Reflow | Co-Creating Circular Resource Flows in Cities

Circular Citizens Handbook

Recommendations for citizen engagement in circular city transition

About REFLOW

REFLOW is an EU Horizon 2020 research project running from 2019-2022, which aims to enable the transition of European cities towards circular and regenerative practices. More specifically, REFLOW used Fab Labs and makerspaces as catalysers of a systemic change in urban and peri-urban environments, which enable, visualize and regulate "four freedoms": free movement of materials, people, (technological) knowledge and commons, in order to reduce materials consumption, maximize multifunctional use of (public) spaces and envisage regenerative practices.

The project provided best practices aligning market and government needs in order to create favourable conditions for the public and private sector to adopt circular economy (CE) practices. REFLOW created new CE business models within six pilot cities: Amsterdam, Berlin, Cluj-Napoca, Milan, Paris and Vejle and assessed their social, environmental and economic impact, by enabling active citizen involvement and systemic change to re-think the current approach to material flows in cities.

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Introduction

The ***Circular Citizens handbook*** offers an overview of key recommendations based on the analysis of the activities undertaken by the six pilot cities of the REFLOW project in developing their own strategies related to citizen engagement.

From these experiences, we propose **six key recommendations** targeting policy makers and municipalities for citizens' participation in the circular economy transition. These were drawn by considering the different dimensions of REFLOW: materials flows and tracking of data, technology and platforms, urban dimension, and network of social innovators and entrepreneurs.

Recommendation #1:

Developing digital solutions to help citizens understand material flows to foster circular economy initiatives

Digital technologies are an enabler for the upscaling of the circular economy as they allow the creation and processing of data and information required for circular business models and the complex demands of circular supply chains. However, the circular economy is based on a strong integration and connection of the value chain as quality and predictability gain in importance. Therefore, digital technologies provide the basis for the development of circular business models. Additionally, the digital part of the business determines feasibility, usability and customer (or rather user) satisfaction[1].

Importantly, according to the European Circular Economy Research Alliance (2020), the use of digital technology can be applied on three main levels:

1) Processes, technologies that allow **higher efficiency** and circularity in processing of materials and manufacturing of products.
2) 'Products, technologies that allow **tracking and tracing** of products and components, value chain optimisation, development of products as a service, increase reuse, repair, or refurbishment.
3) Platforms, technologies that **connect consumers and producers**, allow development of services and dematerialisation.

[1] ECERA, European Circular Economy Research Alliance (2020). *Digital circular economy as a cornerstone of a sustainable European industry transformation.*

The Milan experience

The Milan pilot in REFLOW focuses on food by tracking its flows across the city, specifically looking at the flows going through the city's main food wholesale Market, SoGeMi, and the city's 23 covered markets. To transition their urban food system towards becoming circular, the pilot project sets out to focus on specific food flows to test new food prototypes, support existing projects that transform food waste into new products and enable initiatives that focus on reducing food waste at the wholesale and market stage. With SoGeMi as a key player in the Milan pilot, there is a strong emphasis on building solid business cases. This focus is reflected in the pilot solutions developed which push forward a local sustainable food system in Milan through circular food innovations.

The Milan pilot applied various solutions to rethink the current economy and reconfigure the urban metabolism towards a more sustainable urban food system.

Particularly, Milan's city pilot objectives were:

- *Reducing waste upstream by rethinking freight logistics based on intelligent tracking mechanisms;*
- *Through donations, recover what would be thrown away and is still edible;*
- *Encourage the reuse-recycling of materials by certifying the circularity of processes.*

The three different solutions developed occur in different ways to the objectives mentioned above. These solutions are:

1. Food market 4.0 dashboard;
2. Foody zero waste - BOTTO;
3. Milano Prima Seconda.

The ***food market 4.0 dashboard*** is an integrated system of both hardware and software solutions aiming to prevent food waste. The system allows for the tracking, management, data analysis and servitization of food flows in the covered markets.

BOTTO is an automated communication system for surplus fruit and vegetable products made available by wholesalers operating within **SoGeMi** to selected stakeholders, such as **RECUP**, an NGO that operates in the city's markets to combat food waste and social exclusion. Particularly, they recover the food before it is thrown away, divide it between edible and non-edible, and redistribute it to anyone who wants to take it. More specifically, **BOTTO** incorporates signal and tracking to facilitate the reallocation of surplus/unwanted food between fruit and vegetable wholesalers.

