p>

stakeholders, involved in the participatory process of RECiProCo project, were classified according to the pentahelix multi-stakeholder framework (Carayannis and Campbell, 2010; Ostrom, 2010; Calzada, 2017), as follows:

- Academia and research: ENEA; University of Bologna (only in the ULL of Bologna).
- Public: the former Italian Ministry of Economic Development, now the Ministry of Enterprises and Made in Italy; the local governments of the three pilot territories (Anguillara Sabazia, Bologna, Taranto); the Chamber of Commerce (only in the ULL of Taranto).
- Private: local enterprises specialized on sustainable activities such as tourism, production and sale of local products; HERA group (a group of municipalized companies that manages the provision of energy and environmental services to citizens and businesses).
- Civil society: national and local representatives of consumer associations, local NGOs advocated for consumer rights and for environmental issues; local cultural associations; local associations working on sustainability issues.
- Citizens: activists, social entrepreneurs, innovators of the three pilot areas community.

The Basilicata Heritage Smart Lab (BHSL) project was promoted by the Cluster of Cultural and Creative Industries of Basilicata Region (Basilicata Creativa), in southern Italy, funded by the Basilicata Region as part of the Smart Specialization Strategy, Axis I of the PO FESR 2014–2020 – Research, Innovation and Technical Development. The aim of this project was to develop technologies and methodologies for the conservation, enhancement and use of the tangible and intangible cultural heritage of the Basilicata Region. The project activities involved about twenty pilot cultural sites, reflecting the great complexity of the Lucan cultural heritage. A Heritage Smart Lab (HSL) was set up in each pilot site involving a multidisciplinary group of

researchers, entrepreneurs, young talents, active citizens, experts and innovators. The HSL called “Basilicata Living Lab” has been implemented by the ENEA team in the old town of Venosa (Basilicata Region) with the aim of co-designing CE activities in the context of cultural heritage. The following relevant stakeholders were involved in the definition of CE activities and in the co-design process:

- Academia and research: ENEA; the Institute of Cultural Heritage Sciences of the Italian National Research Council.
- Public: local Government of Venosa.
- Private: creative and cultural enterprises belonging to the Cluster Basilicata Creativa; local creative recycling enterprises.
- Civil society: local NGOs advocated for culture, creativity and environmental development of the community.
- Citizens: activists, bricoleurs, social entrepreneurs, innovators of the urban community.

Biocircularcities (BCC) project was funded by the Bio-based Industries Joint Undertaking (JU) and the European Union’s Horizon 2020 Framework Program through “Funding & tender opportunities” (BBI-2020-SO4-S4 Type of action BBI-CSA). The aim was the implementation of CE principles to the disposal of urban organic waste. BCC activities were focused on integrating bio-based processes and products into both local and global markets through the identification of business prospective as well as regulatory opportunities and gaps. In detail, following the analysis of the current status of organic waste management in Napoli (Italy), Barcelona (Spain), and Pazardzhik (Bulgaria), the project results suggested potential circular bioeconomy strategies for each metropolitan area (Ansanelli et al., 2023). Through a participatory process, in the three local territories, different stakeholders were involved to get insights and concretely address barriers limiting the implementation of circular solutions within the investigated areas (Meisterl et al., 2024). In particular, the following groups of relevant stakeholders were involved:

- Academia and Research: research centers (e.g., ENEA, CREDA-UPC, Bulgarian Energy Agency), Universities (such as University of Napoli Federico II, University of Napoli Parthenope, Universitat Autònoma de Barcelona), national and local research associations.
- Public: local government and local waste management authorities in the three pilot areas.
- Private: companies in charge of managing Research Topic, recovery, recycling and disposal of biowaste in the pilot areas.
- Civil society: professional associations able to provide technical recommendations in the waste management (order of engineers); NGOs advocated for environmental preservation.
- Citizens: group of people that can be potentially affected by circular bioeconomy actions, unorganized citizens but also informal organizations like neighborhood activists and a variety of civil society activism forms.

### 3.1 Lessons learnt from the experience

In the context of different scientific projects, the authors implemented some ULLs on CE, starting from the literature knowledge on the general LL and ULL methodologies and from previous experiences (Cappellaro et al., 2018, 2019). The methodology was first drafted before the implementation of the ULLs in the three research projects and then improved through a learning-by-doing process, not only during the activities of the same project but also from one project to another, as they are chronologically different. Hence, all findings and elements of the proposed ULL methodology have been implemented and tested in at least one of the ULLs organized within the ENEA projects.

The three ULLs within the RECiProCo project were implemented during the months from March to October of the year, 2022, the ULL of BHSL was implemented from October, 2022 to June, 2023, the ULLs of BCC project were implemented by October 2021 to September, 2023.

For the RECiProCo project and BHSL project a draft methodology was structured before starting the implementation of the ULL in each project (details about ULLs organized within these projects are reported in the [Supplementary material](#)). Each of the organized ULLs was characterized by 4 main phases: (1) Scouting phase and territorial context analysis; (2) Listening and exploration phase; (3) Participation phase and (4) Execution phase.

In the RECiProCo project, prior to the start of the three ULLs, a contract was signed with experienced facilitation companies to provide support both in mapping the target stakeholders and in organizing the meetings. The role of the facilitator, according to Kaner (2005), is to promote full participation, mutual understanding and shared responsibility within a group of people (further details about ULLs organized within the RECiProCo project are reported in the [Supplementary material](#)).

This first step was dedicated to the study of the three pilot areas based on bibliographic and website sources. This was followed by a mapping of potential target stakeholders and by drawing up a list of potential target stakeholders for each pilot area (Anguillara Sabazia, Bologna and Taranto). The identified target stakeholders were contacted by e-mail, explaining the purpose of the ULL, the commitment required and the contribution expected. A preliminary

telephone call was also made in the case of direct knowledge. A launch event online was then organized in each pilot area to which the target stakeholders were invited. During the launch event, a more detailed presentation of the project was made and a survey was distributed not only among the participants but also via social media, in the following days, to reach the entire local community. Based on the results of the survey, a detailed program for each pilot area for the next four meetings was prepared and circulated to the participants by e-mail. This was followed by four face-to-face meetings in each pilot area: the first two meetings also included information sessions given by experts in the sector on the topics of greatest relevance and interest identified in the survey. In the third and fourth meetings, which represented the executive phase, the proposals were co-designed. During the meetings, brainstorming was stimulated through some *ad hoc* questions and specific canvas worksheets, and the co-design process was also conducted using the Open Space and World Café methodologies.

