Reflow | Co-Creating Circular Resource Flows in Cities

constRuctive mEtabolic processes For materiaL fIOWs in urban and peri-urban environments across Europe

Deliverable 1.1

# CO-PRODUCTION PRACTICES IN PILOT CITIES

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# DELIVERABLE

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## List of acronyms and abbreviations used in this document

| | |
|---|---|
| CE | Circular Economy |
| DCE | Digital Circular Economy |
| DCI | Digital Circular Innovation |
| DoA | Description of Actions |
| EC | European Commission |
| IoT | Internet of Things |
| OS | Open Source |
| ToC | Theory of Change |

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## Summary

This Deliverable entitled *Co-Production Practices in Pilot Cities* is related to Task *T1.1 - Research and Mapping* within the REFLOW Building block *Business design and Co-creation.*
The document summarises and validates the initial co-production practices foreseen by each REFLOW Pilot City in their transition process towards the Circular Economy, also considering *de facto* existing resources and technological infrastructures implied in the achievement of this goal.
The work is mainly based on:

- a literature review about the definitions of Circular Economy, as well as about methods and tools for the implementation of circular economy practices, with a specific focus on urban contexts;
- a selection of comparable best practices about the adoption of co-production practices and digital technologies for the development of urban Circular Economy;
- the analysis of *D5.1 - Detailed Pilot Planning & Evaluation Framework*; in particular, this Deliverable has been used to validate the Action Plans described by each Pilot City;
- the results of the REFLOW Co-creation Workshop (21th and 22th November 2019, Copenhagen).

Other working documents developed in parallel to D1.1 have not been taken in consideration as they were in progress and/or under finalisation.

The Deliverable is structured in six sections:

- Section 1 contains a brief introduction about the REFLOW project and the description of the specific objectives of this Deliverable.
- Section 2 describes the methodological approach adopted for the development of the validation activity described in the Deliverable.
- Section 3 introduces the key concepts needed to successfully implement Circular Economy practices within urban contexts: it explores the principles of Circular Economy, the tools and methods to support co-production processes and the possible scenarios related to the adoption of digital technologies for the implementation of Circular Economy solutions. Key concepts represent a fundamental starting point to design a grounded theoretical model and the related interventions aimed at fostering the transition towards Circular Economy.
- Section 4 defines a general validation model to be applied in relation to new CE production practices and the technological infrastructure within REFLOW (according to what has been developed so far by the project). We started from the exploration of the meaning and scope of the concept of *validation* as an applied investigation process and a form of qualitative research which aims to collect and synthesise evidence on the validity of co-production processes for the Circular Economy (through comparison with existing validation models and field experiences). The Deliverable starts to solve this task by defining a specific approach to use the Theory of Change for the transition of cities towards urban circularity that can be used as the basis for the identification of the enabling conditions and core values which guide the City Pilots' future implementation.
- Section 5 implements and tests the validation process defined in the previous sections. Thus, the methodological implementation of the validation process has been divided into two phases: the *ex-post* validation of the preparatory activities carried out so far by the REFLOW project for the development of the City Pilots and the *ex-ante* validation of the activities planned by the Pilot Cities. The combination of these two

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phases makes it possible to validate the process and the replicability of the entire collaborative REFLOW transition process (including the co-design process of the Action Plans) and provides an anticipation of the development and replicability of the circular initiatives that each Pilot City plans to co-produce.

- Section 6 summarises the work developed within D1.1 and provides a set of suggestions both to support the forthcoming REFLOW activities and to make the defined validation process usable, scalable and replicable by other experiences outside REFLOW which intends to develop a transition journey towards Circular Economy.

So conceived, this document intends to propose a first grounding phase which could be a reference for other validation activities planned within REFLOW (for example in *Task 1.5 - Validation and Performance Analysis* [M12-M30] also related to the results produced by *Task 1.3 - Design and Planning* [M06- M12]): the search for a literature-based theoretical model which explicates the enabling drivers, values, resources, conditions necessary for a possible implementation of Circular Economy practices within urban contexts. This general model may become the base for the validation of the ongoing CE initiatives co-designed within the City Pilot Action Plans and the verification of the collective activities carried out so far within the project. The ultimate objective of D1.1 is to transform the project legacy and the Pilots' results in a shareable and replicable experience for organisations and cities willing to develop a transition process towards Circular Economy.

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# Preface: struck by the COVID-19 emergency

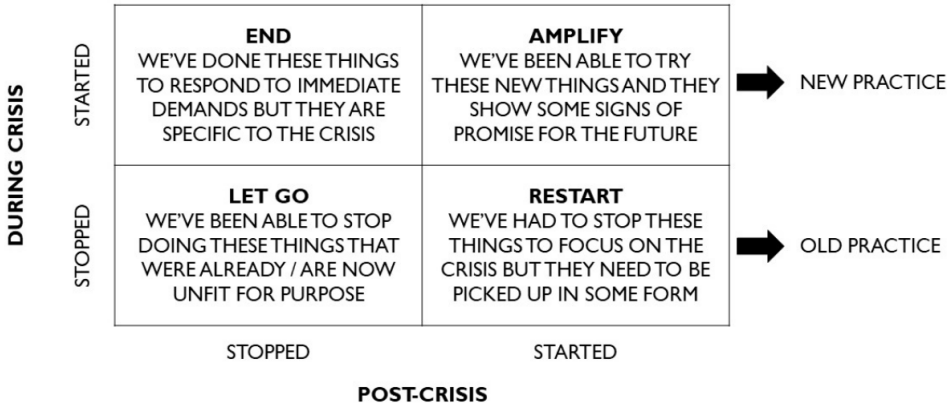
Milan, 2020 spring. We witnessed from our workplaces and then closed in our homes the planetary explosion of the pandemic caused by the COVID-19 virus. Since the end of February 2020, after China, the pandemic has affected all European countries and created an unpredictable scenario that disrupted our research activities, changing our daily lives and the world we knew. Our lives are safe, but many more ones are suspended. Our routines have suddenly disappeared. In this new and problematic scenario, we will have to look at the objectives of the REFLOW project and our previous expectations to understand which of them could survive to this unprecedented emergency and which new challenges are emerging for the Urban Circular Economy. What impact will this have on the continuation of our work? Can the situation of the REFLOW project and of its City Pilots remain untouched? How will the medium-long term consequences affect our activity and the resilience of the project itself?

The REFLOW project never stopped during the COVID-19 emergency. A mapping of the risks related to the development of the activities has started to be discussed, but it has not been possible yet to generate a pragmatic plan for the reprogramming of the project starting from a careful assessment of what has changed and will change everywhere and surely also in the Pilot Cities and in their Action Plans. We are still struck by the COVID-19 emergency, but we must think about the post-emergency, and the new phase that awaits us cannot be approached with an optimistic and stereotyped will. Similarly, the validation activity carried out in this Deliverable is related to actions designed for contexts that probably need to be reconsidered. The completion of this and other Deliverables due in M12 may be the cornerstone for the next REFLOW challenges, now that the impact of the pandemic is more evident and begins to show the need for change of individuals and organisations, giving us also a glimpse of the possibilities for change. Will we be able to face the unknown, to enhance our abilities, to foresee the new alternative and concrete practices?

In such a rapid transition, it is essential to distinguish between emergency actions and interventions with long-term potential, and between innovations resulting from new activities emerging from the post-emergency conditions and those made possible by the blockade of activities and bureaucracy, tackled by an extensive and deep digitalisation process (Taylor 2020; Burbidge, 2020). We perhaps need paradoxically to *amplify* the experiences that we are living to find new ways to look at the challenges that we have to face.

**Figure 0.1**

*Understanding crisis-response measures*




*(Source: Burbidge, 2020)*

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We might therefore derive from the COVID-19 crisis some interesting directions useful for REFLOW's next steps, which City Pilots can grasp and include in their Action Plans:

- *solidarity* as a value to build upon in the post-emergency phase;
- the rise of new and organised forms of citizen engagement (based on values, activism and a pragmatic way of doing);
- the implementation of spontaneous new collaborative services and practices which bond individuals, companies, institutions, governments;
- the accelerated attempts and ways of experimenting and learning about the use of digital technologies;
- a great public discussion about key topics like data use and privacy.

Within REFLOW, this discussion is currently underway. Starting from M10 an internal working group focused on COVID-19 Risk Assessment has been activated. A risk management operation is under development to assess all the risks which might influence the context of the Pilot Cities during and after the COVID-19 emergency. This operation is aimed at identifying similarities and synergies between Pilot Cities, for a successful adaptation and transformation within the current situation.
As Geoff Mulgan says in his last white paper (Mulgan, 2020) *The Imaginary Crisis (and how we might quicken social and public imagination)* there are a lot of strategies which we might adopt in this extreme contingency:

> *"...• Cultivating milieu – that combination of creativity, audiences, criticism, conversations that is so crucial to almost any kind of imaginative activity. Just as the arts thrive best with intensive fields of creativity, criticism, competition and engagement;*
> *so do we need an equivalent for social imagination, not least to raise the quality of work done in this space.*
> *• Creating institutions with an economic base and space – we need more institutions for social imagination that are comparable to the very well-funded ones around science and technology, with universities one obvious location for them. Some need to be devoted to the more analytic side – understanding complex systems, how they work and change (and learning from the heavy investment in such work in fields like defense). Others need to be more open, speculative and creative;*
> *• Cultivating imaginariums – we need more places, virtual and physical that gather, curate and promote imaginative ideas;*
> *• Spreading methods – social imagination is helped by many people becoming fluent in the methods described earlier, which requires practice, and conscious reflection on what methods work best, partly to discourage one-dimensional imagination…" (Mulgan, 2020, pp. 35-36)*

The COVID-19 emergency is a dramatic test of how our communities and nations will have to reframe to face this gigantic challenge: this is moreover inextricably intertwined with the climate change's complex and systemic challenges. As scholars we need to define and implement new and pragmatic ways to foster this social and public, but pragmatic, imagination nurturing it with our expertise and a new model of collaborative leadership.

*Alea iacta est. We could never go back.*

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# 1. Introduction

## 1.1 The Deliverable and the partners involved

This Deliverable is entirely written and developed by the Design Department, Politecnico di Milano (POLIMI). It aims to validate the CE co-production practices and the technological infrastructure within the REFLOW process developed so far, considering also the Action Plans envisioned by the Pilot Cities as described within *D5.1 - Detailed Pilot Planning & Evaluation Framework* (Building block on Pilot coordination, initially scheduled for Month 6 and then postponed to Month 9). The set-up phase of this document, especially in its methodological approach, also saw an initial discussion upon some key topics with a number of Consortium partners: with Copenhagen Business School upon the Theory of Change, with DYNE upon the technological infrastructures for the Circular Economy, with P2P Lab upon the co-production practices in cities. Starting from the end of February 2020, the Covid-19 emergency first limited and then prevented the participation of POLIMI and other partners in a workshop dedicated to the alignment and finalisation of the different deliverables foreseen for the M12.

## 1.2 About the REFLOW project

REFLOW[1] is an EU H2020 funded project, which will run from 2019 to 2022, that tries to understand and tackle urban material flows (linked to a variety of production and consumption activities) and to co-create and test circular and regenerative solutions valuable for new circular practices, business and policy models and citizen engagement and participation. It has been funded within the *European Union Innovation and Research Program*, with the Grant Agreement No. 820937. The main vision of REFLOW is to develop systemic solutions for circular and regenerative cities through the transformation of the production-consumption chains and the consequent reconfiguration of material (and data) flows at different scales, leveraging upon innovation processes created by public institutions/bodies, Fab Labs and makerspaces, innovative enterprises as catalysts for wide-scale, collaborative and co-created systemic, sustainable transition. The REFLOW mission is to understand and demonstrate how this reconfiguration of the urban metabolisms may enable the transition to circular and regenerative cities.
REFLOW aims to provide pragmatic approaches, tools and practices which may align market and government needs in order to create favourable conditions for the public and private sector to adopt circular principles. It will provide new ways to create Circular Economy business models that the cities can adopt to achieve the *2030 Sustainable Development Goals*. This process involves 6 pilot cities (Amsterdam, Berlin, Cluj-Napoca, Milan, Paris, and Vejle) and will transform and assess their social, environmental and economic impact. The project will also make use of novel digital technologies (like distributed ledger technologies for instance) to enable these circular practices in local ecosystems and create data analysis and visualisation tools to perform a continuous monitoring and optimisation of urban metabolic processes. Networks of sensors, urban computing and geo-localisation will capture data ensuring accuracy, continuity and interoperability of relevant data infrastructures, while data visualisation and standard templates will be available for effective communication, public consultation, and exchange of experiences.

[1] REFLOW project. Available at: https://reflowproject.eu/

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Moving from the strategic to the operational level, REFLOW envisages the development of validation and evaluation methods and processes applied to the co-design and co-production activities tested within the pilot cities, in order to promote circular solutions capable of bringing environmental, social and economic benefits. In addition, REFLOW is responsible for designing and implementing specific models and methodologies to test new forms of circular governance that involve the participation of citizens. Finally, REFLOW mobilises existing international networks and movements that are working towards a new production model for cities such as *Circular Cities*, *C40 Cities* and *Fab City Global Initiative*. The structure of the REFLOW project is based on a complex set of activities concerning:

- a methodological and evaluation framework and definition of co-creation and co-production practices for the Circular Economy in cities (WP1). The aim of this activity is to define a general model of action for the circular urban economy that integrates digital technological infrastructures, circular engineering practices, co-design and prototyping processes, business models and governance models;
- a digital technological infrastructure that integrates and software solutions for CE that connects data and resource flows (WP2);
- the approach, method and tools needed for the creation and management of urban metabolisms (WP3);
- a set of practices to redesign the policy models in the urban area, based on collaborative processes and distributed systems (WP4);
- a cluster of City Pilots projects addressing the pragmatic processes of co-design and prototyping solutions for Circular Economy (WP5);
- a set of actions for the development of capabilities that integrate and empower the skills and needs of the various actors involved in urban circularity processes (WP6);
- a communication strategy to inform and involve stakeholders and create a successful narrative of this circular transition and their methods and practices (WP7).

## 1.3 The objectives of this Deliverable

*D1.1 - Co-Production Practices in Pilot Cities* is the first Deliverable developed within the REFLOW Building block of *Business design and Co-creation*. This Building block addresses the topic of co-creation, delivery, validation and evaluation of a series of CE practices responding to pressing citizen and business needs and issues in the area of innovative production and waste management. The main goals of this Building block are related to identify best CE practices, to facilitate the co-creation activities of six pilot cities, to define KPIs to assess CE practices, to assess social, economic and environmental impact of the CE practices developed by the Pilot Cities. Within the above mentioned Building block, Task T1.1 involves municipalities, Fab Labs and other stakeholders in the development of concepts for CE experiments to be developed within the REFLOW Pilot Cities and map those against their potential value, impact and conditions for success. This task also aims to generate the first inputs for the REFLOW framework. This Deliverable, connected to Task T1.1, summarises and validates new Circular Economy co-production practices and the related technological infrastructure within REFLOW, including a description of the possible outcomes around the adoption of CE practices in the Pilot Cities. Specific objectives of D1.1 are:

1. to discuss and define a possible set of key concepts for a successful implementation of Circular Economy practices within urban contexts;

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2. to define a general validation model to be adopted within REFLOW and within other external CE actions proposed by other cities;
3. to implement and execute the validation model and apply its process and method on each of the Action Plans developed by the City Pilots.

# 2. The transition of cities towards Circular Economy

After the overview of the project's objectives and framework, this section describes the methodological approach adopted for developing this Deliverable.