BOTTO
PER QUELLO CHE NON BUTTO!

Lastly, **Milano PrimaSeconda** is a distributed system of mapping, collection and exchange of waste materials as a starting point for different, higher value products produced through upcycling. The system supports organizations that claim to have a closed circular loop, but do not have the technical tools to track and trace which can prove this circularity.

For all three solutions it is evident that the **tracing of the material flows** is the starting condition. Moreover, tracing material flows should be done through simple systems that facilitate and do not complicate the processes.

In this regard, **digital technology** should be the drivers of this change. Another point in common among these three solutions is the importance of the **co-creation** and **co-design** phases directly with the future users: these include the Municipality, wholesale market operators, retailers, logistics companies, active citizenship organizations, and citizens.

Recommendation #2

Creation of neighbourhood hotspots in line with the 15 minutes framework, on circularity of different material flows

For a long time, cities have been growing in a way that necessitates long-distance commuting and traffic and air pollution. Cities have developed according to the citizen's need for mobility (physical ability to reach destinations) instead of their need for accessibility, the ability to gain access to services, goods and activities at destinations. Consequently, urban design has become car-focused, rather than addressing reasons for travel. It is in response to this, that the *"15-minute city"* concept has gained public attention, fostering increasing efforts towards the strengthening of the neighbourhood scale.

When an urban area achieves the *15-minute city* goal[2], becomes socio-economically equitable, and the convenient location of services, accessible by multiple modes, saves time and improves quality of life, and therefore more sustainable.

> *"The 15-minute city represents the possibility of a decentralized city. [...] At its heart is the concept of mixing urban social functions to create a vibrant vicinity[3]."*
>
> *Carlos Moreno*

[2] Duany, A., & Steuteville, R. (2021, February). *Defininig the 15-minute city.* Congress for the New Urbanism (CNU). https://www.cnu.org/publicsquare/2021/02/08/defining-15-minute-city

[3] https://www.ted.com/talks/carlos_moreno_the_15_minute_city/up-next#t-112749

The Amsterdam experience

The Amsterdam pilot in REFLOW focuses on textiles used by its citizens, the way these textiles are discarded and reused, and how textiles as resources can be brought back into the city's material flow. Overall, the Amsterdam pilot works towards achieving the desired long-lasting impact of transforming the textile stream from linear to circular. To facilitate the shift towards more circular textile material streams in the region, the Amsterdam pilot is implementing an overarching strategy consisting of two complementary scenarios, a short-term citizen scenario and a long-term industrial scenario.

A core focal point in the Amsterdam pilot focuses on behavioural change starting with its citizens. Thus, the pilot team places a large emphasis on this within the development of their solutions. The short-term citizen scenario aims to achieve impact through behavioural change by empowering its citizens to become changemakers across two key goals:

- to discard fewer textiles by extending textile lifecycles through reuse, repair, revaluing, and reducing.
- to increase the collection of home textile waste by informing and engaging citizens to discard correctly.

The long-term industrial scenario is a corresponding continuation of the citizen scenario. Feeding into this long-term scenario, the support of more diverse strategies for the collection of textiles in the pilot project can aid the provision of feedstock for recycling industries, increase the demand for recycled textile, and support the supply of newly produced products out of recycled resources for other stakeholders.

The swapshop is a place where citizens can bring in their clothing and receive a *"swap"* voucher entitling them to an exchange of what is in the swapshop's stock.

Clothing in the store can only be purchased with a *"swap"* voucher. Clothing that goes into the swapshop is sorted, cleaned and repaired if needed, through which an overhead is paid as a service fee by the swapshop's participants. The swapshop also incorporates a social aspect into its solution through the inclusion of people who are at distance from the job market.

Strikingly, the problem of the disposal of textiles was exacerbated by the Covid-19 pandemic. People at home were cleaning up more and more of their houses and filling the textile bins. In addition to that, due to the national safety restrictions, borders across nations were closed, and therefore the Municipality of Amsterdam decided to bring all the collected textiles in a warehouse at Amsterdam-Noord. The loads of textile discarded there raised the attention of the citizens, journalists as well as the Municipality. The latter opened a call for action for circular solutions that could help to reduce the amount of clothes being discarded.

The winning solution of the swapshop was proposed by the *Startup in Residence* programme. Through the *Startup in Residence* programme **the Municipality of Amsterdam invites startups to provide solutions for pre-defined urban and societal issues.** Subsequently, a business plan was developed. Initially, the swapshop activities were run on a voluntary basis. In this regard, a training programme addressing unemployed people was established. Nowadays, the swapshop's activities are run by paid workers as well as by volunteers.