The ULLs results of the RECiProCo project led to the co-design of a total of 10 proposals in the three pilot areas. For the Anguillara Sabazia case study, four proposals were developed on sustainable tourism and the recovery of natural resources. For the city of Bologna, three proposals were developed on the theme of sustainable and circular water management. Finally, for the Taranto pilot area, three proposals were developed on urban regeneration and food waste reduction. All the proposals were presented at a final project event held simultaneously in the three different pilot areas. The event was attended by members of local authorities, municipalities, research, industry, civil society and citizens.

Another ULL focused on the co-design of CE activities was realized within the Basilicata Heritage Smart Lab (BHSL) project, in the urban area of Venosa (Basilicata region, southern Italy). Following the experience of RECiProCo, the ULL was organized in the same four phases: (1) scouting phase and territorial context analysis; (2) listening and exploration phase; (3) participation phase and (4) implementation phase (further details on the ULL organized within the BHSL project are reported in the [Supplementary material](#)). In this case, no contract was signed with a facilitation company, but the ULL was carried out only by the ENEA researchers, supported by the local government of the city.

The first step was dedicated to the study of the territory, based on bibliographical sources and websites. The support of the local authority helped in the individualization of the target stakeholders, who were contacted by e-mail and invited to attend the launch event. During the launch event, a more detailed presentation of the project, its objectives and the commitment required were made. A questionnaire aimed at identifying the circularity needs of the participants was also distributed, through a QR code, during the launch event, with a 20-min time limit. The questionnaire included a specific section for participants to indicate if they were interested in participating in the ULL pathway. Following these steps, the agenda of the four meetings was set and shared with the stakeholders who expressed interest in participating in the ULL. During the subsequent four meetings, brainstorming was stimulated by some *ad hoc* questions and a specific canvas worksheet, and the co-design process was also conducted using the World Café methodology. The outcome of the ULL was a single project, focused on the need to regenerate an unused public space, to be used for CE activities related to the cultural and creative supply chain, considered as a driver of social and economic

development for the entire community of Venosa. At the end of the project, a final public event was organized to present the results of the ULL.

Regarding the BCC project, four ULL meetings were organized in each pilot area (Napoli, Barcelona, Pazardzhik). Some meetings were held online (due to the COVID-19 pandemic restrictions), and at least one in each territory was held in person or in hybrid mode (in person with the possibility of remote connection). An agenda was defined for each meeting and attached to the invitation emails sent to stakeholders. Sometimes, the emails were preceded by phone calls (in case of previous knowledge) and, always a reminder was sent. All agendas (both for face-to-face and online meetings) included presentations by the organizers and some of the stakeholders, followed by common discussion, involving all participants. The experience of face-to-face meetings proved to be more engaging than online meetings, as it favored greater interaction between participants (both during discussions and during breaks). In particular, the creation of small groups, coordinated by one of the organizers, guaranteed a space for each participant to speak, facilitating the participation of everyone. The ideas emerged from the discussion groups were reported on a poster and presented to all participants. In addition, sometimes, in face-to-face meetings, a general roundtable was held for a common evaluation of all collected contributions. In the online meetings, visual collaboration tools (e.g., Miro, Mural and Slido) proved very useful to propose discussion topics and collect stakeholder suggestions. Moreover, in some cases, small online discussion groups were created through virtual rooms, for greater interaction among participants. Finally, the main results from such discussions were presented by the organizers to the whole audience. The meetings were held in the local language and, in some cases, in English to allow the participation of international experts. The interaction in local language facilitated the interaction among the different stakeholders, as alternative options the simultaneous translation also resulted to be a valid option to guarantee the interaction between international expert (project partners) and local stakeholders (additional details on BCC ULLs are reported in the [Supplementary material](#)).

Starting from the basic principles of ULL from literature (see section 2) and from the lessons learnt through the concrete experiences made in the ULLs organized within the RECiProCo, BHSL and BCC projects, a general ULL methodology suitable to be employed also in other EU contexts was developed, following an inductive approach.

[Table 3](#) summarizes the lessons learnt from the three ENEA projects, considered as the basis for the development of step-by-step ULL methodology described in the section 3.2.

On the other hand, [Table 4](#) reports in the form of recommendations all the critical points identified in the RECiProCo, BHSL and BCC projects.

### 3.2 Methodology steps

Drawing from both the experiences detailed in the literature and those gained from the three national and European projects, a general ULL methodology for co-creation processes of CE actions, also

suitable for other contexts, has been implemented. It is worth noting that all findings and elements in the proposed ULL methodology have been implemented and tested in at least one of the ULLs organized within the three projects.

The framework of the ULL methodology ([Figure 1](#)) is organized into four main phases: 1- Scouting and analysis of the territorial context; 2- Listening and exploration; 3- Participation; 4- Execution.

### 3.3 Phase 1—scouting and analysis of the territorial context

This step is dedicated to the study of the territory based on bibliographic and web sites sources. It is important to know the territory before starting an ULL process in order to have a complete picture of the geographical, economic and social aspects of the territory. This knowledge in turn allows to identify the main issues to be addressed within the ULL.

In particular, it is useful the study of one or more of the following aspects of the territory in which the ULL takes place:

- Territorial framework: population, extension, province, region, maps.
- Geomorphology: description and location of the different mountain, hill and plain areas.
- Hydrology: location of water basins (seas, rivers, lakes), with any critical issues related to the management of water resources, special geological formations.
- Climate: temperatures, rainfall, highlighting their evolution over the years and any anomalies, pollution, correlation between the environment and health.
- Landscape and protected areas: presence of natural parks of regional or national interest, identification of Sites of Community Importance (SCIs).
- Flora and fauna: overview of the plant and animal species present in the different areas of the territory (mountains, water, forests, plains).
- Cultural, archeological and architectural heritage: analysis of the presence of particularly important aspect of the territory, archeological sites, ancient settlements, streets, churches, palaces of historical interest, UNESCO heritage sites, areas of significant public interest.
- Mobility and transport: number and type of connections available in the area, from main roads to railway stations, airports and ports, if any.
- Demography: births and deaths by sex, average age, old age index, structural dependency ratio, labor turnover, fertility, birth and death rates, human capital and education supply and demand.
- Settlement system: building activity over the years as a function of population growth; identification of possible needs for urban recycling.
- Economy of the production system: analysis of economic development, labor market survey; welfare indicators, articulation and relative percentages of the three different sectors.
- Economy of the agricultural sector: production of meat, fish, fruit and vegetables, possible presence of PDO and PGI products,



TABLE 3 Lessons learnt from the three ENEA projects (RECIProCo, BHSL and BCC) for developing the ULL methodology.