## 2.1 Methodology

Deliverable D1.1 deals with the internal validation of the activities of the REFLOW project, set up and developed by the partner responsible for the deliverable (POLIMI). This document is made and delivered at the end of the first year (M11+1) of work, in which the REFLOW project has laid down the methodological and operational foundations in order to define the Action Plans that the Pilot Cities will have to further develop in the next 24 months. In parallel, the REFLOW project has started to design and implement a set of co-design and technological tools to support the cities in their transition towards CE.
Thus, the validation approach contained in D1.1 is the result of four main activities:

- the definition of an overarching Theory of Change for the transition of cities towards Circular Economy, to be used as main validation tool within this Deliverable;
- a preliminary analysis of the REFLOW process developed so far in order to reconstruct its knowledge framework in a way as accurate as possible;
- a preliminary verification of the information contained in the Action Plans to check their accuracy and ascertain their compliance with the REFLOW project DoA, as well as with the typical co-production process for the CE derived from the study of scientific literature and practices;
- a final validation, i.e. the formalisation of the outcome of the preliminary verification which can be used both as a design stimulus and as the object of subsequent counter-deductions by the Pilot Cities.

The set-up of the validation activity foreseen by Deliverable 1.1 took place after about five months (M2-M6) of study and preliminary understanding of the phenomenon that is the main object of the validation activity: co-production practices informing actions and initiatives for the CE in urban areas. From this preliminary study, developed within Task *T1.2 – Ideation* and based on the analysis of relevant literature and a number of case studies, it emerged that co-production practices for CE are not isolated initiatives but contextualised actions within systemic transformation frameworks that require, involve and activate different levels of resources and capabilities. Moreover, these practices are often the final outcome of a previous path that also includes iterative activities of co-creation and co-design and a process of verification and learning through concrete experimentation.
Therefore, this work has allowed us to understand how these collaborative circular practices develop in sociotechnical systems (also described in D5.1) and whether they are accompanied and supported by evaluation and validation

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methods and tools. Nowadays, there are a number of analytical and design approaches and tools that support organisations, institutions and territories to undertake circular actions (e.g. see Ellen MacArthur Foundation); yet, the majority of such approaches and tools often stop at a design or prototype stage and rarely reach the experimental one. In fact, our literature analysis has not found codified or standardised theories, methods and tools able to validate the CE transformation actions and to assist the actors involved.
Acknowledging the lack of shared validation models for the Circular Economy is the starting point to understand the relationship between the use of *Theory of Change* and the validation activity. Indeed, the Theory of Change paradigm generates the theoretical and structural foundation necessary to identify the *object* that must be validated (i.e. "what" must be validated) and the definition of the validation model and process (i.e. "how" it is possible to validate the *object*). In this Deliverable, the validation process thus derives from the application of a *paradigmatic ideal-type* of the Theory of Change, which has been modelled on best practices analysis and a literature review on Circular Economy.
The absence of acknowledged and specific methodologies or practices for the validation of urban circular practices and the need to validate actions that are at an early stage (and therefore not yet supported by concrete and measurable evidence) have influenced and delimited the scope, depth and extent of the validation activity presented within this Deliverable. This statement prompted us to explore the field of validation by working in two directions:

- to deepen the theme of validation, in order to set up a codified activity with respect to the CE that can be adapted and used as a reference tool to validate the subsequent steps of the Pilot Cities or, more generally, as a tool developed by REFLOW that could be further refined and transferred to other cities beyond the REFLOW ones;
- to set up a qualitative validation process that is configured not (only) as a technical verification activity, but as an activity that provides input to the Pilot Cities for stimulating them to reflect on the setting of their Action Plans in relation to the subsequent design and prototype phases.

The idea (and the challenge) underlying our validation activity is based on two key elements: i) the definition of a validation strategy suitable for actions and initiatives dedicated to CE; ii) the implementation of a *progressive and dynamic validation process* which can be adapted or scaled according to the initial and growing level of development and maturity (technological, design, social) achieved by the Pilot Actions (and according to the completeness and accuracy of the information and data about the achieved results). Our operational approach is based on the definition of an overarching Theory of Change that includes the enabling conditions necessary for the successful implementation of CE practices within urban contexts. As a consequence, the methodological approach adopted for the development of this Deliverable connects three themes: i) the study of models and collaborative practices for urban Circular Economy; ii) the study of the Theory of Change as a methodology chosen by REFLOW for triggering circular transformation processes in cities; iii) the study of validation models and processes: the concept of validation has been widely explored in order to understand and distinguish it from the topic of evaluation. In general terms, the validation process developed in this Deliverable can be considered as a preliminary step linked to a wider and systemic evaluation activity.

The validation methodology developed in this Deliverable can be divided into the following three main phases:

1. *Analysis of collaborative processes for (urban) Circular Economy (M1-M6).*
   This phase (documented in Section 3) explores collaborative processes for Circular Economy with a focus on urban

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contexts. The first phase of the analysis explores how collaborative models for Circular Economy have been applied within cities, in terms of co-creation, co-design and co-production of innovative circular initiatives and solutions. It combines literature review with desk research in order to find relevant scientific evidence and best practices related to urban Circular Economy. In parallel, literature review on Circular Economy has also been applied to achieve a preliminary overview on digital transformation for Circular Economy. This work aims to obtain information and feedback on the use of digital technologies for Circular Economy, in particular those identified by the Building block *IT Infrastructure and Tools*. The specific objective of this work is to define the basic elements for a general, yet preliminary validation of the REFLOW's technological infrastructure at the definition and development stage reached at M11.

2. *Analysis of validation models and definition of the Validation Model for the transition of cities towards CE(M6-M9).* This phase, documented in Section 4, aims to investigate and define the Validation Model - in terms of strategy and process - i.e. the nature, meaning and function of a validation process and its application to the REFLOW activities. In the absence of specific validation models for the CE, the general concept of validation has been explored (from various perspectives and disciplinary fields) in order to identify key concepts useful to define a validation model suitable/adaptable to urban Circular Economy. This process was implemented via two steps: the first step concerns a literature review providing an overview on existing validation models and experiences implemented in relation to different types of (validation) objects and scales of intervention; the second step concerns a further level of literature review and analysis for the collection of a series of best practices informed by the Theory of Change with a specific focus on circular processes. The connection between these two levels of investigation provides a link between the validation process and the REFLOW project, including its Evaluation Framework (mentioned within the DoA).

3. *REFLOW Validation Model implementation and validation of the Action Plans (M9-M12).* This phase (documented in section 5) implements the methodology of the Validation Model in two moments: the *ex post validation* regarding what has already been developed within the REFLOW project, and the *ex ante validation* regarding what has been envisioned by the Pilot Cities. The *ex-post validation* activity operates on the whole REFLOW process developed so far, together with its tools and related outcomes, while the *ex-ante validation* operates on the Action Plans defined by each Pilot City. The final output of this phase concerns the validation of the co-creation processes adopted for the creation of the Action Plans, the co-production of the interventions co-designed by the City Pilots to implement urban circular practices and, finally, the validation of the entire collaborative transition process defined within and by the whole REFLOW project.

Within phase 3, the postponement of D5.1 (from M6 to M9) and the COVID-19 emergency (from M9 to M12) both reduced the time and opportunity to directly interact with the Pilot Cities in order to discuss the validation issues after the definition of the Action Plans (M9) and before the completion of D1.1 (M11). A specific session dedicated to the validation with the Pilot Cities was initially planned within the Workshop in Vejle (2020 March 11-12, M10). However, the rapid spread of COVID-19 emergency in March 2020 (Milan is one of the cities most affected by the pandemic) forced the POLIMI research unit to cancel its presence at the workshop in order to focus on wrap-up and complete this deliverable.

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# 3. Key concepts for a successful implementation of Circular Economy practices in urban contexts

This section provides an overview of the key concepts for a successful implementation of circular economy practices in urban contexts: investigating and understanding the principles of circular economy, the tools and methods supporting co-production processes and the possible scenarios related to the adoption of digital technologies for implementing circular economy solutions. These elements represent a fundamental starting point for designing a theoretical reference model and the related interventions aimed at fostering the transition of cities towards Circular Economy.

## 3.1 Circular Economy: theories and practice

The concept of Circular Economy (CE), whose origins can be traced back to research theories defined decades ago, has recently emerged in response to the need for better alternatives able to subvert the current economic model based on continuous growth and resource exploitation. By essentially promoting sustainable production and consumption patterns, CE aims to foster a more appropriate and efficient use of resources, thus positively contributing to re-establish a harmonious balance between all the elements which constitute the economic, environmental and social systems, whose stability today is increasingly under threat. Given the multidisciplinary nature of the CE concept and the multi-strategic approach of the interventions it provides, policy-makers and enterprises have shown growing interest toward the implementation of circular practices, also relying on the decision of the European Commission (EC) to fully support the transition toward CE through the 54 actions within the so called *Circular economy package* (EC, 2015).

Although the concept of CE has widely spread in recent years, there is not yet a consensus on its theoretical framework (Kirchherr et al., 2018; Prieto-Sandoval et al., 2018), nor there is a univocal definition. This is mainly due to the different visions that still animate the debate on the relationship between sustainable development and CE: as highlighted by Sauvé et al. (2016), some experts claim that the concept of sustainable development can be traced back to linear thinking and therefore place it in strong opposition to a circular vision of sustainability; others describe instead the two concepts as interdependent and define CE as a way to foster sustainable development. Geissdoerfer et al. (2017) affirm the existence of a clear connection between them by defining three possible connections: i) CE is necessary for sustainable development; ii) CE is beneficial to sustainable development, and iii) CE and sustainable development have a compensatory relationship. In addition, another interesting perspective is suggested by Bonciu (2014), who argues that while a sustainable development approach is limited to solving specific environmental problems and their possible consequences, CE deals instead with the causes of the problems, thus representing an indispensable tool for achieving sustainability targets.

However, it has been noted by several authors (Kircherr et. al, 2017) that, due to the non-application of a systemic vision, CE has so far privileged the achievement of economic prosperity and environmental quality, ending up with neglecting important aspects such as social justice and behavioural change, which are necessary for the well-being of current and future generations and represent a cornerstone of sustainable development, including in cities. In this regard, Ghisellini et al. (2016, p. 12) highlight the need for *"… a broader and much more comprehensive look at the design of radically alternative solutions, over the entire life cycle of any process as well as at the interaction between the*

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*process and the environment and the economy in which it is embedded…*", suggesting that the implementation of CE should be supported by innovative actors able to contribute to radical changes within the practical and decision-making spheres through the design of appropriate tools.

The systemic dimension of CE can be traced back to previous scholars among which we might highlight Von Bertalanffy's proposal (Von Bertalanffy, 1950) to consider all organisms as systems characterised by the interactions between their components, Boulding's (1966) *spaceman economy* concept, which suggested the vision of the economic system as a cyclical system, followed by the work of Georgescu-Roegen (1971) on the importance of considering the second principle of thermodynamics in economic systems. The complexity of relational dynamics within a system also represents one of the main aspects of other fundamental concepts of CE: *industrial ecology* (Frosch & Gallopoulos, 1989), which calls for the implementation of eco-industrial parks envisioning the integration between the industrial system and the its environment; *industrial symbiosis*, which focuses on fostering the exchange of resources through the creation of symbiotic networks at local and regional level between different organisations and sectors traditionally operate in silos.

In addition to other theories such as *cradle-to-cradle*, *steady economy*, *limits to growth*, *biomimicry* and *blue economy*, the *eco-efficiency approach*, based on the minimisation and dematerialisation of material flows, has often been identified among the features of CE. However, the Ellen MacArthur Foundation clarified the difference between the concepts of *eco-efficiency* and *eco-effectiveness* by describing how the latter involves *"...the transformation of products and their associated material flows such that they form a supportive relationship with ecological systems and future economic growth..."* (Ellen MacArthur Foundation, 2012) and therefore indicating eco-effectiveness as a preferable target of CE rather than eco-efficiency.

The different research traditions at the basis of CE therefore share complementary points of view, while identifying different concepts and strategies. This knowledge has been translated into a CE approach with three main theoretical guidelines summarised by Suárez-Eiroa et al. (2019) as follows: i) minimising inputs of raw materials and outputs of waste; ii) maintaining the value of resources as long as possible within the system, and iii) reintegrating products into the system when they reach the end-of-life stage. From the reflection on the limited nature of resources, what clearly emerges is the common intention among CE visions to focus on stock optimisation in order to maximise the value of the resources used and prevent waste (Kalmykova et al., 2018). Literature review confirms that, for achieving stock optimisation, CE implementation strategies mainly suggest the adoption of the so-called 3Rs principles[2]:

- the *Reduction principle*, which acts through the development of eco-efficient production and consumption processes aims to reduce the input of primary energy, raw materials and waste;
- the *Reuse principle*, which refers to *"...any operation by which products or components that are not waste are used again for the same purpose for which they were conceived…"* (European Council, 2008, p. 5);

[2] Within the analysis conducted on 114 definitions of Circular Economy by Kirchherr et al. (2017) they examined the frequency of the four 4R framework components (reduce, reuse, recycle, recover) concluding that *"The 4R framework, as the official EU policy framework for CE, is only reflected in 3–4% of definitions"* while *"... reduce, reuse, recycle (the 3R framework) is the most commonly employed in the entire sample (35% – 40% of definitions)"* Kirchherr et al., 2017, p. 226).

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- the *Recycle principle*, which instead refers to *"...any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations…"* (European Council, 2008, p. 5).

According to Stahel (2014), the leading principle in the hierarchy between the 3Rs principles for CE should be represented by *reuse*, although most of the practical examples available on transition processes towards CE show a greater adhesion to the *recycling principle* (Kircherr et al., 2017), without considering that it is actually *"…the least sustainable of all the circular economy activities, in terms of profitability and resource efficiency…"* (Stahel, 2014), given that waste materials are not infinitely recyclable and in some cases they are not recyclable at all.
Furthermore, in order to encourage a systemic perspective based on large value chains which contribute to the creation of a regenerative and restorative economy, the Ellen MacArthur Foundation (2015a) defines the following three additional guiding principles for CE: a) *preserve and enhance natural capital* through the control of finite stocks and the balance of renewable resource flows; b) *optimise resource yields* by promoting the circulation of products, components and materials both within technical and biological cycles; c) *foster system effectiveness,* by minimising negative externalities. In the same report they translated these principles into the so-called *Re-SOLVE framework* based on six business actions: *Regenerate*, *Share*, *Optimise*, *Loop*, *Virtualise*, and *Exchange*. The six actions have been described with reference to three main themes - *mobility*, *food*, and *shelter* - in order to offer specific insights to companies and countries interested in the transition towards CE. For instance, a circular mobility system might be shared, electrified, autonomous, multimodal, and looped; while a circular food system might be regenerative, resilient, non-wasteful, and healthy; and a built environment based on circular economy principles might integrate green infrastructure (e.g. parks) to create high-quality life and work spaces where power and food are generated, rather than consumed.
By adapting existing principles and defining new intervention strategies, CE therefore aims to solve long-standing problems including scarcity of natural resources, climate change, biodiversity loss, unemployment and social inequalities (Friant et al., 2019). Although these proposals appear promising and appealing for different stakeholders, the *lack of an agreement upon a theoretical framework* for CE still poses many challenges for the successful implementation of the principles and practices proposed, as evidenced by the existence of a multitude of different definitions that make CE *a still blurred concept*.