Interestingly, *the Startup in Residence* programme is a young organization, which also has contact with students. This, from a circular economy perspective, is a strength because it permits the inclusion of students and youngsters, generally characterized by a lower spending capacity, in circular economy solutions.

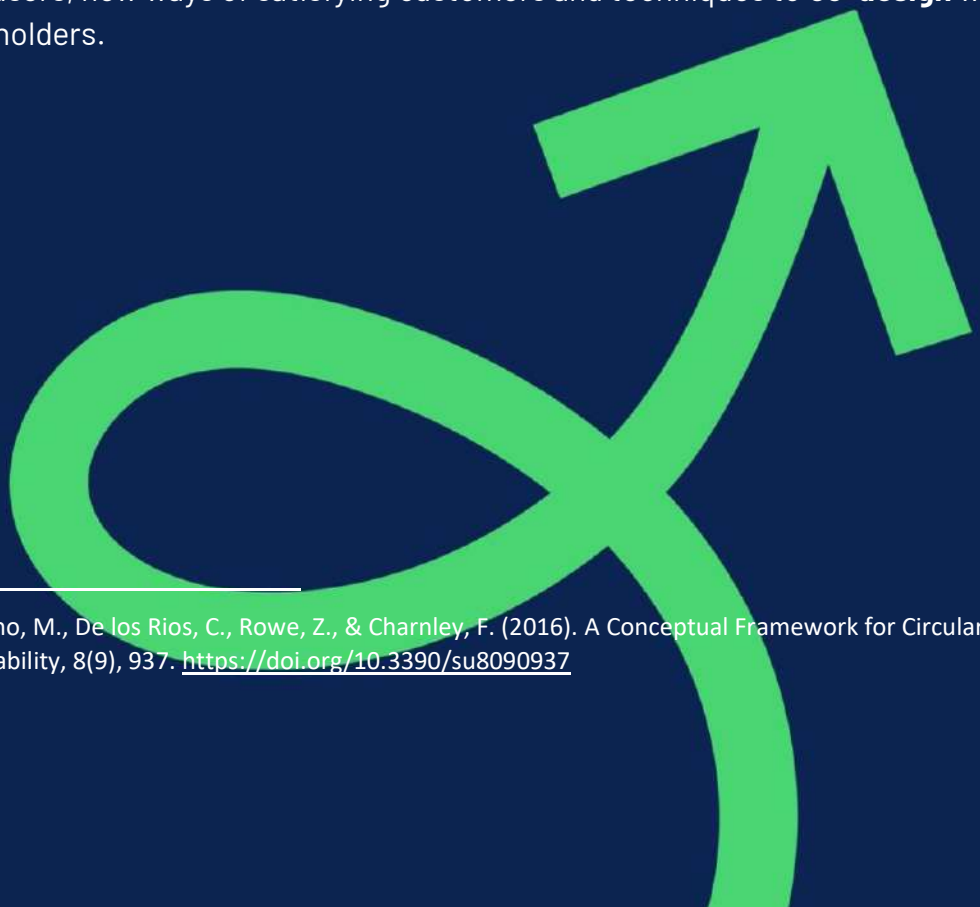
Since the experimentation started, 8.000 swapped has been counted already. *Startup in Residence* programme aims to **create a network of swapshops in Amsterdam**, increasing the number of locations within The Municipality, but also beyond the city borders.

Recommendation #3

Mobilization of innovators capable of including citizens in experimenting with new circular solutions

By recognizing designers' responsibility, over the years, environmental philosophies have evolved from green design to **design for sustainability** and, more recently, **design for circularity** or **circular design**[4]. These approaches mean applying circular economy principles at the design stage of everything. It is a practice that embraces systems thinking to address some of the biggest interconnected challenges we are facing today. A future where products, services and systems are designed with the bigger picture in mind. A future where designers zoom in on user needs, while zooming out to consider the system in which they are creating, including ease of maintenance and repair.

The evolution of *circular design* has broadened its theoretical and practical scope over the years. While the first approaches were focusing predominantly on the technical side, the preceding ones have recognised the **crucial importance of the role of users**, the resilience of communities, and more generally of the various actors and dynamics of socio-technical systems[5]. Recent approaches to circular design require designers to be equipped with a different set of expertise such as techniques to gather insights from users, new ways of satisfying customers and techniques to **co-design** with all stakeholders.