Phase 1 - Scouting and analysis of the territorial context	
<ul style="list-style-type: none"> <li>• Study of the territory from bibliographical sources with a focus on circularity issues</li> </ul>	
<ul style="list-style-type: none"> <li>• Mapping of potential stakeholders on the basis of ULL specificities and objectives</li> </ul>	
<ul style="list-style-type: none"> <li>• List of target stakeholders with related contacts</li> </ul>	
<ul style="list-style-type: none"> <li>• Identification of the meetings place (in presence, hybrid or online)</li> </ul>	
Phase 2 - Listening and exploration	
<ul style="list-style-type: none"> <li>• Contact with target stakeholders, specifying the ULLs objectives, activities, commitment, expected contribution and timetable</li> </ul>	
<ul style="list-style-type: none"> <li>• Drawing up a survey to identify circularity needs</li> </ul>	
<ul style="list-style-type: none"> <li>• Launch event in presence, hybrid or online and invitation to target stakeholders</li> </ul>	
<ul style="list-style-type: none"> <li>• Presentation, dissemination and invitation to fill in a questionnaire on the circularity needs of the investigated local territory</li> </ul>	
<ul style="list-style-type: none"> <li>• Processing of the results and identification of the circular economy topics of greatest interest</li> </ul>	
<ul style="list-style-type: none"> <li>• List of stakeholders available to participate in the ULL</li> </ul>	
<ul style="list-style-type: none"> <li>• Preparation of the programs of the four ULL meetings based on the results of the survey (through <i>ad hoc</i> questionnaires)</li> </ul>	
<ul style="list-style-type: none"> <li>• Invitation to target stakeholders to participate in the four ULL meetings</li> </ul>	
Phase 3 - Participation	
1st Meeting	2nd Meeting
<ul style="list-style-type: none"> <li>• Welcome and registration of the participants</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building through in-depth seminars on the topics of greatest interest emerged during the first meeting</li> </ul>
<ul style="list-style-type: none"> <li>• Capacity building through short interactive workshops (working in small groups) on circular economy and sharing economy</li> </ul>	<ul style="list-style-type: none"> <li>• Invitation to participants to express their ideas on circular economy projects that can be implemented in their own area</li> </ul>
<ul style="list-style-type: none"> <li>• Exchange of experiences of circular economy among ULL participants</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion on the ideas emerged and co-definition of the most representative in accordance with the circular economy principles</li> </ul>
<ul style="list-style-type: none"> <li>• Identification of circular economy experiences of greatest interest</li> </ul>	
<ul style="list-style-type: none"> <li>• Initial co-ideation of circular economy pathways/projects suitable to be implemented in the investigated local area</li> </ul>	
Phase 4 - Execution	
3rd Meeting	4th Meeting
<ul style="list-style-type: none"> <li>• Composition of working tables (or groups) on each selected idea for a detailed elaboration of the most suitable pathway or project</li> </ul>	<ul style="list-style-type: none"> <li>• Each working group elaborates its pathway/project idea according to the canvas sheet</li> </ul>
<ul style="list-style-type: none"> <li>• Contamination: exchange of participants between groups so that each participant can contribute their ideas to all ULL pathway/projects</li> </ul>	<ul style="list-style-type: none"> <li>• Each working group presents its pathway/project proposal</li> </ul>

possible ideas for valorization and circularity of agricultural and water resources.

- Economy of the industrial sector: analysis of the presence of various sectors (manufacturing, food, metallurgy, textiles), with attention to the possibility of recovering and exploiting raw materials.
- Economy of the tertiary sector: analysis of mobility and tourism in the area, important services on which a path toward environmental sustainability can most easily be established.

If necessary, all or some of this information can be presented in a report in the form of plots or tables for a better use by all ULL organizers and participants. Since the ULLs are specifically focused on the CE, it is useful to know whether the territory is mountainous or coastal; whether it has a tourist and/or industrial vocation; how its water supplies are structured and whether they are able to meet the needs of the territory more or less easily; whether there are economic activities inspired by the principles of the sharing economy (e.g., car

sharing, the presence of re-use centers, repair cafés, the presence of shared gardens and vegetable gardens, or water houses).