Indeed, in addition to the most used definition provided by the Ellen MacArthur Foundation (2013a; p.7), which identifies CE as *" … an industrial system that is restorative or regenerative by intention and design…"*, over the years CE has also been described as a way for reducing, reusing and recycling activities (Government of People's Republic of China, 2008), or 1) an alternative model to a traditional linear economy (WRAP, 2016); or 2) an economic and industrial system (Bastein et al., 2013); or 3) as an industrial model (World Economic Forum, 2014). Furthermore, it has also been claimed that CE may represent a paradigm shift (Ellen MacArthur Foundation, 2013b), but as underlined by Korhonen et al. (2018, p. 549), based on Thomas Kuhn's (1962) and Ehrenfeld's (2000) work, *"… for a thorough paradigm shift to occur the new paradigm needs to be embedded in everyday life…"*. Korhonen et al. (2018) describe the two interdependent stages of a paradigm shift and state how CE should be committed to integrating and balancing the *normal practice stage* - which includes metrics, tools, instruments and practical measures - with the *paradigm stage* - concerning values, societal structures and culture - to become a culturally accepted paradigm, capable of leading to a

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radical transition. When it comes to addressing social and cultural change, *design* and *education* can play a valuable role to ensure the achievement of social benefits in accordance with the sustainable targets of CE, as supported by one of the most recent and complete definitions of CE provided by Suárez-Eiroa et al. (2019): *"… circular economy is a regenerative production- consumption system that aims to maintain extraction rates of resources and generation rates of wastes and emissions under suitable values for planetary boundaries, through closing the system, reducing its size and maintaining the resource's value as long as possible within the system, mainly leaning on design and education, and with capacity to be implemented at any scale."* (Suárez-Eiroa et al., 2019, p. 958)

In conclusion, CE still has many challenges to face, both theoretically and practically. According to De Jesus and Mendonça (De Jesus & Mendonça, 2018), the barriers to the implementation of CE are linked to different types of factors: technical (inappropriate technology and technology gaps), economic (high initial costs and market uncertainty), institutional (misaligned incentives, lacking of a conducive legal system) and socio-cultural (rigidity of consumer behaviour and businesses routines). In particular, poor awareness and fragmented information across the civil society regarding the CE concept and its potential for sustainable innovation and growth represent key gaps that should be addressed through *"... ways of supporting co-creation by developing, experimenting and demonstrating new business models together with end -users, taking into consideration their needs..."* (European Commission, 2017, p. 75), in order to develop a multidimensional and multi-actor systemic approach for the transition towards CE.

### 3.1.1 Circular Economy within urban contexts

With the rapid growth of urbanisation processes in the last decades, cities have become huge centres for the transformation of material and immaterial resource flows, hosting a complex system of agents and concentrating most of the world's wealth. This makes the urban scale a suitable yet challenging context where undertaking circular economy interventions. Indeed, the collaborative dimension finds its ideal space in cities, through experimentation and prototyping activities, taking advantage of conditions such as the high concentration of resources, capital, and data – for both hosting and sharing relevant experiences within national and international networks. A brief overview of relevant contributions provided by academics and experts allows us to describe the urban circular economy principles and the possible urban scenarios that their adoption may generate, indicating tools and methods suggested by authors for dealing with metabolisms' complexity in order to develop circular practices in cities.
Finally, by providing a focus on the role of urban living labs as useful tools for orchestrating collaborative activities, the transition towards sustainable futures is presented as a long term and systemic intervention. Contrary to what has been described in the previous paragraph about the lack of a commonly recognised theoretical framework for CE, a scientific consensus was found regarding the definition of three implementation levels of CE (Suárez-Eiroa et al., 2019):

- the *micro level*, which refers to the transition processes towards CE activated by companies through the adoption and integration of cleaner production and eco-design approaches;
- the *meso level*, which entails the development of eco-industrial parks and other types of production networks through the symbiotic association between industrial realities that usually do not interact with each other;
- the *macro level,* which refers to the transition of cities, regions and countries towards CE. At this level, the adoption of eco-cities programmes, collaborative consumption models, innovation waste management and zero waste programmes suggested to redesign the industrial system, the infrastructure system delivering services,

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the cultural framework and the social system that characterise the intervention context (Ghisellini et al., 2016).

By focusing on the development of a circular vision in cities, the Ellen MacArthur Foundation (2017) has identified three principles, able to ensure the transition of urban contexts towards CE, and to be adopted as a basis to define the interpretative categories of the City Pilots:

- *design out waste and pollution*, in order to preserve human health and natural systems from negative externalities of economic activity;
- *keep products, components, and materials in use and at their highest value*, favouring inner loops of resources through the adoption of design approaches that encourage reuse, remanufacturing and recycling;
- *regenerate natural systems* by fostering flows of nutrients in and around cities.

The principles of CE are therefore integrated and adapted to the city context in order to generate an urban system which is able to improve its resilience and the living conditions of citizens, while reducing pollution, creating local value loops and minimising waste generation. To achieve these goals *"...innovation in Circular Economy requires a systemic approach where cities must act as key facilitators by stimulating co-creation, co-design and co-implementation with different actors and citizens at both the local and the international level..."* (Santonen et al., 2017, p. 3). The involvement of all social actors requires the development of *capacity building and sharing knowledge activities* that foster awareness about CE and the possibilities for sustainable change that it can offer, encouraging all stakeholders to play an active role within the transition process. Furthermore, the effective participation of the whole society also makes the establishment of innovative and democratic governance models indispensable to ensure that the benefits deriving from the implementation of a circular vision address interests of all actors, including the most vulnerable (Friant et al., 2019).

In addition, in order to promote new business models and foster private-public partnerships, the creation of urban innovation spaces such as the Urban Living Labs represents an interesting example of *"...a form of experimental governance, whereby urban stakeholders develop and test new technologies, products, services and ways of living to produce innovative solutions to the challenges of climate change, resilience and urban sustainability ..."* (Voytenko et. al., 2016, p. 45). In this regard, Fab Labs and Makerspaces should also have a role in offering spaces for co-designing innovative tools and testing prototypes, while encouraging local production, repair and digital manufacturing (Ellen MacArthur Foundation, 2017). Indeed, the definition and implementation of open data platforms and digital applications are essential to enhance the development of interactive and collaborative processes in addition to monitoring and reporting activities (Santonen et al., 2017). Moreover, digital technologies can also support the identification of challenges related to material flows in cities, orientating decision-making processes towards the development of circular solutions (Ellen MacArthur Foundation, 2017). Local governments can play, in fact, a crucial role in engaging national and business actors, providing new financial instruments and supporting education and training, so as to increase general awareness and social participation within the circular transition path (Ellen MacArthur Foundation, 2015b, 2017).

The implementation of the principles and guidelines described above could contribute to the shift towards three possible urban scenarios informed by a circular vision (Ellen Macarthur Foundation, ARUP, 2019):

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- *Thriving city*, in which the increased economic productivity enabled by reduced congestion, minimised waste and reduced costs, can generate new business opportunities capable of supporting skills development and new jobs;
- *Liveable city*, characterised by enhanced social interactions, an improvement in air quality and urban health, a reduction in carbon emissions and pollution;
- *Resilient city*, where the potential of digital technologies and local and distributed production allows materials to be kept in use, also reducing the pressure on virgin materials.

In conclusion, the adoption of a systemic and long-term perspective is therefore essential for the transition of cities towards CE, given the need to undertake multiple interventions able to act on all levels of the urban system and to lead towards radical and permanent positive changes.

## 3.2 Co-production practices: a design driven approach

Many scientific publications and strategic planning and policy documents are providing new visions and approaches for implementing circular economy principles and innovating traditional production processes and resources metabolisms. The European Commission states a competitive economy to be that of a society engaged in the adoption of circular economy practices, recognising co-creation and different forms of collaboration between public authorities, economic actors and civil society as the pillars of this transition process (European Commission, 2015).
In its alignment with the European directives, the REFLOW project can be seen as a large-scale co-creation effort, in which municipalities, SMEs, makerspaces and citizens collaborate to bring new value for CE in urban contexts. The project adopts a people-centered approach for mobilising a variety of stakeholders and their networks for developing an implementation strategy and designing circular urban solutions.
REFLOW aims at collaboratively intervening, operating on cities material and information flows, on local production ecosystems and globally sharing viable and innovative circular practices. Co-creation is performed through different levels of collaboration, i.e. within the pilot cities, the consortium and their international networks, being transversally supported by a shared data infrastructure and a dedicated infrastructure of digital technologies. Moreover, these activities are facilitated by a continuous process of knowledge exchange and capacity building within the consortium, providing a fertile ground for the realisation of both the project and pilot cities's objectives.
The co-production practices that REFLOW intends to implement within the pilot cities are therefore the result of an extensive and multi-level collaborative process that depends on a successful integration of resources and skills.
Although many successful practices and toolkit for co-creation in CE exist (see *The Circular Design Guide* by Ellen MacArthur Foundation and IDEO, and the *Systemic Design Toolkit* by Namahn and ShiftIn), no significant contribution has yet been provided on how collaborative activities should be strategically adopted in Circular Economy initiatives and projects. Thus, since the relationship between co-creation and CE still remains unclear, the idea here is to provide a shared perspective on how to collaboratively build a transition path for sustainable development.
Firstly, it is necessary to define the semantic boundaries of the term co-creation. According to literature, the concept of co-creation has been defined in business and management sciences as a way to reposition value creation and the traditional firm-consumer relationship (Prahalad & Ramaswamy, 2004; Vargo et al., 2008). Under this perspective, the

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consumer becomes a user actively involved in re-thinking and re-designing the interactions with the products/services. On the other hand, in the field of public sector innovation, co-creation is involved in complex project frameworks where different categories of actors, with different competencies, are included in the provision of public services (Voorberg et al., 2015; Bason, 2018).
This perspective highlights a major challenge for REFLOW, which aim is thus not to build a linear and standardised collaborative model for Circular Economy, but to work both on the enabling conditions for generating co-production practices, and to define a shared and circular design-driven approach. When adopting a design-driven perspective, a clear distinction between co-creation, co-design and co-production needs to be firstly drawn.
Co-creation has been generally defined as *"… the joint, collaborative, concurrent, peer-like process of producing new value, both materially and symbolically…"* (Galvagno & Dalli, 2014, p. 644), where, within the business world, value *"... is always co-created, in interactions among providers and beneficiaries through the integration of resources and application of competences..."* (Vargo et al, 2008, p. 146). This vision has widely been accepted; nonetheless, little consensus exists on a unique concept definition or its operating aspects (Alves et al., 2016; Galvagno & Dalli, 2014; Ramaswamy & Ozcan, 2018; Voorberg et al., 2015). Moreover, in an attempt to make it operational, co-creation and co-production have been often used interchangeably in literature.
A distinction was proposed by Lusch and Vargo, which stated that co-production *"… involves the participation in the creation of the core offering itself. It can occur through shared inventiveness, co-design, or shared production of related goods, and can occur with customers and any other partners in the value network..."* (Lusch & Vargo 2006, p. 284). In this sense, co-production is part of an overall co-creation framework, where the user becomes to various degrees co-designer and co-implementer in a mutual exchange that can be either physical or mental (Etgar, 2008; Grönroos & Voima, 2013; Lusch & Vargo, 2006; Ranjan & Read, 2016). The concept of co-production has been widely adopted also in the public sector, while addressing citizen engagement in the delivery of public services and policies, and in public and social innovation initiatives (Bason, 2018; Selloni, 2017; Voorberg et al., 2015), thus contributing to create new collaborative forms of governance.
Furthermore, notable contribution on the concept of co-design originates from the discipline of design, especially by Sanders and Stappers (2008), according to which co-design *"... refers, for some people, to the collective activity of collaborating designers […] in a broader sense to refer to the creativity of designers and people not trained in design working together in the design development process..."* (Sanders & Stappers, 2008, p. 6). Moreover, in line with its historical connection with the Scandinavian participatory design movement, co-design is considered as a way to engage stakeholders within a socio-technical system under transformation, to envision "*use before actual use*" of a service (as it happens in prototyping activities). But co-design is also a way to think about the sustainability of the design in social innovation practices (Cantù & Selloni, 2013).

In REFLOW, these different dimensions of participation converge in an *action research approach*, which defines the overall design-driven framework for their adoption and implementation. Indeed, following a democratic and participative orientation, action research is *"...a pragmatic co-creation of knowing with, not on, people..."* (Bradbury, 2015), that generates knowledge and outcomes through practice. Moreover, it has widely been considered as a suitable, systems-oriented approach for tackling contemporary wicked challenges, such as sustainable development (Bradbury, 2015; Zuber-Skerritt, 2012).

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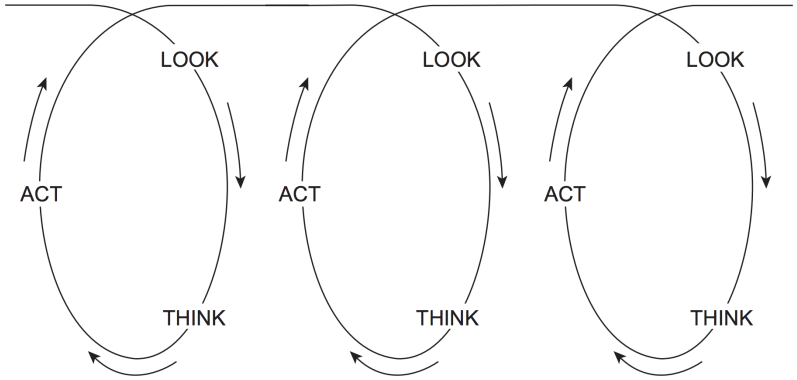
Action research is based on dynamic and iterative operating models able to deal with and act within societal complexity (Lewin, 1946; Stringer 2007). For instance, the action research routine by Stringer (2007) defines three main activities (see Figure 3.1) within a constant process of observation, interpretation and action where review and evaluation become fundamental for the process to move successfully forward. This process can be summarised in three phases:

- *The look phase.* In this first stage, researchers build the picture of the context through desk and field activities. Data collection is carried out through quantitative and qualitative approaches, gathering information via both statistical data and literature, and ethnographic methods and tools like interviews, participants observations, focus groups and surveys. Immersive research activities have the additional purpose of establishing engagement and capacity building with the participants, fully involved throughout the research process.
- *The think phase.* The next phase has the aim of analysing and interpreting the collected information to collaboratively understand the phenomena and the context observed. The resulting interpretations can be enabled through dedicated workshops in order to produce a final report.
- *The act phase*. This stage reflects on how to collaboratively turn problems into solutions, through planning the intervention (through an action plan), implementing the activities to finally review and evaluate their progress.

**Figure 3.1**
*Action Research Interacting Spiral*




*(Source: Stringer, 2007)*

Assigning these theoretical considerations to a design-driven perspective for the entire REFLOW, co-creation should be included in a wider design framework supported by an action research model.
Thereby, any Pilot's generative action aimed at implementing, for instance, a shared action plan, dedicated technological solutions, activity monitoring system, etc. needs to be adapted to this model, which provides a reflective process of observation and action in the field. This will generate a *collaborative system of co-creation, co-design and co-production actions* (see Figure 3.2) within the pilots. Therefore, co-production practices should result from a collaborative and iterative design process reflecting the experimental and non-linear nature of the transition towards Circular Economy.

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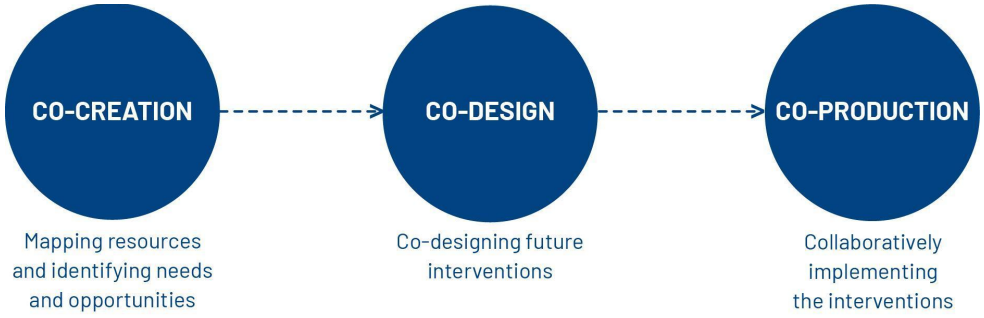
In this sense, REFLOW will co-produce new values within the six pilot cities, leveraging the participation of citizens and stakeholders, and urban infrastructures and resources.