[4] Moreno, M., De los Rios, C., Rowe, Z., & Charnley, F. (2016). A Conceptual Framework for Circular Design. Sustainability, 8(9), 937. https://doi.org/10.3390/su8090937

[5] Ibid.

The Vejle experience

The Vejle pilot in REFLOW focuses on plastics through gaining insights into urban plastic consumption and to increase the circularity of the city's plastic value chains. The pilot project in Vejle dives into four micro-scale test sites in the Western neighborhood of the city – Vestbyen where the pilot project runs targeted experimentations, workshops, and engagement sessions to identify and showcase solutions for increased plastic reuse, recovery, and reduction. These test sites include a retail store in the supermarket chain REMA 1000, the public housing block Den Gamle Gård, the public elderly home Sofiegården, and the innovation-hub Spinderihallerne.

The Vejle pilot places a large emphasis on its citizens as changemakers towards reaching the Vejle pilot's long-term goal of circular plastics. As such, this citizen focus is evident in the solutions that have been developed by Vejle pilot which seek to activate a citizen movement through empowering them to become informed and active in changemaking

The **new sorting solution** was applied at the apartment building *Den Gamle Gård*. This solution entails a new integrated way to dispose of plastic material directly in their kitchen. Through the new sorting solution, by removing the plastic out of the residual waste, the sorting rate will improve. Moreover, residents will be made more aware of waste and that it is possible to make new products out of household plastic waste.

Initially, a series of interviews and observations were conducted with a sample of tenants at *Den Gamle Gård* in order to identify the main challenges and issues on sorting plastics that tenants were encountering. Drawing upon this initial investigation an initial vision was drafted.

Subsequently, together with a broad range of actors, among them designers and Fab-Lab, as well as technical actors, a **co-creation workshop** has been carried out. Through this co-creation moment more detailed ideas and possible concepts to be prototyped were developed.

The extracted concepts were, then, evaluated by the tenants and one was selected to be further developed and prototyped. Consequently, the innovator/s that could help in making the prototype was selected.

In this regard, Wild Studio for the creation of **flower pots** made out of recycled plastic was selected. Wild Studio is uniquely placed in terms of collaborations with a closed loop agenda. They link design and industry, the consumer and the contributor. Their closed loop concept enables municipalities, institutions as well as bigger companies to integrate their waste strategy with Wild Studio's design concept.

It was also important to create a community feeling around this intervention.

Accordingly, pilot city partners were able to organize an event last August 2021. During this event, the new sorting solution and the flower pot were presented and shown to the entire community.

Most importantly, the new sorting solution started from the beginning from a citizens, and tenants' point of view and real need. In a second moment, innovators and designers were added in the process to make this solution possible. This method is now being tested and replicated in a new housing development in Vejle.