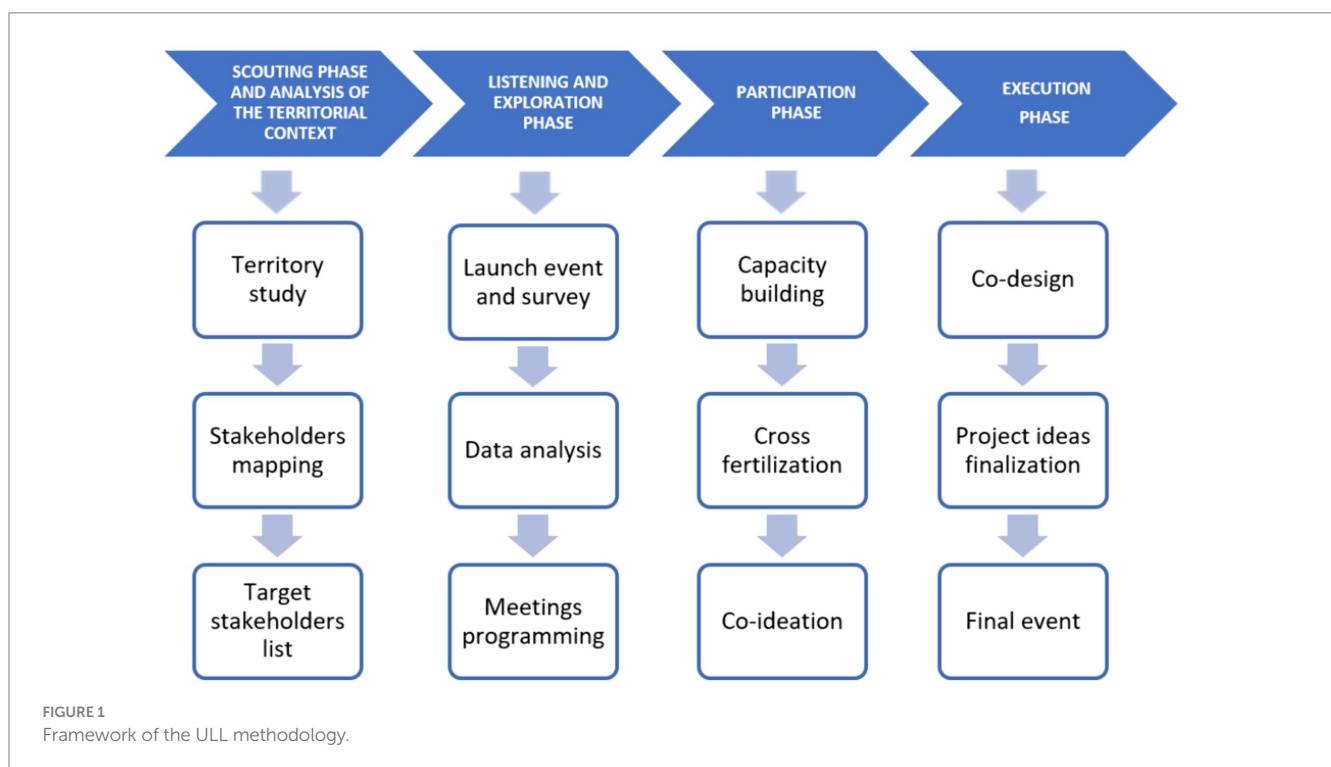
If the ULL pathway has a more specific focus (such as water resources or reuse), a preliminary technical study may be useful to identify and analyze the CE solutions already existing and operating in the area under consideration, paying particular attention to their diffusion, environmental and economic costs and to the users' satisfactions.

The study of the territory is followed by a mapping of the potential stakeholders of interest, based on the specificities and objectives of the ULL. A list of potential target stakeholders is then drawn up, also with the help of other actors familiar with the area. At this stage, it is useful for the organizers to seek the help of facilitators, i.e., experts in stakeholder engagement, collective intelligence and participatory processes, in order to create an innovative co-creation environment from the outset.

After that, a desk study of each stakeholder's website is performed to understand (through news, publications, and possible statutes) their

TABLE 4 Recommendations for implementing an ULL.

Reccomendations
<p><b>Phase 1 - Scouting and analysis of the territorial context</b></p> <ul style="list-style-type: none"> <li>• The chosen venue, for the meeting in the presence, must be easily accessible, also by public transport, and equipped with a screen for video presentations and a Wi-Fi connection. It must also be able to accommodate 20–30 people and have space and furniture (tables and chairs) suitable for working group.</li> <li>• If possible, it is advisable to be supported by professional facilitators who know the area and can help the research team at all stages of the ULL.</li> <li>• The involvement of the local government is an important part of the process.</li> </ul>
<p><b>Phase 2 - Listening and exploration</b></p> <ul style="list-style-type: none"> <li>• It is advisable a launch event in presence.</li> <li>• It is advisable to conduct the survey (through questionnaires) at the launch event.</li> <li>• It is useful including in the survey a specific question on the interest in following the circular economy pathway, specifying the contact persons for each association/institution/company.</li> <li>• When preparing the calendar of meetings, in order to facilitate the widest possible participation, it is preferable:                     <ul style="list-style-type: none"> <li>➤ to avoid Saturdays and the summer period</li> <li>➤ to choose a weekday and an afternoon time, after work time</li> <li>➤ to schedule the meetings every 2 weeks</li> </ul> </li> </ul>
<p><b>Phase 3 - Participation</b></p> <ul style="list-style-type: none"> <li>• Seminars should be designed in an interactive way to actively involve participants. Moreover, in order to stimulate creativity, it is also useful to illustrate examples of good circular economy practices implemented in other areas.</li> <li>• It is important to keep the dialog as informal as possible to encourage people to express their ideas freely.</li> <li>• A coffee break table is suggested in the meeting room.</li> <li>• During group work, access to the coffee break table should be maintained so that participants can move around and stop at other tables to contribute ideas and suggestions.</li> </ul>
<p><b>Phase 4 - Execution</b></p> <ul style="list-style-type: none"> <li>• Working group formation must be free and voluntary.</li> <li>• To create a relaxed, informal and engaging atmosphere, it is advisable to divide the participants into working groups after the first coffee break (useful moment for starting an informal acquaintance). Working groups can then be formed around the first interactions among stakeholders and based on participants' endorsement to the proposed ideas (sharing ideas).</li> </ul>



interest in sustainability and CE topics as well as in the care for their territory. The stakeholders do not need to be statutorily dedicated to environmental issues; they could also be cultural associations, tourism

promoter or supporter for the economically weaker sections of the population. Once a list of potential target stakeholders has been drawn up, it is possible to proceed with the engagement activity by choosing

the location and scheduling the ULL meetings. The group of participants must not exceed 30–35 people for the process to be effective.

The meeting place (paid or free of charge) can be provided by local partners involved in the project activities (local authority, school, chamber of commerce, association headquarters, etc.). Regarding the ULL scheduling, it is recommended to choose days and times that are more compatible with the availability of potential participants (non-working hours and not holidays or pre-holidays days).

This first phase ends with the drafting of a document describing the area and a map of the target stakeholders, including all needed contacts.

### 3.4 Phase 2—listening and exploration

The identified target stakeholders are contacted via e-mail specifying the studied territory, the involved group of stakeholders, the purposes of the ULL, the required commitment and the expected contribution. Additionally, when there is a direct knowledge of the stakeholders, a preliminary explanatory phone call should be made, outlining the goals and activities of the ULL. Afterwards, the launch event takes place online, in-presence (preferable option) or in hybrid mode: its purpose is to present the ULL's path, objectives and timetable. The launch event, if in-presence, is an event open to the entire local community and can also take place in a space provided by the municipal administration or other local authorities. At this launch event, to plan the path of the ULL, it is necessary to get the stakeholders' point of view about the needs of the investigated territory and the CE pathways to be implemented. For this purpose, a survey is carried out through the preparation and distribution of an *ad hoc* questionnaire accessible online (a specific link is generated) and/or coupled with a QR-code and/or directly distributed in paper form. The questionnaire for the survey is illustrated and target stakeholders are invited to fill it in during the event itself, or at a later stage online (by using the link or the QR-code). In some cases, the survey can also be promoted on social platforms to reach the entire local community.