**Figure 3.2**

*System of co-creation, co-design and co-production for collaborative practices implementation*




**Box 3.1**

*How to approach design for transition?*

Designing for Circular Economy means to design for transitions able to act from the micro to the macro level of a system, and in this way produce a real change. Adopting a circular economy strategy means to plan a transition from a linear production system following the principles of take, make, dispose, to a circular one in which materials are re-introduced within the production chain.

Moreover *"... the transition phase is a context in which design is embedded..."* (Manzini, 2015a, p. 59) for being able to frame systemic actions by mobilising both designers, experts and the civil society, as change makers. In this sense, some disciplinary areas of design (as presented below) are considered as drivers of change, by reorienting their models of action to help the definition of core principles to be adopted for a successful transition. They moved from a traditional perspective to a systems' oriented one, in which not only economic, but also social, environmental, and political aspects are taken into account. New design-driven approaches have been formulated for acting within complex socio-technical systems, like the urban ones. Thus, design might offer a way for envisioning alternative futures and designing change journeys.

**System Oriented Design.** In the late 20th century, the idea of a new area for design practice and research was expressed *"... more concerned with exploring the role of design in sustaining, developing, and integrating human beings into a broader ecological and cultural environment..."* (Buchanan, 1992, p. 10). This perspective reoriented design interests towards wider spaces and scales of intervention, thus systemic actions and impacts, and generative, empathic and transdisciplinary design methodologies (Jones, 2014). System thinking moved the focus of the design process from finding a solution, to the early stages of problem definition and the exploration of related possible alternatives, working in this way to create meaningful conditions for change to happen. The development of many toolkits supporting co-creation and co-design activities witness such a shift. When it comes to circular economy related interventions, many examples can be presented, like, to name just a few, the *Systemic Design Toolkit* by Namahn and ShiftIn, and the *Circular Economy Guide* by IDEO and Ellen MacArthur Foundation. Common to these and

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other tools is the iterative and fluid thinking at the centre of the approaches proposed. According to a system-oriented intervention and the complex nature of contemporary challenges we are called to tackle, we are progressively moving from the traditional design thinking process, to a more open, fluid and participative one.

**Transformation Design.** Reaping the legacy of traditional user centred design principles and participatory design, back in the early 2000s, Transformation Design envisions a new design paradigm addressing complex social and economic problems (Burns et al., 2006). With the aim of triggering impactful changes at system level, both in public and private sector, Transformation Design promotes top down (i.e. interdisciplinary exchange of knowledge) and bottom up (involving users) forms of collaboration. Mainly working in the services sector, Sangiorgi (2011) defines Service Design as a transformational practice, able to act at organisation (private) and community (public) level re-distributing power. In this sense, if supported by a suitable infrastructure, *"... participatory and community-based interventions have in themselves […] the potential to be transformative..."* (Sangiorgi, 2011, p. 34). In this sense, *designing for something*, rather than *designing something* is addressed, where "... [t]he 'for' is very important because it encapsulates the idea of transformation in progress…" (Meroni & Sangiorgi, 2011, p. 3).

**Transition design.** With the aim of addressing contemporary societal challenges, the so-called *wicked problems* (Buchanan, 1992), Transition Design, as a theoretical and operational field of research, *"... advocates design-led societal transition toward sustainable futures..."* (Irwin, 2015). This emerging design area, which inherits some of the principles of social innovation and service design, adopts a long-term vision, according to which small scale, local interventions are included in a broader picture for change. This is in line with the *cosmopolitan localism* proposed by Manzini (2015b), as a key characteristic of a resilient planet in which small scale actions connected to bigger networks contribute to regenerate cities and the world. Transition Design has contributed to structure an approach and tools supporting organisations to build a new vision of the future in which a new mindset, new ways of designing and new dynamics for change are required.

### 3.2.1 Co-production practices for Circular Economy in urban contexts | Best practices

Many practices around the world are benchmarks for undertaking circular economy interventions at different scales: new products, new services, new processes successfully designed to meet circular principles, thus marking a path to sustainable innovation and out-of-waste future. Despite the proliferation of such practices, no consensus has yet been reached on a shared operational strategy to be adopted for their implementation, especially with regards to the complexity of the urban system. Although an underlying thought exists on urban circular processes and behaviours being able to significantly contribute to global resource consumption, there is still no shared operational decoding of a circular strategy at city level. For this reason, REFLOW intends to provide a shared and feasible design and experimental process at urban level: an (inter)operable design model is necessary to coordinate and ensure the effectiveness and replicability of circular actions within the Pilot Cities. It is also important to highlight which elements can support the creation of a shared design framework.

In a collaborative scenario, what differentiate design interventions is the context (Jones, 2018): cities are complex socio-technical systems in which fluid metabolisms of material and immaterial resources coexist. In order to trigger change meaningfully, it is necessary to adopt a systemic approach to understand the possible benefits and barriers that the rich interplay of resources and actions in cities can offer. As a response, for instance, the *design for scape* approach has been

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adopted within the urban context for enhancing value co-production while developing *"... design interventions which aim at contributing to both situated and limited problem spheres, to broader phenomena of innovation, which configure large transitions of society, urban environments and political governances..."* (Concilio et al., 2019, p. 80).

System approaches to co-creation may indeed produce transformative effects both within organisations and at societal level through design and decision processes (Jones, 2018) that involve businesses, public institutions, citizens and the civil society as a whole. This makes it possible to reflect not only in terms of the city's production and consumption, but also to consider the broader picture of resources and influence behaviours and lifestyles within society (Williams, 2019). Nogueira et al. (2019) argue the *community capitals* to be fundamental not just as a descriptive framework of Circular Economy, but as analytical and generative lenses to understand the connection of all the elements of a system and enable new strategies for future interventions. With this in mind, eight main community capitals provide the ingredients to manage the intervention and a baseline to measure the success within the society. They are:

- *Natural capital*: geography, renewable and non-renewable natural resources;
- *Social capital*: social actors and the system of collaborations they produce;
- *Financial capital*: financial resources that produce wealth for the future;
- *Cultural capital*: inner values of a society;
- *Built capital:* material goods and human build infrastructure;
- *Political capital*: system of governance and policies;
- *Human capital*: human values and individuals' ability to produce knowledge, health, skills;
- *Digital capital*: digital infrastructure and data.

Finally, through desk research, some co-production practices for Circular Economy and sustainability in urban contexts were identified (see Table 3.2).

**Table 3.1**
*Best Practices of Co-Production for Circular Economy in cities*

| *Best practice* | *Type* | *Origin* | *Source* |
|---|---|---|---|
| *FORCE. Cities Cooperating for Circular Economy* | EU-funded project | Desk Research | ce-force.eu/ |
| *Halle 2* | Local initiative | Desk Research | nws.eurocities.eu/MediaShell/media/2017cities_and_circular_economy-web-spreads.pdf |
| *Making Sense* | EU-funded project | Suggested by REFLOW (DoA, part A) | making-sense.eu/ |
| *RePoPP* | Local initiative | Desk Research | nws.eurocities.eu/MediaShell/media/2017cities_and_circular_economy-web-spreads.pdf |

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| | | | |
|---|---|---|---|
| *Centocelle Urban Living Lab* | National funded project | Desk Research | isdrs2018.exordo.com/files/papers/182/final_draft/182_Cappellaro_Paper_Final_Revised.pdf |
| *Sustainable professional laundry services at Bornholm* | Industry foundation project | Desk Research | researchgate.net/publication/326225678_Co-designing_For_A_Circular_Economy |

We decided to deepen and present two successful best practices; their description, in a narrative form, is supported by desk research. The cases have been selected according to their specific focus on Circular Economy practices. Moreover, the availability of online information was fundamental in providing detailed descriptions.
The objective of this case study analysis is to explore and inquire the main characteristics that make them successfully designed to meet urban circular principles.

**Box 3.2**
BEST PRACTICE 1: *FORCE. Cities cooperating for Circular Economy*

FORCE is an EU Horizon 2020 funded project (2016-2020) that adopts circular economy principles to overcome waste production stemming from different urban material streams in four European cities: Copenhagen, Genoa, Hamburg and Lisbon. The ultimate goal is to implement new eco-innovative market solutions at city scale employing metals, flexible plastic, wood and biowaste, thus adopting new value chain partnerships between public and private stakeholders. Accordingly, each of the four cities established a lead partnership based on a chosen material stream and three experimental local partnerships with respect to the others, through the design of more sustainable materials life cycles. The process adopted by the project is built on the following aspects:

- Participation. By engaging with municipalities, enterprises, academia and citizens, the whole project at both consortium and city level adopts a participatory approach, implementing a variety of collaborative activities and initiatives with these stakeholders. This is reflected both in the adoption of a co-creative process throughout the project and in the purpose of promoting new private public partnerships.
- Urban governance. At a governance level participation evolves in the adoption of a collaborative approach that seeks to engage all actors across the different stages of the material flows, to create and adopt new urban governance models. In this respect, the value chain partnership is intended as a model of collaboration able to foster innovation actions. According to this approach, the adoption of circular actions (i.e. recycle, reuse, remanufacturing) and principles helps increase value within the local material streams, while aligning stakeholders' needs.
- Data. Data are relevant for both the effectiveness and efficiency of the project and the related local interventions. Data are gathered from the early stages of the state of the art mapping activities, thus sustaining decision making and evaluation processes. With this in mind, FORCE aims to develop suitable tools that can enable the aforementioned activities.
- Replication. Since replication is one of the main objectives of the project, an internal institution, which performs and supports the project replicability, has been established from the beginning of the research activities. The FORCE Academy acts as a hub for knowledge exchange and dissemination, by convening stakeholders and promoting events, training activities and seminars.

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These aspects framed a range of urban interventions co-developed according to a common thread that, through a first desk analysis, seem to guide all experimentations in all their design phases. Indeed, evaluation activities on material stream performances were carried out from the early stages of context analysis, to the later measurement of the impact of the planned interventions.
For instance, the first step of each city design process started by drafting a baseline evaluation report, that has become a tool providing both information on the current status and actual performance of the material streams (also informing co-design activities), and a common ground for further successful monitoring and evaluation activities. This approach ensures that a shared framework and language is adopted which clearly facilitates the design, monitoring (and further assessment) of the project activities.
Moreover, another tool used for evaluation activities are big data technologies. For instance, an app providing information about the demand of the market of used electrical and electronic devices was developed. Other techniques for business model's evaluation were used.
Furthermore, a number of tasks are carried out and support cities transversally from the beginning, to the end of the project, providing the necessary building blocks of knowledge and action. In FORCE, the overall aim is to guarantee the transferability, at a governance level, of the urban partnerships established, to plan a dissemination and communication strategy and to assure the effective replicability of the experimentations.

**Box 3.3**
BEST PRACTICE 2: *RePoPP*. Turin, Italy

The neighbourhood of Porta Palazzo, placed between Turin periphery and the city centre, has been for years a place of experimentation of urban and social regeneration practices. The main social innovation is the presence of one of the biggest European open-air markets and the peculiar multiethnicity of this part of the city brought in by the great migratory flows. RePoPP is a circular economy urban project, carried out within the Porta Palazzo context, that started in 2016 with the initial objectives of reducing the market food waste through the collection and re-distribution of food and by promoting social inclusion. The initiative, firstly born to raise awareness on food waste, was promoted by the local municipality with the scientific support of the Università di Scienze Gastronomiche di Pollenzo and built on partnership with local stakeholders and associations. A new waste collection system was collectively designed with stakeholders: dedicated small carts and bags were used for daily food collection and sorting activities, and at the end of the day separate stalls made food available to those who might need it. The success of this project, that still continues to work, relied on a strong collaboration with municipal local actors, on the support of vendors and on the participation of citizens and volunteers. After three years of experimentation, which have doubled the recycling of biowaste in the market (from almost 35% in 2016, to 70% at the beginning of 2019[3]), the project was able to activate virtuous circular dynamics that also contributed to social inclusion. Moreover, this project has become a replicable model adopted by other municipal markets in Turin and scaled up to other urban contexts around the world.
Also thanks to the establishment of new successful partnerships, RePoPP continues to act within the urban ecosystem by constantly eliciting many collateral and complementary initiatives, which contribute to give strength to the project itself, while together inserting this intervention within a distributed system of circular actions that amplify its impact

[3] *See at (only in Italian): http://www.ecodallecitta.it/notizie/392339/torino-porta-palazzo-il-progetto-repopp-diventa-strutturale-e-si-amplia-ad-altri-settori-merceologici/*

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at scale and sectors. In fact, as an early consequence of a first experimentation period while becoming a structured project, the voluntary work of asylum seekers has turned into real job opportunities and food waste recovery activities started to involve other market retailers in addition to vegetable and fruit sellers.
In a long-term perspective, even today, almost four years after its start, the project still continues to produce its effects. In 2020, the initiative of Porta Palazzo has been connected to the context of the Central Market in Turin; actually, through the involvement of the starred chef, Davide Scabin, and the professional kitchen equipment of the market, ready to eat soups from vegetables waste collected are donated to poor people. Moreover, during the Covid-19 emergency, RePoPP has been able to reshape its activities by including its collection and redistribution processes to other local markets.
Among many circular economy experiences that still struggle to integrate the social dimension in the transition towards circularity, RePoPP becomes an exemplary practice. The social aspect, ranging from individuals and community awareness and participation, to a strong governance model, is pivotal for the success of the local intervention. Actually, the project, acting at the urban processes level (but still on a small scale) finds its efficiency in the integration of bottom-up action and top-down support. In this sense, the dialogue with the city's system of governance and policies, as well as scientific and market expertise, is still fundamental.
This section highlights some further features about the design process and the actual implementation of circular practices within the urban context. Together with findings from literature presented in the previous paragraphs, they provide some useful considerations to build a scenario of transition towards circular economy in cities and a lens through which to look at the practices envisioned within REFLOW in order to validate them.

## 3.3 Digital Technologies for Circular Economy: an overview

Within REFLOW there is a combination of technical partners such as software developers (DYNE, FOKUS) that develop distributed digital technologies to support circular and co-production practices and other partners, such as makerspaces, that are in charge to implement co-design and prototyping activities using distributed digital technologies in order to develop solutions for circular economy.  For this reason, it is important to better understand the existing relationship between co-production practices and the use of open and distributed technologies, ranging from software to hardware. This section aims to explore the topic of CE digitalisation processes. The aim is to validate the principles, characteristics, and critical values of the digital technologies constituting the project technological infrastructure, as it was initially declared and is currently under definition and development within REFLOW (*Building block IT Infrastructure and Tools*). For this reason, the starting point is the general exploration of CE digitalisation, to understand what are the key-concepts identified and developed by scholars and experts in the field. In particular: what are the principles and characteristics of CE digitalisation and what topics they focus on, how this phenomenon is emerging and what are the conditions that enable or hinder it, and finally what are the main typologies of digital technologies involved. Understanding the phenomenon of CE digitalisation is important to build a knowledge base necessary to start a general validation of REFLOW technological infrastructure. This might allow a comparison between evidence coming from scientific literature and the most advanced practices, and the REFLOW approach to CE digitalisation.
The Ellen McArthur Foundation emphasises that, in addition to the shared production of durable goods, one of the most important directions of CE development concerns the evolution of product-service systems in the digital perspective.