Recommendation #4

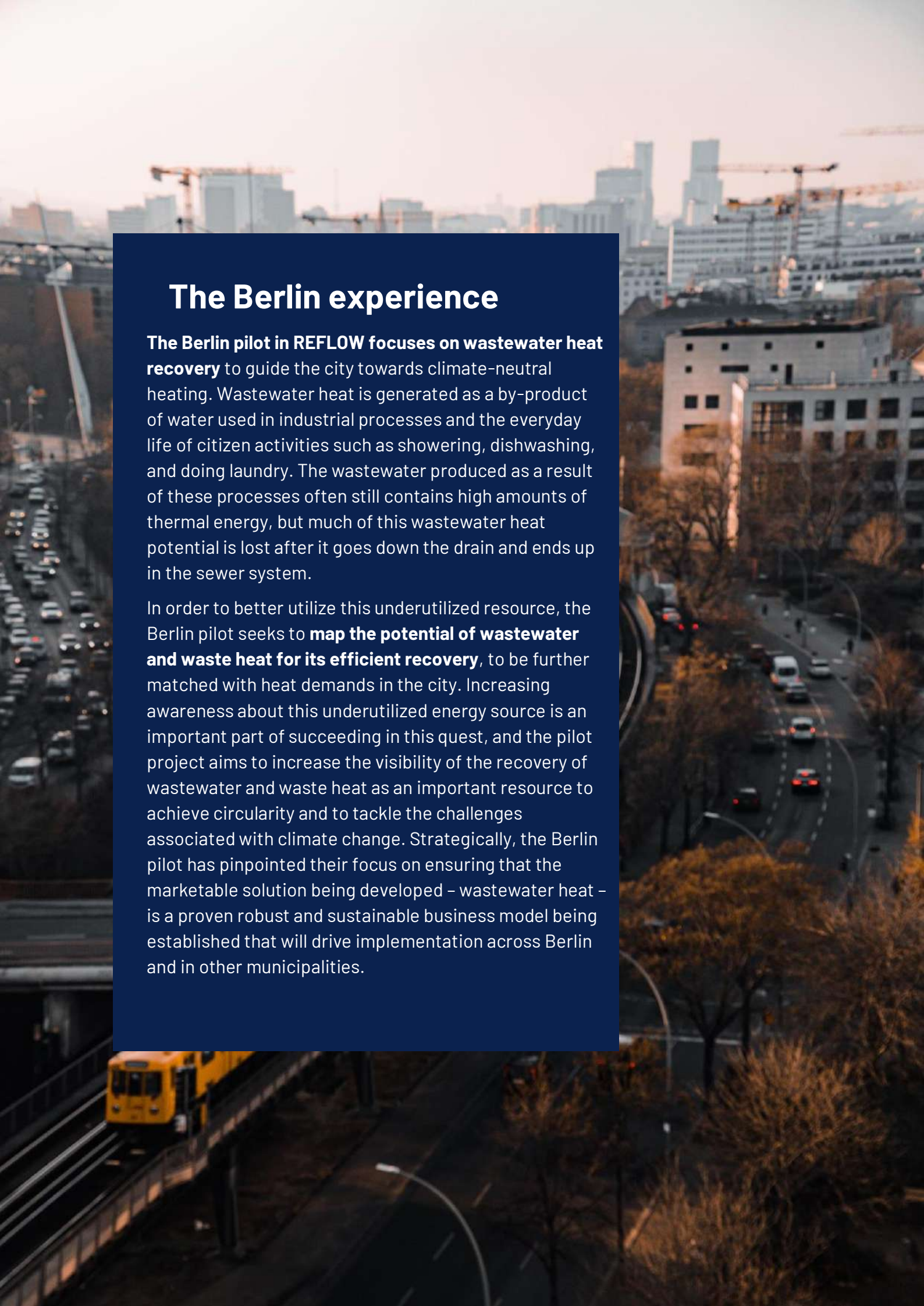
Facilitate the transition towards a circular economy by proactively sourcing homeowner and tenant input regarding energy consumption

The circular economy proposes an economic framework, restorative and regenerative by intention and design based on circular flows of products and materials. A **transition** towards a circular economy is already underway and an understanding of the nature and the state of this *transition* is important for the creation of effective policies, profitable business models and a more rapid exploitation of circular solutions[6].

However, *transition* results in a complex process that requires changes in all the societal subsystems and not only in the economic system. Accordingly, it has been defined as *"a fundamental change in the structure, culture and practices of a societal (sub)system that is the result of a co-evolution of economic, technological, institutional, cultural and ecological developments at different scale levels"*[7].

[6] Kevin van Langen, S., Vassillo, C., Ghisellini, P., Restaino, D., Passaro, R., & Ulgiati, S. (2021). Promoting circular economy transition: A study about perceptions and awareness by different stakeholders groups. Journal of Cleaner Production, 316, 128166. doi:10.1016/j.jclepro.2021.128166

[7] Grin, J., Rotmans, J., & Schot, J. (2010). Transitions to sustainable development: new directions in the study of long term transformative change. Routledge.



The Berlin experience

The Berlin pilot in REFLOW focuses on wastewater heat recovery to guide the city towards climate-neutral heating. Wastewater heat is generated as a by-product of water used in industrial processes and the everyday life of citizen activities such as showering, dishwashing, and doing laundry. The wastewater produced as a result of these processes often still contains high amounts of thermal energy, but much of this wastewater heat potential is lost after it goes down the drain and ends up in the sewer system.

In order to better utilize this underutilized resource, the Berlin pilot seeks to **map the potential of wastewater and waste heat for its efficient recovery**, to be further matched with heat demands in the city. Increasing awareness about this underutilized energy source is an important part of succeeding in this quest, and the pilot project aims to increase the visibility of the recovery of wastewater and waste heat as an important resource to achieve circularity and to tackle the challenges associated with climate change. Strategically, the Berlin pilot has pinpointed their focus on ensuring that the marketable solution being developed – wastewater heat – is a proven robust and sustainable business model being established that will drive implementation across Berlin and in other municipalities.