In detail, the survey is divided into four main sections:

- The first one regards demographic information and includes multiple choice questions on the respondent's age group, level of education, occupation and municipality of residence, as well as their possible membership of an organization (association, institution, company). If so, an additional sub-section has to be filled in regarding the respondent's role within the organization as well as the name, the operation place, the number of members and the organization purpose.
- In the second section, respondents are asked about their knowledge and their interest in circularity, sustainability issues and good practices (or other more detailed topics if the focus of the ULL is more specific), both at personal, household and territorial levels. In this section there are multiple choice questions on the level of interest/curiosity in circularity, the reasons for this interest, the choice of topics closest to one's own needs and the perceived importance of these topics. This section also includes open questions where respondents can indicate other CE topics they would like to deepen and address during the ULL. The suggested CE models as well as the good practices have to be in line with the priorities of the investigated area (e.g.: zero

km production and consumption; sharing of spaces, goods or services to implement; recovery and repair of goods; urban regeneration; implementation of sustainable tourism activities; implementation of forms of education for sustainable consumption through cultural and creative activities or education on the proper use of water resources, etc.).

- The third section is devoted to an illustration of one's organization (if the respondent is a member). In this way it is also possible to check how much organization activities are related to the themes of sustainability, CE and sharing economy. This section also asks for a description of one's family and housing profile, which is very useful when possible CE interventions concern the home environment and civil dwellings.
- The fourth part of the survey includes, in addition to the information on the protection of privacy, in accordance with current regulations, the calendar of meetings of the ULL and the respondents' interest in participating. If stakeholders (including individual citizens) wish to participate in ULL, a deadline for registration is set, and in this both telephone and e-mail contact details are requested.

In the weeks following the launch event, after the stakeholders have completed the questionnaire, the ULL organizers process and interpret the survey data. To this aim, data are aggregated, also in the form of pie charts or bar graphs, to have a summary picture of the survey. The outcomes of the survey are very important to calibrate and fine-tune the info-training moments of ULL. The results of the survey are then presented and commented during the first ULL meeting.

Then, to complete the Phase 2 (listening/exploration), the following actions are needed: (i) study of the territory, (ii) list of both targeted stakeholders and those enrolled in the ULL, and (iii) possessing and synthesis of the survey results. In this phase all the preliminary work of preparing and organizing the ULL is concluded and the subsequent phases of participation and the co-creation (it comprises the co-ideation and co-design process) can begin.

Following the indications received from the survey, the ULL organizers prepare a detailed program of the next four meetings, generally lasting three to 4 h each: the first two meetings, which represent the participation phase, also include info-training sessions held by experts in the sector, on the topics of greatest relevance and interest that emerged from the survey. The meetings are also set aside for a more in-depth knowledge of the participants' activities and experiences, and then the work of co-creating CE ideas and activities, suitable for the investigated community and the territory, can begin. In the third and fourth meetings, which represent the executive phase, the proposals are co-designed, defining their contents and opportunities, as well as the potential benefits and the activities that will bring to the area are identified.

### 3.5 Phase 3—participation

This phase consists of two meetings to get to know each other and share experiences and practices in the field of CE. The researchers describe the aim of the ULL by presenting some project experiences

USEFUL QUESTIONS TO STIMULATE BRAINSTORMING		
<b>Question 1:</b> <i>Which of the topics proposed by the speakers surprised and intrigued you the most?</i>	<b>Question 2:</b> <i>Among the various solutions illustrated by the speakers, is there one in particular that you would like to implement?</i>	<b>Question 3:</b> <i>Is it feasible for my reality or for my association?</i>
<b>SPACE FOR ANSWERS</b>		
<b>Answers to question 1</b>	<b>Answers to question 2</b>	<b>Answers to question 3</b>

FIGURE 2  
Canvas-style worksheet of the first meeting.

and a literature review. On the other hand, the stakeholders describe their experiences in the field of CE, the role they play at the local level and their knowledge of the territory in terms of needs, obstacles and opportunities. Moreover, in this phase a first process of co-ideation of possible CE activities and actions suitable to be implemented in the studied territory is developed.

In detail, the two meetings are structured as follows.

### 3.5.1 First meeting

In the first meeting, researchers, facilitators (if any) and participants have the opportunity to get to know each other personally and to establish the first contacts necessary to carry out the whole ULL process, starting to create a friendly, cooperative, participative and inclusive atmosphere. Indeed, the organizers must bear in mind that in an ULL pathway the relationships and the human aspects are of fundamental importance for the success of the whole process. Therefore, at this stage, based on the experience of the authors, the role of the facilitators is of considerable importance as a link between researchers and participants, promoting: (i) capacity building (info training and awareness-raising), (ii) the exchange of experiences among participants (cross-fertilization), (iii) the identification of topics of greatest interest, and (iv) the initial co-ideation and co-design of CE models and actions suitable to be implemented in the reference area. The presentation of all participants (citizens and other stakeholders, researchers and facilitators) and of the survey results is thus the first step toward achieving the ULL objectives.

It is important to actively engage participants through open discussion, even during presentations, or through direct questions. Today, discussions can also be conducted effectively through specialized applications and dedicated platforms, accessible via smartphones, tablets or computers, usually by simply entering a unique code or scanning a QR code. They offer a user-friendly interface, customizable templates and real-time analytics, making them a popular choice for enhancing audience participation and

gathering insights during the ULL. In particular, these applications and platforms enable interaction among participants, who can anonymously answer questions, vote in polls, and share their opinions in real time using their devices. During the ULL, stakeholder responses are instantly displayed on the presenter’s screen in the form of visualizations such as graphs or word clouds. This instant feedback allows presenters to effectively gauge audience opinion, gather data or stimulate discussion. In addition, these tools provide a digital workspace where members can brainstorm ideas, organize concepts, create diagrams and collaborate on ULL topics using various templates, sticky notes, drawings and multimedia elements. Among the most popular applications and dedicated platforms there are: Mentimeter,<sup>4</sup> Slido,<sup>5</sup> Mural,<sup>6</sup> Miro,<sup>7</sup> etc. Through these instruments, stakeholders work together seamlessly, whether they are in the same room or distributed across different locations, making such tools particularly valuable for remote teams and virtual meetings.