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Digitalisation is one of the main enabling factors to increase visibility and smartness in products and goods, knowledge on their location, conditions and availability throughout their life cycle (Ellen McArthur Foundation, 2013, 2016).
The New Circular Economy Action Plan (European Commission, 2020) mentions, among its cross-cutting actions, the theme of transition to the CE through research, innovation and digitalisation. The next Horizon Europe program will support the development of indicators and data, new solutions for circularity taking into due consideration the role of digital tools to achieve circular objectives. In particular, the Action Plan states that "*... Digital technologies can track the journeys of products, components and materials and make the resulting data securely accessible. The European data space for smart circular applications will provide the architecture and governance system to drive applications and services such as product passports, resource mapping and consumer information...*" (European Commission, 2020, p. 21).
This statement reinforces the idea that digital technologies combined with communication technologies and, more recently, machine learning, foster the development of participatory processes based on the use of data, which produce results relevant to the circular economy (Ellen MacArthur Foundation, 2016). These data can measure circularity and create innovation initiatives for the CE based on distributed technologies.
However, what is the state of the art regarding the connection between digital transformation and Circular Economy? The first fundamental reflection is that CE systems are based on and/or generate large amounts of data on production and life cycles, use, reuse, recycling of materials, logistics systems and actors involved in the value chain. At present, many of these data are not yet digital or are not yet digitally connected. At a general level, digitalisation, therefore, offers new means and tools to access this data to arrange and coordinate information and material flows.
The most significant contributions collected in this paragraph propose a literature review on the state of the art of the so-called Digital Circular Economy. Taken together, they identify the main areas of opportunity, criticalities and conceptual tools for digitalisation. At the same time, they also highlight a substantial and general lack of applied case studies and best practices that try to meet the Digital Circular Economy challenges and test concrete solutions (Antikainen et al., 2018; Pagoropoulos et al. 2017; Tseng et al., 2018).
In this regard, the research report *Digitalisation - unlocking the potential of the Circular Economy* from EIT Climate-KIC (Europe's leading climate knowledge and innovation initiative) highlights how the relationship between digitalisation and the Circular Economy is still at an early stage (EIT Climate-KIC, 2018). According to the report, by unlocking the potential of the Circular Economy "*... Digitalisation offers us the opportunity to reinvent our relationship to natural resources. IoT applications will intensify connectivity between units, gathering data across things and people. Blockchain brings greater transparency, security and traceability. AI allows us to analyse data with higher detail and accuracy, increases resource efficiency and productivity, enables predictive maintenance, and opens up further untapped potentials...*" (EIT Climate-KIC, 2018, p. 37). In considering technology as an enabling factor, the report identifies some relevant issues: the integration between software and hardware technologies, the need for complete and accurate data, an existing data access and data standard problem, and the challenge of interoperability between technologies.
In the context of digitalization for the Circular Economy, the main research question certainly concerns the definition of a technological landscape, i.e. the set of existing digital technologies that can support the transition to a CE.

The report *Cities in the Circular Economy: the role of Digital Technology* (Sukhdev et al., 2016) developed by Ellen McArthur Foundation with Google, identifies several digital technologies that play a role as enablers of the CE in cities. These are, on the one hand, technologies to obtain information on conditions, availability and flows of products, components or materials (e.g., asset tagging and geo-spatial technologies). On the other hand, technologies for the

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management of open and big data on human behaviours, connected to flows' identification and tracking, allowing easy access and widespread connection between people and information on flows (e.g., data management and connectivity technologies). In official research reports on digital transformation for the CE (issued by European public bodies, private institutions and global consulting firms) various *Technology Landscapes* are represented, offering an overview on the families of technologies related to different CE processes. An overlap between the system of enabling technologies for the CE and those of the Industry 4.0 paradigm is recognisable. These representations go as far as to outline a general model of digital circular innovation, based on the evident coexistence of different digital technology families. One of these representations, elaborated by Deloitte (See Figure 3.3), reports a fascinating subdivision of digital technologies concerning CE transition activities: i) technologies that support the mapping of resources or the alignment between data and material flows; ii) technologies that support the redefinition of operational models through connectivity among data, devices and stakeholders; iii) technologies that support the production or upgrade of solutions; iv) technologies that allow communication, dissemination and learning of circular practices.

This representation will be used in the final part of Section 3 as a useful reference to describe and validate the choice and positioning of REFLOW's technological infrastructure in a broader technological reference landscape for CE.
The literature review on the development of digital innovation for CE (Aintilaken et al., 2018; Bressanelli et al., 2018) indicates that the main challenge focuses on the relationship between business models and data. These reports refer to data ownership, integration and sharing and information management, but also the collaborative processes necessary for their creation and acquisition. They address critical issues related to privacy, trust, intellectual property rights and require a radical change of organisational, technological and cultural mindset to organise systemic processes.
Ritzén and Sandström (2018) precisely identified the main types of barriers to CE digitalisation by dividing them into: 1) financial barriers (e.g., measurement of financial benefits, financial profitability); 2) structural barriers (e.g., lack of information exchange, unclear distribution of responsibilities); 3) operational barriers (e.g., infrastructure, supply chain management); 4)attitudinal barriers (e.g., perception of sustainability, risk aversion).

**Figure 3.3**
*Representation of digital technologies for Circular Economy*

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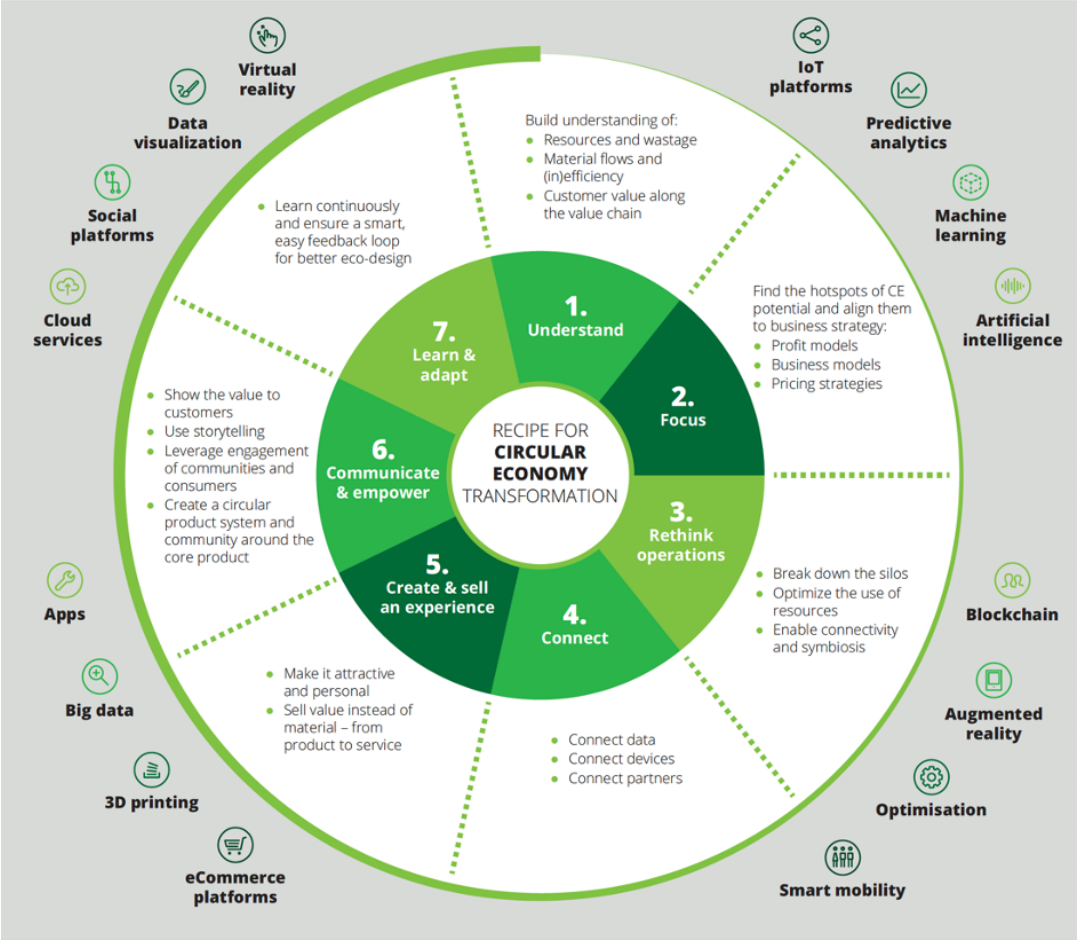


*(Source: Report Circular Goes Digital, Deloitte Finland)*

Finally, they also identify technological barriers related to product design and the integration of digital technologies into production processes. From all these works, it is possible to identify, extrapolate and synthesise some key themes or issues for the design of Digital Circular Economy initiatives:

- *Digitalisation and speed in the development and adoption and processes of CE.* The market is increasingly requiring the possibility to use digital solutions to enable and scale up circular economy models. While consumers and citizens are beginning to understand and embrace the principles and models of the CE, the adaptation to more evolved and complex forms of consumption takes longer. On the other hand, many companies that are developing digital solutions for CE are essentially start-ups. Start-ups, in particular, need to focus on both business scalability and the implementation of technological solutions. Both are very demanding challenges that require the involvement of human capital and the use of economic resources;
- *Digitalisation and the issue of data/information quality on circular systems.* While there is no doubt that digitalisation has significantly increased the quantity and volume of information exchange, the scientific literature shows a gap in the quality, accuracy of data and information and access costs. According to several reports, this is one of the main obstacles to the development of CE. Another relevant issue concerns the

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integration of available data between the various stakeholders within a circular system, an aspect that is fundamental to reconstruct and align information flows with material flows. Again, the scientific literature shows that this aspect has not yet been considered and explored with due attention (Pagoropoulos et al., 2017; Wilts & Berg, 2017);

- *Digitalisation and co-creation for CE.* The analysis of the scientific literature conducted by several scholars highlights a direct and recurrent connection between the topic of digitalisation and co-creation. In particular, co-creation processes that privilege the sharing and combination of competencies coming from different sectors and organisations of different nature and size (large and small, public and private, educational and productive) are considered relevant, as well as the development of project actions and initiatives that combine social participation, multidisciplinarity and technological experimentation (e.g. workshops, hackathons, challenges and competitions);
- *Digitalisation, distribution and strengthening of agency and individual participation in CE systems.* Digitalisation is deemed as a relevant element to speed up the transition to a circular economy, not only in terms of scalability and replicability of business models, but in power distribution between consumers, local business and citizen communities. Digitalisation, through novel technologies such as distributed ledgers, allows for the re-allocation of knowledge, structure and ownership of data, but allows for the development of more connected and long-lasting relationships between the various stakeholders of the system including users. Digitalisation can go as far as developing new business models based on advanced forms of end-user participation in monitoring and control processes of resources and material flows (Salminen et al., 2017).

The last level of analysis concerns the main features and the role of digital technologies initially considered by REFLOW for the development of solutions for urban circularity: Open Data platform and distributed ledger technologies.
The scientific literature analysed agrees that the combination of these technologies could, in the future, provide significant opportunities for the creation of circular business models (Bressanelli et al., 2018). Below are summarised the main features of Open Data, Blockchain and IoT, concerning the development of systems or models for the CE.

- *Open Data (platform).* The correlation between data and circularity is one of the most recurrent topics in the debate on the CE digitisation. Studies by subjects such as NESTA, Ellen McArthur Foundation and other researchers (Lieder and Rashid, 2015; Charnley et al., 2019; Jabbour et al., 2019) suggest the idea of a *data-driven circular economy*. Although, the scientific literature and application cases exploring the relationship between Open Data and the CE are still somewhat limited. A recent study entitled "*Open data in Circular Economy*" (Saario et al. 2019; Open Data as Service project) has mapped open data solutions used in the circular economy sector in Finland and worldwide. The results show that the use of open data related to resources and material flows in circular business models is problematic or non-existent. The main critical elements in experimental initiatives using open data concern availability, completeness, reliability and impartiality (i.e., the lack of standards). Moreover, they report a widespread lack of culture on the subject or the reluctance of individuals or organisations (especially companies) to share data in highly competitive contexts.
- *Blockchain (platform).* Blockchain is an emerging technology that is gaining the interest of a wide variety of economic activities: finance, productive sectors (e.g. agri-food), public services (e.g. health, water management) and governance systems. The reason for this growing interest lies in the fact that applications using a blockchain can operate in a decentralised and disintermediated way, maintaining their functionality and reliability without

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the need for a verification system (Casado-Vara et al., 2018). The usefulness of the blockchain for CE activities is mainly related to the management of information within waste recycling programs, reusability of materials, reduction of energy consumption and carbon emissions. The information recorded in a decentralised way makes it possible to monitor different types of transactions ranging from the use of raw materials to the sale of the final product, by tracing its origin. The blockchain can therefore be useful and advantageous to trace the origin of a raw material and stimulate the sustainability of supply chains or facilitate the sharing of information within production chains. At the same time, it can connect autonomous systems or dispersed/distributed subjects or provide real-time data to all stakeholders involved in a process. In the application area, one of the most promising and emerging areas of work concerns the connection between blockchain and IoT (Košťál et al., 2019; Panarello et al., 2018; Reyna et al. 2018). In summary, the blockchain can support CE testing initiatives in the following areas: reducing IoT operational silos by increasing their scalability, facilitating the connection of devices and individuals by implementing distributed device authentication and authorisation for IoT applications, facilitating interaction between devices without the use of servers, facilitating the traceability of sensor data, protecting device information exchanges, and stimulating the development of microservices.

- *Internet of Things (platform).* In general terms, this technology implies the inclusion of sensors into devices, making them able to communicate and actively participate in an information network. Through the IoT, it is possible to remotely monitor the use, status and position of a product in real-time, increasing the possibilities to manage its end-of-life collection, reconditioning, remanufacturing and recycling. For example, widely used technologies such as RFID help to collect information on how products and services are used (Askoxylakis, 2018; Bressanelli et al. 2018). Another feature of this technology is the easiness and low cost of designing and deploying IoT-based trials. These experimentations can apply existing solutions on the market (which is very fragmented to date) or designing new devices from scratch, also by using open source resources (open design, open hardware and software). The development of IoT-based experimentations in the CE area, however, presumes the introduction of structural, strategic and cultural changes in all the organisations involved. In this regard, the analysis of the scientific literature suggests a path to: i.) to identify, define and design transition projects; ii.) to analyse digital resources that act as enablers of IoT-based business models and product/service solutions; iii.) to introduce evaluation models of the transition experiences implemented through the use of IoT devices, so to develop guidelines for product/service transformation. Other elements to take into account in the design of IoT-based trials concern: scalability of IoT devices in terms of connectivity capabilities, semantic interoperability between IoT platforms, devices and applications, reliability and security of the devices and applications used.

### 3.3.1 Digital Technologies for Circular Economy in urban contexts | Best practices

In this paragraph, we analyse best practices that use data through open-source technologies, the Internet of Things, and blockchain. Before deciding to develop them, we searched for several other examples, either through desk research or by indications from REFLOW's partners (see Table 3.3 for an indicative sample).

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**Table 3.2**
*Best Practices of digital technologies for Circular Economy in cities*

| *Best practice* | *Type* | *Origin* | *Source* |
|---|---|---|---|
| *Carrefour Act for Food* | Private company initiative | Suggested by partner (Municipality of Milan) | carrefour.com/en/group/food-transition |
| *IBM Food Trust* | Private company initiative | Desk Research | ibm.com/blockchain/solutions/food-trust |
| *Locecon* | Community project | Suggested by partner (DYNE) | locecon.org/nova-story/ |
| *Quartierstrom* | Public pilot | Desk Research | quartier-strom.ch |
| *Sensorica* | Community project | Suggested by partner (DYNE) | sensorica.co |
| *TagIT Smart* | EU-funded project | Desk Research | tagitsmart.eu/index |
| *Making Sense* | EU-funded project | Desk Research | http://making-sense.eu/ |
| *Antwerp Circular South* | EU-funded project | Desk Research | https://www.uia-initiative.eu/en/uia-cities |

The availability and extensiveness of primary sources were essential criteria for selection. We privileged the cases whose sources offered an exhaustive description of the principles behind technology and the utilisation processes. More importantly, we judged the final cases selected as exemplary according to a characterisation and specific use of technology (as outlined above). They display a note-worthy relationship between the use of digital technologies, CE, co-creation, and public engagement.