Sourcing energy consumption data refers to approaching the cooperative or building owners in order to source intel about energy consumption of properties, thereby triggering interest in a more sustainable way of heating.

Specifically, this solution would make tenants and homeowners aware of circular heating options, and it also extends the network of the actors involved and the citizen community.

As a first step to employ this solution it is important to identify the right actors to approach. In this regard, pilot city partners focus on **cooperatives**, therefore engaging with tenants who are also shareholders of the building they are living in. Random tenants would not work effectively because tenants are mainly interested in what they are going to pay and generally not interested in long term investment.

Representatives of the cooperatives and tenants were asked about their energy consumption in two different ways: printed flyers with a QR code which directly would link them to an online form where they were able to compile with the intel requested; and directly by a phone call.

Importantly, experts by checking the compiled questionnaire were able to understand if the property was eligible or not for the implementation of a wastewater heat system. Subsequently, whether the building is eligible it is explained to them a clear **call for action**. While, for the ones who are not eligible for the implementation of a wastewater heat system a free energy consumption analysis is offered.

It is pivotal that the follow up of the compilation of the questionnaire is **reliable** and **includes a clear value add perspective**. Hence, there should be mentioned savings for the cooperative or property owners and a clear roadmap of what it is suggested to do next.

Recommendation #5

Building a future generation of circular citizens and professionals

To enable a transition toward a circular economy it is necessary the contribution of a variety of stakeholders, from the private sector, start-ups and entrepreneurs and public. However, it is implied that the transition to a circular economy is dependent on how individuals and organizations learn to innovate and apply what they've learned in the real world.

The **education sector**, from primary school to postgraduate study, plays a vital role in ensuring students of all ages are equipped with the key skills and knowledge to apply circular thinking in their chosen careers. Accordingly, Pandey and Vedak[8] say: *"education is the key intervention for bringing change in knowledge, values, behaviors and lifestyles [...] required to achieve sustainable development"* (p. 3). Even though, this has received still little attention in the higher education, universities have progressively incorporated sustainability education in their curricula since the early 1990s[9].

[8] Pandey, N., & Vedak, V. (2009). Structural transformation of education for sustainable development. *International Journal Environmental Sustainable Development.* DOI: 10.1504/IJESD.2010.030063

[9] Kirchherr, J., & Piscicelli, L. (2019). Towards an education for the circular economy (ECE): Five teaching principles and a case study. Resources, Conservation and Recycling, 150, 104406. https://doi.org/10.1016/j.resconrec.2019.104406

The Cluj-Napoca experience

The Cluj-Napoca pilot in REFLOW focuses on energy through improving the energy efficiency of public buildings and residential homes throughout the city. To work towards this goal, the pilot sets out the following objectives: to assess how the measures taken to date by the city have impacted the energy efficiency of selected buildings; to involve local stakeholders in implementing and furthering these measures; and to encourage different actors in the ecosystem to propose new ideas regarding renewable energy sources to be integrated into the city's strategy for a circular economy. Coinciding with these objectives, the pilot project seeks to educate its citizens on circular economy, its benefits, and possibilities.

The Cluj-Napoca pilot's aim was to raise awareness and empower youngsters and future professionals on the topic of energy transition, sustainability and circularity.

This process followed four main steps: **awareness**, **understanding**, **application** and **creation**.

In the first phase, it was necessary to **disseminate** Reflow in Cluj-Napoca and to make citizens and professionals aware of this opportunity and explain to them the necessity of this project. On these occasions, roundtables with several stakeholders, like city administrators, business, professors, researchers as well as teachers were attended. In addition to that, public events have taken place.

However, only hearing about this matter is usually not sufficient. Students, either from the technical high school, as well as from the university were **tested** in order to evaluate how much they knew about circular economy and related studies.

The third important step was **application**. This refers to the most important solution of Cluj-Napoca pilot, the **curriculum for MA level course on Circular Economy**, as well as the application of the **energy tree**, another pilot solution, through which everyone can gather information on circular economy in public spaces.