After the introductory part, the specific themes of the ULL are identified, also based on the survey results. These themes could be, for example, the sharing economy, the circularity of resources (water, agriculture, etc.), tourism or the ecological footprint. It is therefore necessary to identify the right creative and narrative communication strategy to convey the basic concepts to be shared. An effective strategy is to create a storytelling around specific examples of community-based CE practices from different regions, resulting from initiatives taken independently by the local community in cooperation with local stakeholders such as businesses and government agencies. Figure 2 shows a possible canvas-style worksheet to stimulate participants’ brainstorming.

4 <https://www.mentimeter.com/>

5 [https://www.slido.com/?experience\\_id=240223-a](https://www.slido.com/?experience_id=240223-a)

6 <https://mural.co/>

7 <https://miro.com/it/>



CLASSIFICATION OF THE IDEAS GENERATED BY THE PARTICIPANTS AND GROUPED ACCORDING TO THE 4 R FRAMEWORK OF THE CIRCULAR ECONOMY	
<i>REDUCE</i>	<i>REUSE</i>
<i>REPAIR</i>	<i>RECYCLE</i>

FIGURE 3  
Canvas-style worksheet of the second meeting.

Indeed, the ULL is not an environment divided between teachers and learners, but a place where ideas and experiences are exchanged on an equal footing, where everyone learns from each other. The participants know their territory, its potential and its common sensitivities. Therefore, the creativity of the participants on possible CE solutions to be implemented in the territory can be usefully stimulated. All the feedback is summarized in a poster, including considerations and suggestions to be taken into account in the next phases of the ULL.

### 3.5.2 Second meeting

The second meeting, which focuses on capacity building, begins with one or two seminar presentations by experts on the topics selected in the first session. An attempt is then made to involve the participants more closely and to create a creative and informal atmosphere. One method might be to invite participants to write down their impressions, thoughts, feelings on post-it notes and to draw collective reflections. Another method could be to divide the participants into small groups and then provide each group with stationery such as white and colored sheets of paper, markers, glue, tape, pencils, ribbons and elastic bands of different sizes and colors. Each member of the group is then asked to represent their own organization and the type of activity they carry out (cultural, humanitarian, environmental, etc.) by means of a creative representation, such as a drawing or a kind of 3D puzzle constructed with the materials available. This real exercise in imagination only increases the general creativity and creates interpersonal bonds that make the group more cohesive and willing to share and exchange ideas. Next, a representative of each group describes what their organization does: starting from the object they have constructed, they explain what characteristics they wanted to highlight in their work. After this “creative presentation” by the participants, the workshop activity can begin to think about possible outputs, i.e., project ideas for a community CE that can be implemented in the reference area. The brainstorming needs to be stimulated, e.g., researchers and facilitators can write an opening question on the board, e.g., “What surprised/impressed me?” and invite participants to express their thoughts. This phase serves to raise awareness of the many community-based CE initiatives, starting from the bottom up. The organizers can then write a title on the blackboard, such as “the ideas of the ULL,” and begin to write a sentence as an example of an activity that could be implemented, such as “starting a

community vegetable garden” or “organizing a recycling center. This process stimulates participants to come up with more and more ideas that are in line with their own experiences and what they think is possible, also drawing inspiration from the examples described during the storytelling. This often leads to a ‘competition of ideas,’ a method by which participants are invited to present their innovative ideas. Supported by the facilitators, the participants evaluate the pros and cons of each idea: the ideas are then collected and organized on a flipchart. A possible framework for organizing the results of the co-ideation is shown in Figure 3. These ideas are then presented, commented on, discussed, expanded and “voted on” to select those that are considered feasible and appropriate for the context area.

In the experience of the authors, this approach is often a great source of motivation for the participants, who become more active, informed and empowered, and each idea naturally attracts a certain number of participants, among whom it is possible to identify at least one reference person.

This phase therefore ends with a list of ideas, albeit at an embryonic level. The development of the ideas, which may end up as actual project proposals, is part of the co-design process in the next phase of the ULL, through the next two meetings, which represent the executive phase.

## 3.6 Phase 4—execution

This phase focuses on co-designing the output of the ULL and is organized in two meetings, which represent the third and fourth meetings of the whole ULL pathway.

After the previous phase, the ULL has consolidated mutual knowledge in an inclusive and collaborative atmosphere where all participants feel comfortable to bring their own contribution. The Execution phase is particularly useful in stimulating creativity and generating new insights and perspectives on the project idea that need to be identified and developed.

### 3.6.1 Third meeting

In the third meeting, the co-design of the CE action begins. The facilitation activity is modeled on the needs of the participants in order to make the most of the resources and skills of all the participants.

<b><i>Needs behind the proposal</i></b>		<b><i>Proposal value</i></b>
<b><i>Potentials and competences</i></b>		
<b><i>Users and alliances</i></b>	<b><i>Channels and relationships</i></b>	<b><i>Measurable objectives</i></b>

FIGURE 4  
Canvas-style worksheet of the third meeting.

During the meeting, the co-design activities can be carried out using Open Space Technology (Owen, 2008), a method which, through the creation of working groups and thanks to a pleasant atmosphere, makes it possible to produce a summary document of all the proposals/projects developed by each group in a relatively short time.

The Open Space Technology method is based on four principles:

1. Every participant is the right person, assuming that motivated people can participate in the process.
2. Whatever happens is the only thing that can happen, this principle focuses attention on the present rather than on expectations.
3. Any time you start is the right time.
4. When it is done, it is done, so focus on getting the job done.

The execution phase aims at producing the output of the process, starting from the ideas of the groups spontaneously formed during the participation phase. At the beginning of the execution phase, participants are given 10 min to make a first reflection and to develop ideas that are potentially feasible. The ideas from the participation phase are written down and commented on by the participants and then shared on a magnetic board for a preliminary discussion on possible project ideas. Then, the project ideas are developed together by the participants, divided into working groups, also supported by the facilitators and the researchers. Proposals for the use of circular patterns in the area studied are summarized on a poster according to a scheme proposed by the facilitators and researchers.