**Box 3.4**
BEST PRACTICE 3: *Making Sense*

Making Sense is an EU Horizon 2020 funded research and innovation action (2015 – 2017). The project experimented with the use of open source/digital fabrication technologies to strengthen citizens' awareness of environmental issues. The overall aim was to investigate how these technologies, applied in a participatory and co-creation perspective, can enable more sustainable and proactive behaviours. Making Sense's approach followed the paradigm of citizens' science, aiming *"... at building actionable knowledge, supporting campaign orchestration, connecting networks and creating methods to foster collective awareness on environmental issues.*" (Coulson et al., 2018, p. 819). It developed 9 pilot projects among 3 different European cities (Amsterdam, Barcelona and Prishtina). In each pilot, local stakeholders were involved in participatory activities (e.g., meetups, hands-on workshops) and supported in identifying a contextual environmental issue to investigate. Participants addressed diverse environmental topics they considered relevant in each pilot context, from air pollution to nuclear radiation. The project adopted an iterative, multi-step and replicable framework to accomplish these activities, in which data and digital technologies were a central element. To describe one specific example, let's consider the Amsterdam pilot "Urban AirQ." In this campaign, a community of residents concerned about pollution in their neighbourhoods used open-source hardware (i.e., single-

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computer boards integrated with sensors) to collect data on air quality, seeking to address specific questions they had on the issue. Making Sense is characterised by:

- *the use of open source technologies for participatory sensing* Digital technologies supported collaborative practices, in particular participatory sensing practices (Burke et al., 2006). Data collection by citizens (i.e., citizens-generated data) was a central element around which pilot activities developed;
- *a variegate strategy for citizens engagement and co-creation* While data collection indeed constituted a central and distinctive element, we should consider these technological means within the broader project's engagement strategy. In fact, the pilots used several methods and tools to engage with participants, to build collective awareness, and to facilitate co-design of ideas and concrete actions. Before and after the data collection, various methods were used for these scopes. For example, techniques to support creative thinking as *Future Newspapers* (Making Sense, 2018, p. 126) helped participants to reflect on their projects' current limitations and resources by envisioning futures they wanted to achieve;
- *the interplay between the community of interest and the community of practice* Making Sense engaged with multiple stakeholders at various stages of experimentations, starting from civil society and common citizens. All campaigns: "*... first engage citizens and potentially also other stakeholders i.e. scientists, policy makers and other bodies, around burning issues to support better environmental decision making and action...*" (Scott et al., 2017, p. 12). These communities of interest (i.e., people concerned on a specific environmental issue) worked alongside the community of practice (i.e., the project team, coders, designers), that added their technical knowledge to the campaigns (ibid.). Arguably, the interplay between these two communities was a relevant characteristic of the process, as both groups played an irreplaceable value in attaining pilots' goals. While the community of interest would add their local knowledge and perspective, the community of practice would support data collection and deal with the digital tools.

**Box 3.5**

BEST PRACTICE 4: *Antwerp Circular South*

Antwerp Circular South is a project funded by the initiative *Urban Innovative Actions* of the European Union. The project, currently under development, started in 2018 and will end by December 2020.

The City of Antwerp (Belgium) is in charge of coordination. Both Antwerp and the Region of Flanders, where the city is located, have a years-long tradition of work focused on supporting the CE model. In the past, the city has experimented with initiatives on circular economy within specific city districts (Bonneau, 2018). Accordingly, Antwerp Circular South focuses on a neighborhood called The New South District (Nieuw Zuid). The area, whose official construction started in 2014, is a testbed for "*... new energy practices related to air quality, renewable energy, grey water recovery and circular district heating*" (Bonneau, 2018, p. 4). The project "*... aims to position circularity as a community challenge for the New South district […] and to engage its new residents in co-creating online and offline initiatives to change their consumption behaviours.*" (Bonneau, 2018, p. 2). Through this community approach, the project will experiment with behavioral nudging on specific topics: electricity, heat, water consumption, materials reuse, waste reduction. The program set quantitative results to be accomplished in each of these areas (e.g., reducing tap water use or increasing volume of recycled materials by a certain percentage). As part of its mixed strategy, the project will combine social innovation activities (e.g., citizen Energy Cooperative) and technological innovations. Data

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and digital technologies have a prominent role in the project. According to the expected plan, sensors, and measurement systems for each household (i.e., IoT technologies) will collect consumption data and make them among participants. A blockchain-based system will reward and encourage positive behaviors with a digital currency, called *Circules*. At the time we are writing, the project is entering its final year and ready to implement the experimentation (the latest article on the official UIA website is dated February 2020). As these practices are recent, interpretation of results and conclusions have to be drawn carefully. However, several reports so far published (Bonneau, 2018; 2019a; 2019b) offer us detailed insights on the on-going project process. From these reports, we can understand some characteristics of the project:

- *the join of online and offline activities.* In the sources considered, the importance of a mixed strategy that combines online/offline activities for community engagement is explicit. For example, it was relevant to establish a physical community hub (CIRCUIT) that could be an offline interface for engagement. CIRCUIT was set in the style of a café repair to act as a material collection point and point of engagement for the district community.
- *co-creation ensured at several levels of the process.* The employment of innovative technological solutions, like blockchain, is central. The project organised moments of co-creation and community engagement for many aspects related to its adoption. They regarded, for example, the design of the dashboard displaying consumption data and how to award and use the digital currency.

Based on the knowledge elements reported in this section, specific considerations about the general validation of the technological infrastructure of REFLOW are reported in section 5 of this Deliverable.

# 4. Towards the adoption of a validation model within REFLOW

Many vocabularies[4] define *validation* as a process aimed at checking the validity and correctness of scientific data through comparison with rules and data already known and reliable. At the same time, the action of validating is described as a verification of the validity of data, information, searches through appropriate procedures. Validation is therefore an activity transversal to different disciplinary areas (e.g. medical-health, urban planning, etc.) that can be applied to objects, methods and tools, processes and projects in order to verify and demonstrate their conformity or repeatability in relation to requirements or conditions required and defined. *There are no general theories on validation and there are no coded and specific validation theories or models for the Circular Economy[5] in the urban environment. Nor is there a single approach to validation from a methodological point of view.* This activity can be understood as a propaedeutic and enabling activity for the development of a process and/or as a final control check (generally a sequence composed of an approach/method, a process, activities with a purpose and causally coordinated results). In more structured and codified forms, validation can itself become a method or process.
To approach the topic of validation within REFLOW it is therefore necessary to define a process based on the

[4] see https://www.britannica.com/topic/validity; https://www.merriam-webster.com/thesaurus/validation

[5] There are European research projects involving actions for the validation of circular business models (e. g.: C-SERVEES, see: https://c-serveesproject.eu/) or the development of technology validation tools for CE (e. g.: Environmental Technology Verification ETV, ETV Process, see: https://ec.europa.eu/environment/ecoap/etv_en).

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combination of analysis of specialised scientific literature and identification of best practices as elements of comparison of processes, causes and results. The starting point is to build a correct interpretation of the role of validation within REFLOW with respect to the current stage of development of the project and its City Pilots and to provide a validation method useful for other activities within the project but also for similar external activities.
Before the end of the first year the REFLOW project came to define the Pilot Cities Action Plans. Within Deliverable D*5.1 - Detailed Pilot Planning and Evaluation Framework* the individual plans of each Pilot are not always described in detail. At present, almost all available information on the Pilot City Action Plans and the process that generated them is qualitative (mainly referring to the challenges addressed by the Pilot Cities, the envisioned urban circular scenario, stakeholders to be involved) and quantitative data are currently under elaboration (such as, for instance, those about urban material flows in the six Pilot Cities). The systemic nature of REFLOW and the CE require a combination of quantitative and qualitative data and an analytical description of transformation processes to understand causal relationships. For this reason, at this stage of the project, a validation model should be considered and chosen that is qualitative only. This choice is supported by both the scientific literature and by the potentially usable combination of models and tools developed by scholars, research agencies and companies.
An useful contribution in qualitative validation processes comes from the work of Creswell (2016) which, compared to a project with a systemic nature and impact such as REFLOW, underlines the importance of validation based on "*... the value-laden nature of the study and actively report their values and biases as well as the value-laden nature of information gathered from the field. We say that they position themselves in a study...*" (Creswell, 2016, p. 18). Creswell states that there is no unambiguous perspective on the importance of validation in qualitative research, its definition, the terms to describe it, and the procedures to establish it. By analysing the scientific literature on validation, he highlights the possibility of building different *"qualitative validation strategies"* based on processes that aim to assess the *accuracy, reliability, authenticity of the information or results presented by the participants of an action*. A qualitative validation strategy is based on two assumptions: i) the validation process is considered credible in its effectiveness by the community in which the project operates and by the stakeholders who commission it; ii) the validation process is able to operate with precision on the reconstruction of the activities carried out in the field, having clear the perspective of the participants in these activities.

A second key aspect concerns the relationship between validation and evaluation. Within the social sciences field, evaluation is defined as a process based on trustable and shared evidence aimed at building a hypothesis of reality about the value of what is evaluated, for learning and transformation purposes (Foglieni, 2017).
There are certainly more points of contact between validation and evaluation. First of all, from the point of view of the process, validation and evaluation have in common the object to be evaluated/the subject that evaluates, i.e. the value of something but someone (Foglieni, 2017).
The main difference between evaluation and validation lies in their task: the evaluation must establish or qualify a judgment with respect to an action, while validation must confirm or not the (potential or actual) effectiveness of that action through a verification that establishes compliance with a predefined process or conditions.
A qualifying aspect for REFLOW is that validation as evaluation should not be intended as the expression of a judgment *per se*, but as the expression of a judgment that enables a critical process of learning and change (Foglieni, 2016). So conceived, validation has the fundamental role of building knowledge and skills, developing a capacity for evaluative

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thinking that facilitates continuous quality improvement, providing evidence about the value of what is evaluated, and justifying interventions undertaken (Donaldson & Lipsey in Shaw et al., 2006).

*Validation* and *evaluation* can be considered as separate activities applicable independently to different contexts, situations and activities or to the same project, operating in a complementary way, as it happens in REFLOW. In addition, there is a further aspect relevant to the concrete development process of REFLOW activities: validation and evaluation can be both applied *ex-ante* or *ex-post* to an action. Preliminary (*ex-ante*) validation concerns the verification of the conditions and/or process activities/processes that need to exist/take place and serves to verify their appropriateness for the achievement of a purpose (which is accountable) and could be subject to an *in itinere* or *ex-post* evaluation. On the other hand, validation may be the final (*ex-post*) verification of a concluded action that has been subject to *ex ante* or *in itinere* evaluation. Finally, these combined activities may give rise to validation and evaluation cycles applicable to iterative actions.

Starting from these considerations, a last level of analysis necessary to define the validation strategy for REFLOW concerns the identification of best practices related to the use of tools that can highlight the accountability of a validation process dedicated to the transition towards CE. From a desk research conducted on several disciplinary areas we have identified two main approaches/tools:

- *Standards of Evidence*, namely tools to generate appropriate evidence not necessarily associated with data or research methods that help to identify innovations that may actually be more effective. In particular, the *Nesta Standard of Evidence* (Nesta, 2013) and the *Project Oracle Standards of Evidence* (2018) have been selected;
- *Innovation maturity stages* adapted by Abbasi et al. (2019) to the Geels' (2005) multi-level innovation model, which allows to map and identify transition areas within innovation processes.

The Standards of Evidence are statements that can be made about the effectiveness of a project compared to predefined results based on available evidence (NESTA, 2016). They are tools that work on the scalability of the validation process and therefore on the definition of appropriate verification elements according to the level of development or maturity of a project. The Standards of Evidence are organised on a scale of values. The lowest levels correspond to the initial stage of definition or development of an innovation (e.g. idea, concept) so validation requirements are minimal or basic. Higher levels require increasingly accurate data and evidence that must be validated externally to the organisation. In practice the more the quantity and quality of the Standards of Evidence that must validate an innovation increases, the more likely it is that the innovation will be successful. The Standards of Evidence can be partial or limited in time and is a repeatable exercise that helps develop a validation and evaluation strategy.

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**Figure 4.1**
*Nesta Standards of Evidence*


*(Source: Nesta, 2013)*

**Figure 4.2**
*Project Oracle Standards of Evidence*


*(Source: www.youthimpact.uk)*

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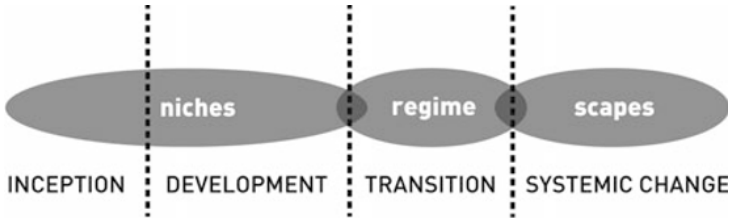
At level 1 the required evidence corresponds to the structuring of a Theory of Change, an Evaluation Framework and a validation plan. At level 2 the required evidence corresponds to the comparison between the Action Plans and the first trials conducted in cities, working on a sample of subjects involved that can be statistically tested in proportion to the levels of participation in City Pilots. At level 3 the required evidence corresponds to the execution of validation and evaluation on the experimental projects in advanced phase of the Pilots (potentially reproducible and/or scalable in other cities through the use of the same resources/instruments/processes/actions) that require the involvement of comparison groups and evaluators external to the REFLOW project.
At present, the REFLOW project, compared to the two Standard of Evidence models, is at the end of step 1 thanks to the Action Plans of the City Pilots which are (although not definitively) defined, but not yet active and implemented both as a level of definition of the evaluation and validation strategy.

As demonstrated also in D5.1*,* the *multiphase* and *multi-level model* approach fits perfectly in the definition of a validation framework useful for assessing not only the process of the REFLOW project, but also the development of the Pilots Cities which are likely to be characterised by different levels of maturity. Abbasi et al. (2019, p. 23) have implemented a scheme of innovation in the urban environment seen as a heterogeneous and multidimensional process that allows to look at innovation by identifying four stages of maturity in relation to the different processes:

- *Inception:* experimental research, marginal practices, identification of needs; embryonic ideas;
- *Development:* from an idea to a product, a service, a design solution, an established practice, etc. Structured value creation process;
- *Transition:* scalability, diffusion of innovation in the native context and beyond; greater adaptability of the solution and/or ability to replace pre-existing socio technical regimes.
- *Systemic Change* and definition of a new one.

**Figure 4.3**
*Innovation maturity stages mapped onto Geels' multi-level model*




*(Source: Geels, 2005)*

At present, the REFLOW project and the Action Plans are fully in the Inception phase. In this phase, validation is preparatory to the completion of this step and supports the transition to the development phase.
In summary, the validation strategy to be configured for the REFLOW project and in particular for the City Pilot Action Plans provides a qualitative process that takes into account:

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1. the systemic and multi-stakeholder nature of CE, which supports the critical reconstruction of transformation processes;
2. a validation model (understood in its fundamental goal of collective learning), which can be applied *ex-ante* and *ex-post* to project or experimental actions to validate in an iterative and interactive way the transition of the systems at stake (the City Pilots) towards CE.