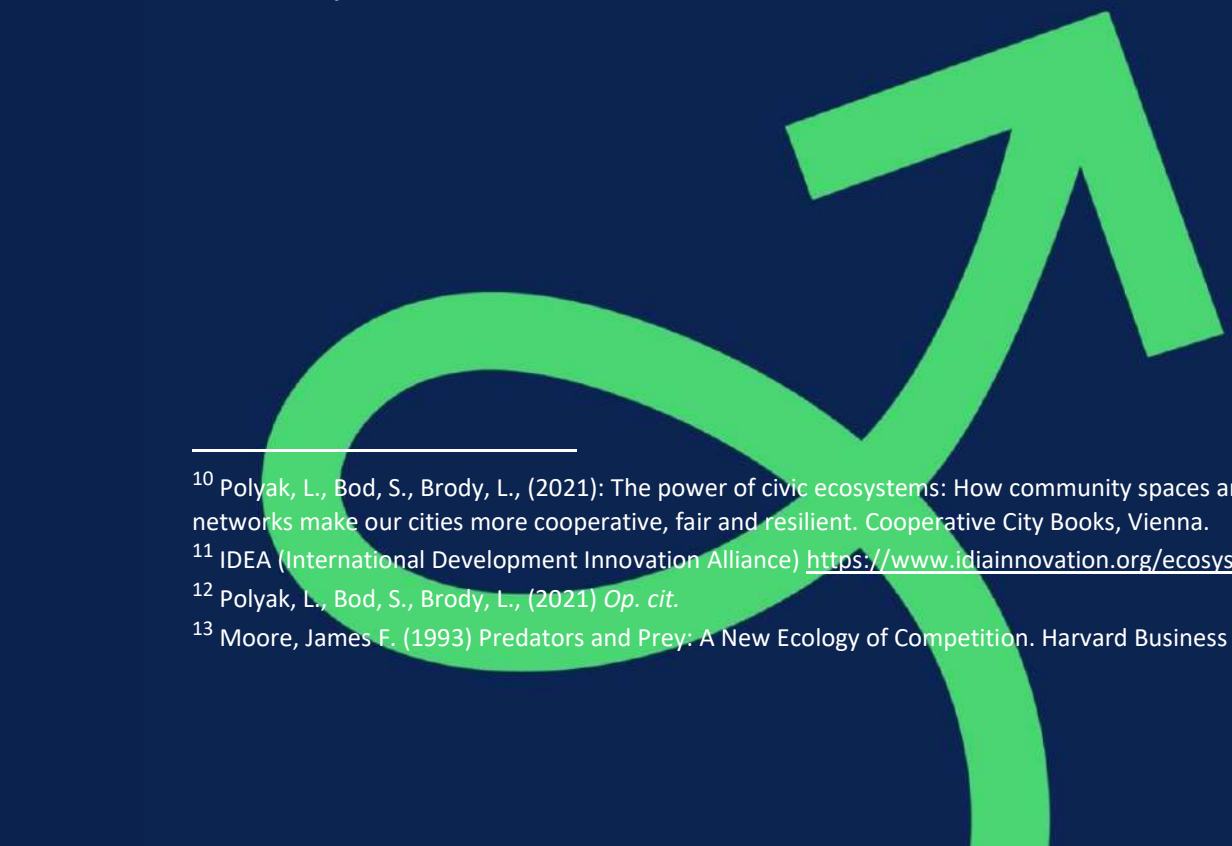
Last step of the process is to **put the theoretical knowledge into practice**. Students, from the high school as well as from university during their courses will be encouraged to create and implement an action plan, and work with projects related to the circular economy.

Recommendation #6

Creating a network of practitioners to foster circular economy solutions

Following the principles of circular economy, initiatives in the same neighbourhood, district or city, can use each other's material resources, at low transportation costs. However, it is important to help different actors to build ties with each other. In this perspective, the notion of the **innovation ecosystem**, borrowed by business and technology fields from ecology, can help us to better understand how these civic networks function[10]. Ecosystems are more than an accumulation of actors: they are also made up by "enabling policies and regulations, accessibility of finance, informed human capital, supportive markets, energy, transport and communications infrastructure, a culture supportive of innovation and entrepreneurship, and networking assets, which together support productive relationships between different actors and other parts of the ecosystem."[11]

Following the logic of natural and innovative ecosystems, recently has been conceived the term of **civic ecosystems**[12] - similarly to natural or business ecosystems - "not only foster interactions but facilitate symbiotic relationships among the various initiatives launched within its environment" as well as "optimize the flow of talent and knowledge if they share a geographical proximity. By developing a certain collective intelligence, such ecosystems move "from a collection of elements to a more structured community."[13]



[10] Polyak, L., Bod, S., Brody, L., (2021): The power of civic ecosystems: How community spaces and their networks make our cities more cooperative, fair and resilient. Cooperative City Books, Vienna.