The co-design process is conducted using the World Café,<sup>8</sup> a team facilitation method (Gurteen, 2008) that is useful for stimulating lively, concrete and constructive informal conversations. The World Café methodology encourages the spontaneous formation of small discussion tables, each of which focuses on a different topic. Each participant can move from one table to another and express his or her opinion on the different topics, thus allowing the circulation of ideas. Thanks to this modality, it is possible to disseminate new patterns of thought that constitute a starting point for other conversations. At this stage, if there are many groups and ideas, it is possible to divide the proposals into two or three macro-areas, e.g., “integrated resource management,” “education and awareness,” “sharing economy,” etc., in order to start co-designing the different proposals.

To facilitate discussion among participants, each working group is given a canvas-style worksheet (Figure 4) on a poster board with open-ended questions related to the project proposals developed.

Each member of the group can freely write down their own ideas on colored post-it notes and then stick them on the whiteboard. In this way, each group highlights on the board the opportunities, strengths and weaknesses, as well as the tools and necessary alliances with third parties that can contribute to the realization of the project.

The working session is divided into three discussion rounds of 15 min each, during which people do not remain in the same working group but mix between the tables, allowing contamination and cross-pollination of ideas (cross-pollination principle).

<sup>8</sup> <https://theworldcafe.com/key-concepts-resources/world-cafe-method/>

The ability to move from one table to another, encouraging the exchange of ideas and the identification of the best solutions, is a distinctive feature of the World Café methodology. For each table, a project leader/contact person (table host) is elected from among the participants. The table host’s role is to welcome the participants during the different rounds, to illustrate the idea as it has been articulated with the previous participants, and to invite the contribution of new participants by encouraging them to write down and fix their ideas. Meanwhile, coffee breaks can be organized in the short interval between the steps to create a convivial, informal and comfortable environment for the exchange of ideas. After the three rounds of discussion, each person returns to his or her original table to comment with the reference person on the contributions received from the other participants and to make final reflections and considerations on the project proposals elaborated. The project idea is then redefined by each original group at each table, and finally the results are presented and discussed in a plenary session where each reference person presents what has been elaborated by the different working groups. In the authors’ ULL experiences, many ideas were generated by each table, in response to the proposed questions, and the World Café methodology proved to be very useful and fruitful, especially in stimulating the production of ideas, reflections and critical questions on concrete problems.

The sharing phase highlights what is defined as ‘collective intelligence’, i.e., all that emerges from people’s proactive engagement and collective decision-making.

### 3.6.2 Fourth meeting

During the fourth and final meeting, the proposals developed in the previous meetings are refined, using participatory planning methods linked to service design to define prototype projects. A number of guiding questions are used to identify the needs underlying the project, the potential and skills available, the possible users and alliances, the channels and relationships to be established, the value proposition and the measurable objectives. The active participation of researchers at the tables to support the technical aspects of the co-design process is crucial. At this stage, several tables may merge to work on a single project idea. At the end of the fourth meeting, a representative of each group presents the project co-designed by their working table to all ULL participants.

The final output of the ULL is a document describing the project proposal(s) co-designed by the participants and indicating the participants’ willingness to collaborate in the implementation of the project. The canvas-style worksheet of each proposal is illustrated in Figure 5.

In the experimented cases, especially when the ULL pathway involves several territories working simultaneously, or when is deemed useful to disseminate the results of the ULL to the territorial

<b>PROJECT PROPOSAL</b>	
<i>Title of the proposal</i>	
<i>Name(s) of promoter(s) with their affiliations</i>	
<i>Brief description of the investigated territory</i>	<i>Description of the proposal objective</i>
<i>Illustration of the proposal</i>	
<i>Identification of suitable alliances</i>	<i>Economic resources needed to implement the proposal</i>
<i>Possible obstacles that could be encountered</i>	<i>Type of circularity to be implemented</i>

FIGURE 5  
Canvas-style worksheet of the fourth meeting.

community, it can be useful to organize a final event, in which the participants themselves, in the presence of the authorities, citizens and other stakeholders of the territory, publicly present the pathway carried out and all the project ideas that have emerged from it. Often, between the end of the fourth ULL meeting and the final event, the ULL participants can continue to deepen the shared journey, through face-to-face meetings, online meetings or chats on messaging applications; at this stage, the ULL organizers and facilitators can encourage, stimulate and, if necessary, moderate these meetings in order to make the most of the co-creative flow established during the ULL.

## 4 Anticipated results

The use of the ULL methodology could provide interesting benefits and results in achieving urban circularity, as it allows the participation of citizens together with other stakeholders and experts through sharing experiences in a co-creation environment. The project proposals co-designed within the ULLs could lead to the promotion of dissemination/education activities on CE or in the improvement of public services for a more sustainable management of natural resources.

For example, within the RECiProCo project, 10 circular project ideas were co-designed in the three pilot cities, ranging from “repair and reuse activities,” “community and vegetable gardens,” and “sustainable tourism” to “sustainable use of the water resources. Specifically, in the ULL of Anguillara Sabazia (RM), one project focused on the reuse, repair and regeneration of household appliances, another on the creation of a “sustainable district” with services for slow tourism (walking or cycling routes), a third idea was to provide tourists with information on how to move around the area with low environmental impact, while a fourth project aimed to create an app that would provide tourists with information on accommodation facilities that have adopted a sustainability specification (e.g., zero kilometer restaurants). The Bologna ULL focused on the sustainable use of water resources and three project ideas were developed. The first was to reduce water leakage by involving the community and requesting technical interventions on the water network from the management body. The second working group created a “Wikipedia page” on the diffusion and advantages of using water houses in Italy as an alternative to bottled water. The third project idea was dedicated to the design of educational actions to spread respect for water and a culture of sustainable use of water resources in schools. Three project ideas were also developed in the ULL of Taranto. The first was the recovery of unsold fresh agricultural produce for the benefit of less well-off families to whom the proposing association already provides long-term food storage. The second idea concerned the recovery of an urban green space by citizens’ associations, transforming it into a community vegetable garden, and the third idea concerned the creation of a repair café, not only for the recovery and reuse of used goods, but also as a place for socialization and mutual help. The 10 circular project ideas were presented to the three pilot municipalities with the aim of implementing them in cooperation with citizens, local stakeholders and the local government. In each pilot area, the local authorities have been activated to seek funding for the implementation of the proposed project ideas in cooperation with citizens and local stakeholders, as all of them were considered to be in line with local needs.