Starting from these assumptions, we will look at the use of the Theory of Change as a meta-frame that defines the structure of objectives and processes that inform the development of a transformation strategy for the REFLOW project.

## 4.1 Theory of Change: developing the implementation theory of a project

According to the REFLOW strategy of adopting the *Theory of Change* methodology to further articulate Pilots' activities and map their *change journey* - as well as to identify expected short, medium and long-term goals - the notion of Theory of Change is explored in this paragraph in order to investigate its role as a strategic planning tool and therefore understand whether, and to what extent, it can be used as a background for the validation process.
On the basis of the literature review, the Theory of Change helps define a sequence of activities where one step leads to another one through cause-and-effect connections, allowing to describe *"... a process of planned social change, from the assumptions that guide its design to the long-term goals it seeks to achieve"* (Mackinnon & Amott, 2006, p. 2), while identifying possible evidence that can be then used to guide the evaluation. The first conceptualisation of the Theory of Change emerged in the 1990s as an approach to improve the evaluation theory and practice in the field of community development (Stein & Valters, 2012). Furthermore, the evaluation practitioner and methodologist Carol Weiss affirmed that using theories of change as the basis for evaluation could directly address some of the issues related to the way complex community-wide programmes had been evaluated so far, describing how one of the pitfalls that characterised past evaluations of such programmes was represented by *"... an inability to explain how and why effects (or no effects) come about in response to program interventions."* (Weiss, 1995, p. 86).
In this way, Weiss stressed the *need to identify and make explicit a series of theoretical assumptions about how communities could develop from the intervention activities, underlining the connections between these activities and the related outcomes*. By tracking the unfolding of assumptions, the intent of the evaluation activity *"... is not so much to render judgment on the particular initiative as to understand the viability of the theories on which the initiative is based..."* (Weiss, 1995, p. 84).
After being used in the development of community initiatives, Theory of Change approaches have been widely adopted for different types of intervention – from events to projects and policies – to explain *"... how activities are understood to produce a series of results that contribute to achieving the final intended impacts..."* (Rogers, 2014, p.1).
Theory of Change can therefore represent a strategic planning tool as it describes and articulates the activities that need to be undertaken to achieve a series of desired goals, and in the meantime identifying the expected results of these activities as a proof of the achieved change. Furthermore, it makes it possible to visualise a project's change journey by showing "*... the theorised causal pathways between a project's objectives, its activities, and its expected outcomes and impacts...*" (Simeone et al., 2019, p. 4).

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In this regard, since the definition of an intervention strategy can also take place by adopting logic models, which "*... are essentially descriptive devices for mapping program or project components and the relationships between them...*" (Cullen et al., 2018), the terms Theory of Change and logic model are often used interchangeably. However, it is important to note that there is actually a clear distinction between the two. In fact, whereas logic model is limited to providing a practical look at the relationship between inputs and results, a Theory of Change offers a wider vision of the desired change, since its articulation "*... entails thinking through all the steps along a path toward a desired change, identifying the preconditions that will enable (and possibly inhibit) each step, listing the activities that will produce those conditions, and explaining why those activities are likely to work…*" (Mackinnon & Amott, 2006, p. 3).

A successful experience in which a Theory of Change approach has been adopted to define the strategy of an initiative can be found in the process of preparing the proposal submitted from the City of Guelph and Wellington County to Canada's Smart Cities Challenge. Through the initiative called *Our Food Future*[6] (2016) the aim of Guelph-Wellington was to become Canada's first technology-enabled Circular Food Economy, reimagining an inclusive food-secure ecosystem that increases access to affordable and nutritious food by 50%, where waste becomes a resource, 50 new circular businesses and collaborations were created, and circular economic revenues were increased by 50%. To address the *Our Food Future*'s impact goals mentioned above, Guelph-Wellington worked with KAP Design and Openly to develop a series of Theory of Change workshops during which the steering committee and the working group members were involved both separately and collectively in reflective conversation about the concepts, projects and goals for a circular food economy. In this way they worked to refine the *Our Food Future Theory of Change* so that it captured the key conditions for a circular food economy and showed the ways each of the three pillars - *Nutritious Foods, Business Development, and Waste as Resource* - were interconnected. Furthermore, Theory of Change was also used to prioritise high-level activities into shorter and longer-term outcomes, which were then translated into a logic model for each of the three main areas of intervention (Darisi & Watt-Kapitain, 2018).

**Figure 4.4**
Smart Cities Theory of Change infographic

[6] Our Food Future. Available at: http://foodfuture.ca/

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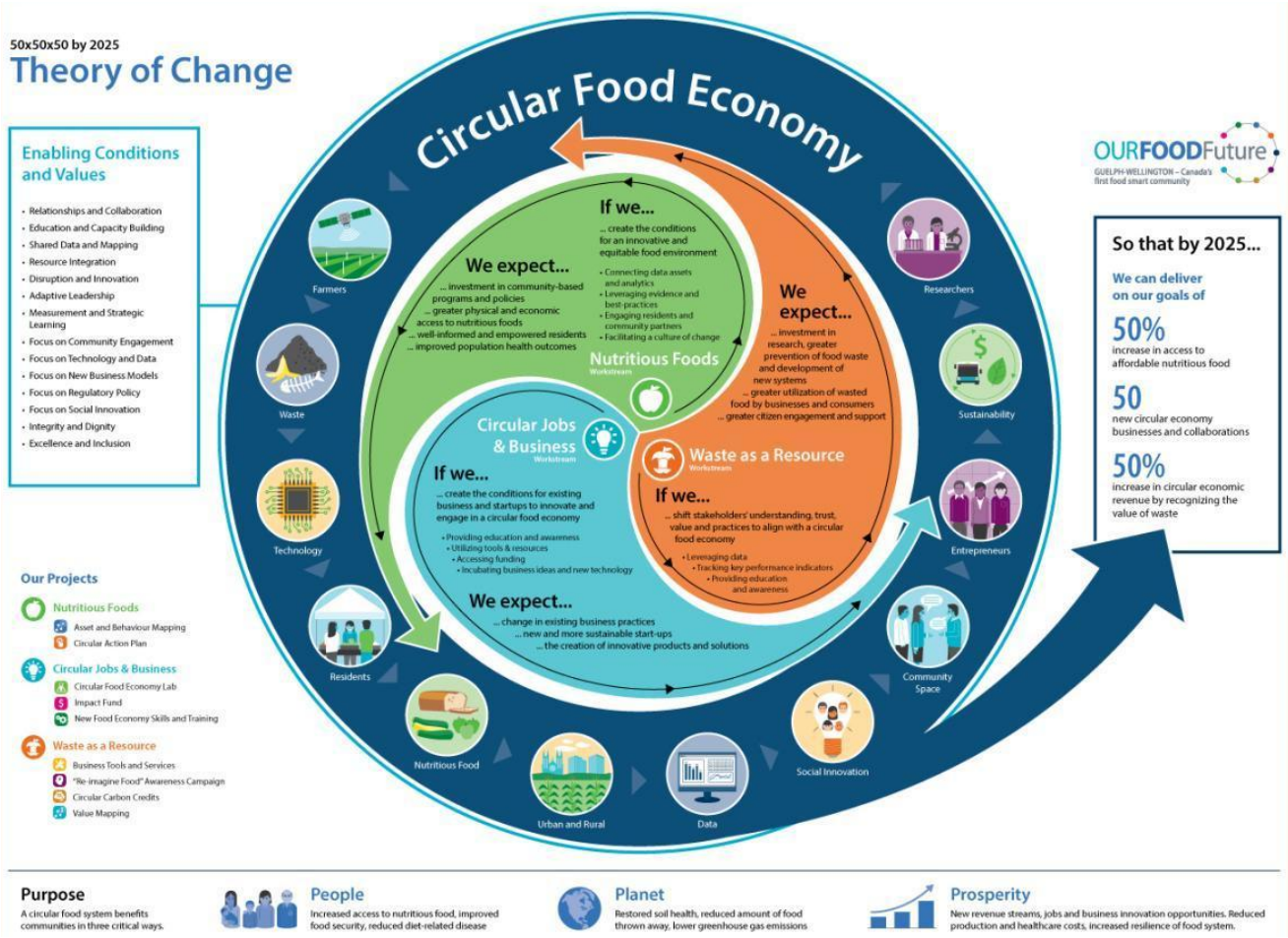


*Source: KAP Design, https://kapdesign.wordpress.com/2019/06/13/theory-of-change-facilitation-and-visualization/*

As shown in Figure 4.4 the Theory of Change process has been helpful for developing nine *Pathfinder projects* that form the framework for Guelph-Wellington plans, also identifying their enabling conditions and values.
Given the close connection between the topics addressed by the Guelph-Wellington proposal and those of the REFLOW project, we find it useful to provide a brief description of the nine *Pathfinder projects* through which the *Our Food Future* initiative is articulated in relation to its three main objectives[7].

[7] A detailed description is available at: https://guelph.ca/wp-content/uploads/SmartCities_Booklet.pdf

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**Box 4.1**
*Our Food Future - Goals and pathfinder projects*

***Goal 1: Nutritious Foods***

- Project 1: *Assess the Guelph- Wellington Food Environment*, whereby using big-data techniques it will be mapped the state of access to nutritious food and community food assets in Guelph-Wellington, in order to provide a baseline data and understand where the gaps lie. Moreover, this information will be made freely available through a public dashboard.

- Project 2: *Circular Food Security and Health Action Plan*, which will make use of the insights from the mapping activity to develop a Food Security and Health Action Plan in collaboration with local agencies and community groups, in order to establish new intervention models and evidence-based policies to create.

***Goal 2: Business Development:***

- Project 1: *Circular Food Economy Innovation Hub (iHub)*, which will drive the use of data and build the necessary technological capacity to support a sustainable regional food economy, thus transforming Guelph-Wellington in a rural-urban living lab. Indeed, the iHub will promote collaboration, mentoring and prototyping activities through Circular Economy Design labs, public idea generation, competitive challenges and awards able to involve social innovators, researchers, industry, technology developers and the community in developing inclusive and innovative solutions.

- Project 2: *The Harve$t Impact Fund*, that will act as a matchmaker, connecting investors with change-makers who are applying circular ideas, data and technology to food problems, while enabling the long-term sustainability of *Our Food Future* by offering innovative projects clear paths to investment.

- Project 3: *New Food Economy Skills and Training*, which will provide food innovation education and training, as well as public learning labs to develop and promote innovative food policies and ideas.

***Goal 3: Waste as Resource:***

- Project 1: *Business Tools and Services*, through which a set of circular economy tools and diagnostics will be developed, curated and shared, providing baseline data and interventions for the processing sector, a key performance indicators dashboard for waste and best practices for reducing municipal food waste.

- Project 2: *"Reimagine Food" Awareness Campaign*, aimed at educating Guelph-Wellington residents on the real costs of food waste, boosting demand for the products of a circular economy, creating local jobs and building stronger relationships between food producers and consumers. The awareness campaign will take place online, via FoodFuture.ca, as well as through in-person activities across Guelph-Wellington.

- Project 3: *Circular Carbon Credits*, with the aim of leveraging already existent carbon credits by using blockchain or similar distributed ledger technologies in order to create a carbon-backed digital social currency that can be traded at the local level to increase awareness and reward sustainable food choices.

- Project 4: *Circularity in Municipal Waste Systems*, which will establish a Value Stream Mapping lab where stakeholders can come together to pinpoint where food loss and waste can be reduced at each stage of the food value chain and design opportunities for appropriate reuse. Moreover, municipal waste collection trucks will be equipped with advanced sensors and AI technologies to audit organic waste on a household-by-household level; a public dashboard will be then created to offer up-to-date stats on the levels of avoidable

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food waste in the community, the percentage of organics contaminating other waste streams and the city progress toward reduction targets.

By undertaking a Theory of Change process to develop the above described intervention strategy, Guelph-Wellington succeeded to deliver a successful application, which has been awarded the $10 million prize by Canada's Smart Cities Challenge.
In addition to contributing to the strategy articulation, as in the case of Guelph-Wellington, Theory of Change also makes it possible to verify the activities developed and the results achieved along the *change journey*, thus representing a key tool for validation within a wider evaluation process. As stated by Hills and Junge:

> "*... Theory of Change is a systematic and cumulative study of the links between activities, outcomes, and context of an intervention. It involves the specification of an explicit theory of how and why an intervention might cause an effect which is used to guide the evaluation. It does this by investigating the causal relationships between context-input-output-outcomes-impact in order to understand the combination of factors that has led to the intended or unintended outcomes and impacts. Theory of Change therefore tests, and normally develops the implementation theory of an intervention and allows this to be modified or refined through the evaluation process...*" (Hills & Junge, 2010, p. 58).

Indeed, the iterative nature of the Theory of Change represents one of its main features because, through the continuous validation of the conditions that allow the success of the planned actions, it allows to test the theory itself and eventually adjust it along the way.

In particular, Theory of Change is suggested as an appropriate approach (Hills & Junge, 2010, p. 59) for the development of evaluation activities that:

- seek to test the implementation theory behind an intervention;
- investigate a highly complex intervention that addresses multiple issues, has a broad focus and/or consists of different components or is implemented in different locations;
- make it necessary to consider how contextual factors (e.g. people, organisations or socio-economic circumstances) influence the design and implementation of an intervention and what this means for the outcomes and impacts achieved;
- examine an intervention implemented over a long timescale;
- are interested in identifying both anticipated and unintended outcomes and impacts of an intervention and how they have been achieved.

An interesting example in which Theory of Change has been identified as a useful evaluation tool is offered by the European project *Designscapes*[8] (2017-2021), funded under the Horizon 2020 Program.
The project focuses on fostering urban innovation initiatives through direct funding and supporting action (made by more than 50 initiatives) to develop, pilot and potentially scale design-enabled innovations addressing pressing social,

[8] Designscapes. Available at: https://designscapes.eu/

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environmental and economic challenges in cities. In order to assess the impact of pilots and the overall project, *Designscapes* chose to develop and continuously refine the project's Theory of Change, planning to use it to inform and feed into all evaluation activities at *ex ante*, process, summative and learning stages. Indeed, together with participatory evaluation, behavioural additionality and replication analysis, Theory of Change represents one of the four key methodological pillars on which the *Designscapes* evaluation rests. Furthermore, the Evaluation Framework developed by *Designscapes* clarifies how Theory of Change is intended within the project as "*... the main data gathering tool to assess the effectiveness and added value of design in the innovation process and its contribution to efficiency and competitiveness...*" (Cullen et al., 2018, p. 34). As the project develops, the *Designscapes*' baseline Theory of Change will be reviewed in line with emerging evaluation data, allowing both to capture the transition accountability of the project towards its ultimate objectives and also the representation of any developments and changes occurred during the implementation phase.

In accordance with what has just been mentioned, Theory of Change therefore appears as an ideal tool to carry out the validation activity envisaged within REFLOW. In fact, only by identifying a series of enabling conditions and ascertaining the presence of actionable processes and grounded plans it will be possible to confirm the validity of each Pilot City Action Plan and to verify the tools, activities and outcomes so far developed within the REFLOW project, in order to also validate the broader REFLOW *change journey*. As stated before, designing the transition towards circular economy implies a multilevel and multidimensional perspective, thus a systemic and iterative design process to be orchestrated. In this sense, an overarching Theory of Change for the transition of cities towards Circular Economy may become the fundamental building block needed to build the REFLOW overall Framework. It helps to represent the context of action and its main objectives to envision a possible circular transformation in cities, its context/scale/impact/dimension and the resources to be deployed to build the *change journey*. Therefore, the draft overarching ToC structure defined in the present document has two main objectives. On one hand it describes an ideal *change journey* that will inform cities' actions towards Circular Economy, on the other hand it is also intended as a tool for validating the REFLOW process developed so far and each REFLOW pilots' Action Plan, since it provides an ideal transition model against to which compare Pilots' envisioned interventions.