[11] IDEA (International Development Innovation Alliance) https://www.idiainnovation.org/ecosystem

[12] Polyak, L., Bod, S., Brody, L., (2021) *Op. cit.*

[13] Moore, James F. (1993) Predators and Prey: A New Ecology of Competition. Harvard Business Review.

The Paris experience

The Paris pilot in REFLOW focuses on timber and wood used in the event and temporary construction industry in the city. The pilot project sets out to quantify and qualify the waste material flows generated from events and temporary structures through the development of new models and digital tools to facilitate the reuse of wood materials and products and to accelerate the transition of these sectors towards circular models. Concretely, the pilot projects prototypes and tests digital tracking and scanning tools that leverage computational design techniques in their incubator, Driven Studio. Through the identification and quantification of these material flows, wood can be monitored and reintegrated back into manufacturing processes, ultimately extending the material's life cycle. In addition to the track and trace of materials, facilitated through the pilot's incubator, tools capable of generating databases of wood products to support the development of an agile digital marketplace will increase exchange between the event and temporary construction sectors. The development of robust business models around digital tracking tools is a key focus for the Paris pilot to support the emerging circular event industry, and as such it is reflected in the pilot solutions that have been focused on and developed.

On an international scale, certificates are common ways to ensure sustainable production, but such international labels are often out of reach for smaller makers, operating on a local or even neighbourhood level. *Ars Longa*, a pilot city partner, developed **RE-Label**. It provides both a more approachable certification that can be adapted to local needs and support for artisans aiming to become more circular in their production.

Re-Label offers a toolbox of tools and services to local makers to better valorise their work, reduce the generation of wood scraps, increase reuse of those scraps that are unavoidable, and increase sales. The improved valorisation is made possible by offering a certificate for the product, which shows the specificities and singularities of their creation.

In the creation of *Re-Label*, city partners, firstly, reached out to the existing communities of creatives and investigated their challenges in terms of circularity and circular design. Upon them, pilot city's partners thought how they could improve the way creatives currently organize themselves and work. This network of existing creatives was then displayed in an interactive and **open map**. Re-Label makes it possible to visualize the state of ecosystems in the different territories, and members are divided in four main categories:

1. Designers, architects, artisans, creators;
2. Manufacturing workshops, carpentry, ceramics, metal;
3. Suppliers, resources or storage space;
4. Partner structures, institutions, incubators.

Re-Label offers local makers and workshops, using wood as their main material, a territorial community of stakeholders to share their sustainable practices.

Makers, who wish to promote and evaluate their range of eco-responsible objects, can join the *RE-label* community in their territory to increase their network. Manufacturers can discover suitable partners to interchange wood scraps and support a circular use of material and waste reduction. The local community further functions as an inspiration for re-use practices in the area and invites makers to share their own practices.

The information includes origin, measurements, history, quality of the material, and time spent by the maker, and is gathered in the Re-Label certificate edited by an online generator. The document is dated and signed by the designer or the workshop manager.

Conclusion

The *Circular Citizens handbook* aims to give a complete and a more substantial understanding on the citizens' role in the implementation of circular solutions.

A strength of the REFLOW project is that innovative solutions were tested in six pilot cities: Milan, Amsterdam, Vejle, Berlin, Cluj-Napoca, and Paris. Additionally, these six pilot cities have worked on different materials, respectively, food, textiles, plastic, energy, waste-water heat, and with wood. However, recommendations were drafted in a transversal way, focusing, per each pilot experience, on an overarching topic and therefore making the solutions replicable in different circumstances.

Each recommendation focuses on different aspects: digital technologies, 15-minutes framework, circular design and design for sustainability, strategies in support to the circular transition, creation of education and university curricula, and the setting up of a civic ecosystem.

It can clearly be seen that **a broad variety of stakeholders could be engaged in the different circular solutions:** tenants, cooperatives, NGOs, public companies, entrepreneurs, social enterprises, designers, students and youngsters. All of which with different and relevant roles.

Lastly, the cases that we reported were different from each other, with their own technicalities and challenges to overcome. Therefore, it is not expected that these solutions could be replicated in the same manner elsewhere. Our auspice is that the Circular Citizens handbook could work as an inspiration for other European municipalities, policy makers and urban practitioners that desire to move towards a more inclusive urban circular metabolism.

Reflowproject.eu
REFLOWproject
@REFLOW_project
info@reflowproject.eu