In the BHSL project, a strong co-creation process was implemented in synergy with the local government to reuse a public space for CE activities, built in the framework of the cultural and creative industries. The participants of the Venosa ULL came up with a project idea called “Forge in a circle - ideas and activities on circular economy. The idea started from the assumption of having a public space dedicated to the co-creation of new forms of culture, awareness and sociality, through the joint implementation of CE activities of different nature, but all related to educational processes, awareness and cultural growth (creative recycling courses, anti-waste cooking courses, exchange of used goods, organization of exhibitions recovering ancient knowledge and traditions, implementation of an energy community, etc.). The implementation of the project required, in addition to the organizational efforts of the ULL participants, the contribution of other stakeholders as identified by the participants themselves. First and foremost, the contribution of the municipal administration was needed, which had to take action to provide a venue for the activities envisaged by the project. Other stakeholders, such as educational institutions, scholars of local customs and traditions, research institutions and companies in the cultural and creative sector, will have to be involved from time to time in the various paths taken by the “Forge in Circles.”

In the framework of the BCC project, for an effective transition to circular bioeconomy patterns in the three pilot areas, namely Metropolitan Area of Barcelona (Spain), Metropolitan City of Naples (Italy), and Province of Pazardzhik (Bulgaria), relevant stakeholders were identified, according to the quintuple helix approach, and engaged in the ULL as well as in all the project activities, from the selection of the biowaste chain to be investigated to the development and validation of alternative circular biowaste management scenarios. ULLs were carried out in local languages and served as a platform for local stakeholders to exchange knowledge and highlight barriers and opportunities for implementing bioeconomy value chains in the investigated territories. The involvement of a heterogeneous group of stakeholders, including local waste management authorities, academic institutions, private companies, NGOs, municipalities, and others involved with biowaste Research Topic and management, enabled to gather and consider all perspectives necessary to provide a holistic view of the biowaste management landscape, in the three pilot areas. The inputs received from the involved stakeholders allowed to identify legal, technical, economic, environmental, and social drivers and barriers and to validate policy recommendations to promote the shift from linear to circular patterns. As a final result, a proactive tool was proposed to support the circular implementation of the bioeconomy by policy makers and stakeholders.

Nevertheless, the ULLs may have some limitations and difficulties, such as the scouting and engagement of citizens and stakeholders, who should be fully aware of ULL activities, potentialities and topics of interest, as well as of the kind of support they can provide in order to meet the ULL needs. In addition, the role of the facilitators is also crucial as they should manage the issues of both citizens and researchers and link them in an appropriate way. Another important limitation may be the involvement of public institutions, and possible private actors, to support the implementation of the project ideas. Although efforts are made to assemble a heterogeneous group of participants in the ULLs, it is not guaranteed that all the stakeholders will actively contribute to the project proposals. However, contributions from public institutions and private actors during the co-design process are essential for the realization of the project. For



example, when considering the design of an urban vegetable garden, the willingness of citizens' associations to organize the activity is not enough: it is essential that the municipality regulates the allocation of the necessary space.

## 5 Conclusion

Nowadays, urban contexts are particularly critical, since they are characterized by a high concentration of people, infrastructures and services, which require sustainable management to ensure collective well-being. Indeed, many problems, such as climate change and the increasingly limited availability of resources, negatively impact on the quality of life. Therefore, it is crucial to change the paradigm of production and consumption, by encouraging the transition toward CE models to decouple the economic growth from harmful effects on the ecosystem. To be effective the CE transition must respond to the real needs of local territories and stakeholders. A useful approach to promote the "circular" transition at a local level is offered by ULL. However, to date, there is no general methodology for implementing ULL. This work, therefore, proposes for the first time a methodology for organizing ULL aimed at the co-creation design of CE activities. The proposed ULL methodology was first drafted starting from the literature knowledge on LL and ULL and then tuned based on experiences made in national and European projects. Methodological improvements were also realized through a continuous learning-by-doing process, considering the lessons learned from one project to another. The proposed ULL methodology was described step-by-step and it includes four main phases: (1) scouting and analysis of the territorial context; (2) listening and exploration; (3) participation phase and (4) execution.

One of the strengths of the ULL is that it allows to systematize resources—both tools and skills—and address needs through the involvement of all stakeholders. In particular, in the ULL, the central role is played by institutions and citizens, who represent the driving force of the CE transition. Moreover, by setting up ULLs it is possible to transform urban contexts into laboratories of transition, in which people co-operate with a view to the wellbeing of the entire community. ULLs become spaces in which to promote participation and systemic innovation open to the needs of the local community, making it an environment for the co-design and implementation of CE solutions and practices, in line with the specificities of the investigated territory. This framework is also useful to rethink the interpretation of the local dimension, so as to calibrate the most effective responses to the individual specificities of territories. In fact, non-expert knowledge, outside the world of research, can be very effective in suggesting unexpected and original interpretations as well as design keys, leading to analyze the urban context and its problems from new perspectives. Finally, the proposed ULL approach in addition to promote the development of innovative CE pathways: (i) triggers a transformative change in society, (ii) increases cultural capital through participatory dynamics, (iii) enhances the social acceptance of new CE activities and facilities proven to be safe for health and for the territory, (iv) helps to rethink local services from a sustainability perspective and (v) creates opportunities for inclusion, based on cooperation and co-responsibility.

Unfortunately, the ULL aimed at the co-design of CE activities also has some limitations. In fact, in order to effectively implement the co-created CE solutions, it is indispensable an economic, logistical, and regulatory support from institutions and administrations at different levels (local, national, and European), as well as the contribution of all other stakeholders. Another significant challenge is the scouting and engagement of citizens and stakeholders capable of making significant contributions to the achievement of the ULL objectives and interests. To this end, the involvement of expert facilitators can be crucial.

## Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

## Author contributions

CI: Writing – original draft, Writing – review & editing. GA: Writing – original draft, Writing – review & editing. GB: Writing – original draft, Writing – review & editing. CB: Writing – original draft, Writing – review & editing. FC: Writing – original draft, Writing – review & editing. RC: Writing – original draft, Writing – review & editing. GF: Writing – original draft, Writing – review & editing. EM: Writing – original draft, Writing – review & editing. RP: Writing – original draft, Writing – review & editing. LS: Writing – original draft, Writing – review & editing. AZ: Writing – original draft, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frsc.2024.1400914/full#supplementary-material>

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