In order to build an overarching ToC able to embrace the desired urban change that REFLOW envision for the Pilot Cities, we took as a reference and further adapted the scheme developed by Ibrahim, El-Zaart and Adams (2017) that, within a consequential and iterative narrative frame, highlights four fundamental elements to be taken into account when designing a transformative action:

- *the context.* The first step for building an effective change strategy is to describe adequately the context in which the initiative takes place. It means to analyse and understand the overall picture related to the economic, political, social and environmental conditions and challenges that could affect the main transformation that the Theory of Change envisions. In REFLOW, this means to identify and deepen (with an accountable and complete grounded work of qualitative and quantitative description based on *desk* baselines and *field* data) the main aspects which characterise each City Pilot environment, its main characteristics, resources and skills available in relation to a circular transformation scenario.
  At this stage, an in-depth analysis will be not useful for validation purposes; rather we are going to build a

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context baseline according to the main considerations led by theory, best practices and the initial REFLOW premises;

- *the expected change.* The second step does not only consist of defining a problem, rather in envisioning a plausible vision for the future, a "...creative, appreciative, and positive visualisation of a situation that we wish to attain at a later time..." (Retolaza Eguren, 2011, p. 16). This means identifying which change is going to happen in the chosen context as a result of the actions undertaken and expanding it in a long-term perspective, which in turn depends on subjective elements related to mindsets, competences, knowledge and interests already existing and interacting within the context itself. Operationally, in the early stages of the Theory of Change definition, it is necessary to describe in a detailed way a long-term objective that the project aims to achieve, to then going back and define which short and medium-term changes will lead to that change;
- *the sequence of actions.* This core part of the Theory of Change focuses on the steps necessary to reach the final objectives, that is the logic path of the activities to be pursued (roadmaps). The quality and the scale of the actions must be detailed and will depend on the context and the expected impact that the project wants to achieve. The sequence of events must be defined in strictly connection with short, medium and long-term objectives;
- *the assumptions.* Assumptions are fundamental in designing the *change journey*. They are often implicit and unconsciously held (Simeone et al., 2019), and describe *how* the change activities are going to happen and whether they are appropriate for the targeted objectives. Assumptions become the necessary conditions for the successful development of the project and the planned actions; basically, they are the pivotal elements without which impact would not be achieved. By observing the Theory of Change template developed by Nesta[9], it is possible to notice how each step described within the framework leads to the key assumptions necessary to achieve a set of goals (i.e. "This goal can be reached *ONLY IF*…"). Moreover, since Theory of Change deals with complexity and conditions which may not occur in the near future, they must be thus periodically checked.

[9] DIY Toolkit. Development Impact & You. PRACTICAL TOOLS TO TRIGGER & SUPPORT SOCIAL INNOVATION. Available at: https://diytoolkit.org/tools/theory-of-change/

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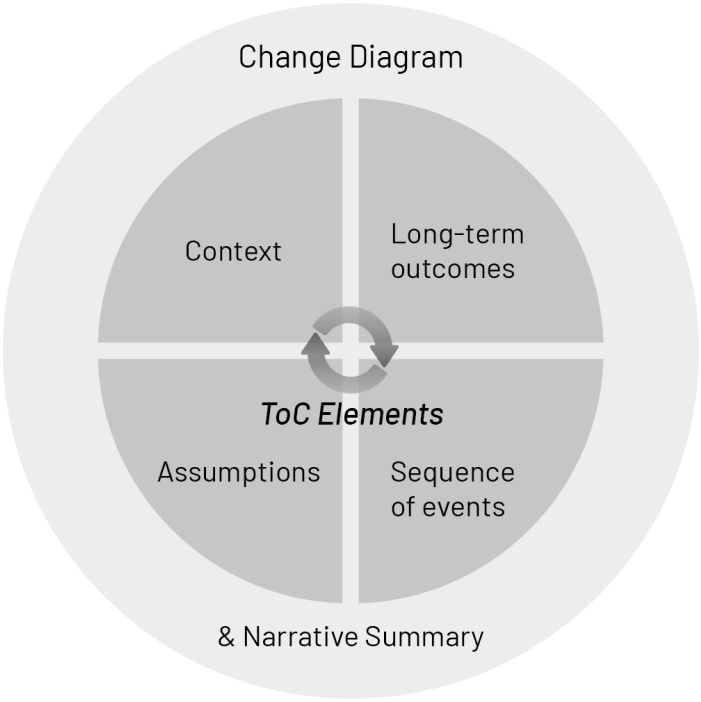
**Figure 4.5**
*Theory of Change elements and stages*




*(Source: Ibrahim et al., 2017)*

This diagram provides an interesting perspective, since it places within a holistic understanding the iterative sequence of components that need to be analysed and described, to frame a change path in a specific urban context. It clearly highlights the logical steps (Simeone et al., 2019) and operational aspects to be taken into account when approaching and using the tool. Moreover, the choice of adopting this approach derives from the need of building a model that respects the principles that Harries, Hodgson and Noble (2014) consider fundamental when representing a Theory of Change: its *purpose*, the *complexity* and the *stage of development* of the project, and the expected *impact* of the intervention. Indeed, as stated before, here the final aim is not to present a change model that analyses the specific complexities of the sole urban metabolisms, rather to provide a universal and shared direction for any circular economy intervention that has an impact on the urban context. The specific actions planned by the cities can therefore find a correspondence in the fundamental operational lines provided by the Theory of Change.
The core principles here presented will be used in the next part of this document for building an overall Theory of Change for the transition of cities towards Circular Economy, so for defining the tools necessary for validating the co-production practices envisioned by REFLOW and each of its Pilot Cities.

### 4.1.1 Theory of Change for the transition of cities towards Circular Economy

We propose an overarching structure of *Theory of Change for the transition of cities towards Circular Economy* based upon literature review findings, best practices and the above-mentioned validation approach. It provides an overview of the main goals and activities related to the change journey towards the implementation of urban circular economy

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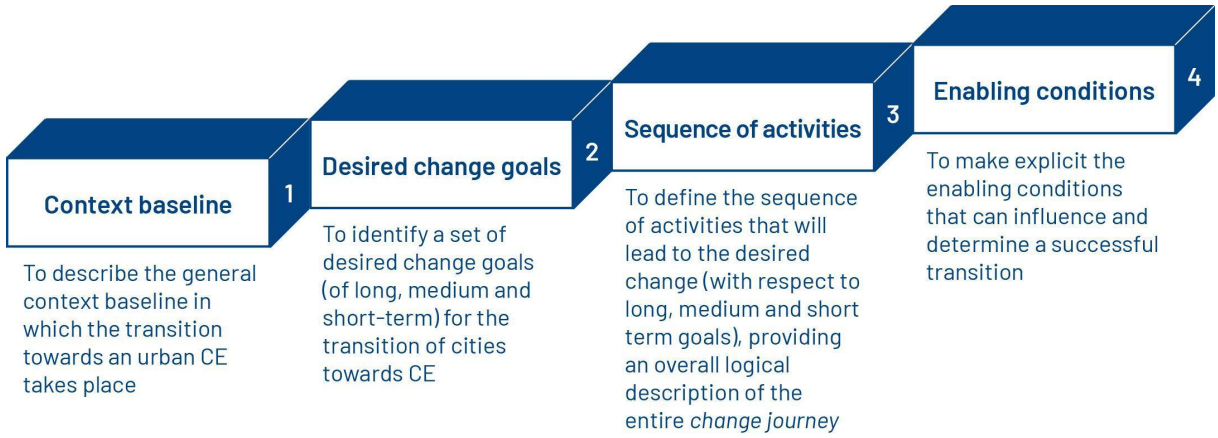
practices and it makes possible to identify a series of enabling conditions for the transition to happen, that allow to verify the REFLOW process so far developed and validate the feasibility of the Pilot City Action Plans, thus providing useful recommendations to eventually re-adjust the actions envisioned by both the Pilots and the REFLOW project itself.

**Figure 4.6**
*Visualisation of the steps followed for the definition of the overarching ToC*




By following what has been stated in the previous paragraphs, the first step to define an overarching Theory of Change for the transition of cities towards Circular Economy briefly describes the general *context baseline* (see Figure 4.6) in which the transition takes place.
The large urbanisation processes of the last decades have transformed cities into complex metabolisms characterised by a high concentration of material and immaterial resources. Moreover, through the contextual development of energy, food and materials' use and transformation cycles, cities generate also a number of degradation processes which increase environmental pollution and waste production, thus threatening the liveability of urban contexts and consequently of the entire globe. However, the recent digital revolution has profoundly affected production, transformation and consumption activities, opening up the possibilities of new dynamic and intertwined data and processes flows which may help in optimising the existing urban processes, thus deeply changing the consolidated but often unsustainable (in a long-term perspective) industrial paradigm.
In addition, the great availability and proximity of resources, competences, wealth and data over a small geographical territory (Ellen MacArthur Foundation, 2017) enables collaborative dynamics which are pivotal to the successful implementation of circular economy practices within the urban environment. Finally, undertaking Circular Economy co-production practices in cities means to act within the urban metabolisms and transform the local production ecosystems by adopting a circular vision. Moreover, the success of such an approach will strictly depend on its potential replicability and scalability in other urban contexts, also supported by the dissemination of experiences within existing national and international city networks. As a second step in the definition of the overarching Theory of Change already mentioned, before defining which are the activities that the cities might undertake for the transition towards Circular Economy, we identified a set of desired change goals based on the principles deriving from literature findings and best practices. By following a shared practice for the development of a Theory of Change, which involves envisioning a future change

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scenario, to then bouncing back to define the necessary steps to accomplish it[10], long-term changes were firstly defined in order to then go back and formulate the related short and medium-term changes as shown below..

**Table 4.1**
*Desired change goals*

***Long-term changes:***

- to develop circular and regenerative cities;
- to reduce materials consumption and waste production;
- to disseminate shareable and replicable circular best practices;
- to adopt new forms of urban circular governance and foster the implementation of new policies;
- to foster new synergies among and across sectors;
- to redesign the local ecosystems involving a wide range of actors.

***Medium-term changes:***

- to foster public-private partnerships;
- to adopt circular and regenerative practices in both urban and peri-urban areas;
- to maximise a multifunctional use of existing spaces/buildings;
- to encourage circular behaviours;
- to build awareness and knowledge on circularity among the civil society.

***Short-term changes:***

- to align public, market and government needs;
- to adopt a common circular strategic vision;
- to acknowledge the current urban productive model and the capacity of local production and supply.

After the first identification of the *desired change goals* (see Figure 4.6), we defined a *sequence of activities* (see Figure 4.6) that can lead to the desired changes, thus providing an overall logical description of the entire *change journey* of a circular transition process. The activities have been articulated in three main blocks with regards to the long, medium

[10] See, for instance, Ibrahim et al., 2017 and Nesta's DIY Toolkit. Development Impact & You. PRACTICAL TOOLS TO TRIGGER & SUPPORT SOCIAL INNOVATION. Available at: https://diytoolkit.org/tools/theory-of-change/

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and short-term changes. The sequence of activities is described following a chronological order, thus starting from those related to short-term changes.

**Table 4.2**
*Sequence of Change Activities*

***Activities related to short-term changes:***

1. to define a common strategic vision of urban circular economy;
2. to map city material and immaterial resources (actors to be involved, material streams, physical and digital infrastructure);
3. to develop co-creation activities to define the transition path towards circular and regenerative cities, involving academics, policy, technological and manufacturing experts;
4. to collect exemplar experiences on urban regeneration practices and models;
5. to translate the circular vision into tailored implementable urban strategies and actions;
6. to co-design an open data platform able to ensure the accountability, transparency and security of data;
7. to co-design a monitoring strategy for enabling a constant optimisation of "urban metabolic" processes;
8. to build a dissemination strategy;
9. to define an evaluation framework including economic, environmental and social aspects.

***Activities related to medium-term changes:***

10. to collect data on the context and identify opportunities areas and needs
11. to co-create with stakeholders' circular scenarios and possible solutions for the re-localisation of production and the re-configuration of material flows in urban and peri-urban areas;
12. to co-design, prototype and test technological tools able to support and manage the circular solutions defined;
13. to co-produce and experiment circular solutions with citizens and stakeholders;
14. to implement the open data platform in order to collect data and share them among stakeholders.

***Activities related to long-term changes:***

15. to share urban circular practices within larger-scale ecosystems through national and international networks of cities;
16. to develop new forms of collaborative governance related to urban circular practices;
17. to evaluate the economic, environmental, social and territorial impacts;

to disseminate within the city context CE practices to be potentially scaled and replicated.

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The desired changes and the related activities here described represent the backbone of the Theory of Change useful to formulate the implementation theory of a transition process. However, in order to explain how and why those activities could lead to effective changes it is necessary to define explicitly the *enabling conditions* (see Figure 4.6) needed to validate the causal pathways of this transition.

### 4.1.2 Enabling conditions for a successful transition of cities towards Circular Economy

When adopting the Theory of Change methodology within the early stages of a change journey planning, it is fundamental to focus on what are the conditions without which each stage of the transition path would not be completed, thus compromising the realisation of the whole project. These enabling conditions, combined with the core principles guiding the project implementation, are pivotal in the orchestration of the validation process.
They are relevant in the development of the Theory of Change because they provide the causal links highlighting strategic and operational issues in the implementation phase. A punctual reflection on how an action could lead to the next is necessary; some guiding questions, for instance, can be: "*If X happens, then will Y really be the result?", "Why do we think X or Y will happen?", "Should anything specific be in place or avoided in our political, economic or organisational context?"* (Guijt, 2013, pp. 3-4). However, by providing many answers to the initial questions it may occur that a huge number of conditions is described. It is important then to reconsider them, only focusing on the most critical ones (Guijt, 2013). Through collecting the findings from literature and best practices, this paragraph has the aim of defining which are the enabling conditions that can influence and determine the successful transition of cities towards Circular Economy and that will therefore be fundamental in validating the transition paths and the replicability of the circular activities envisioned by the REFLOW project and its Pilot Cities. In relation to the desired change goals, the enabling conditions for the successful implementation of the above-mentioned change activities have been identified as follows.

**Table 4.3**
*Enabling Conditions*

***Enabling conditions related to short-term changes:***

- to undertake immersive research activities within the intervention context, further supported by desk research;
- to develop an effective collaborative process with academics, policy, technological and manufacturing experts involved in the project.

***Enabling conditions related to medium-term changes:***

- to identify a specific context and the related stakeholders;
- to undertake immersive research activities within the intervention context, further supported by desk research;
- to develop citizens awareness, engagement and capacity building activities;
- to consolidate and integrate existing open datasets in cities;

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- to leverage on existing local capabilities, resources and initiatives;
- to identify and/or activate urban spaces for collaborative experimentation.

***Enabling conditions related to long-term changes:***

- to be part of national and international networks of cities related to new urban productive models or sustainability issues;
- to leverage on existing policies and initiatives about Circular Economy or sustainability related issues;
- to promote initiatives and programmes that foster collaborative dynamics among all the urban actors: municipalities, citizens, third sector, businesses;
- to adopt an evaluation framework;
- to adopt a dissemination strategy.

These conditions, identified on the basis of the literature sources and best practices described in the previous paragraphs and chapters, may ensure the successful implementation of the sequence of changing activities defined, thus allowing the achievement of the short, medium and long-term changes. As already anticipated, they therefore represent a useful tool for validating both the REFLOW process developed so far, and the implementation strategy envisioned by the REFLOW Pilot Cities.

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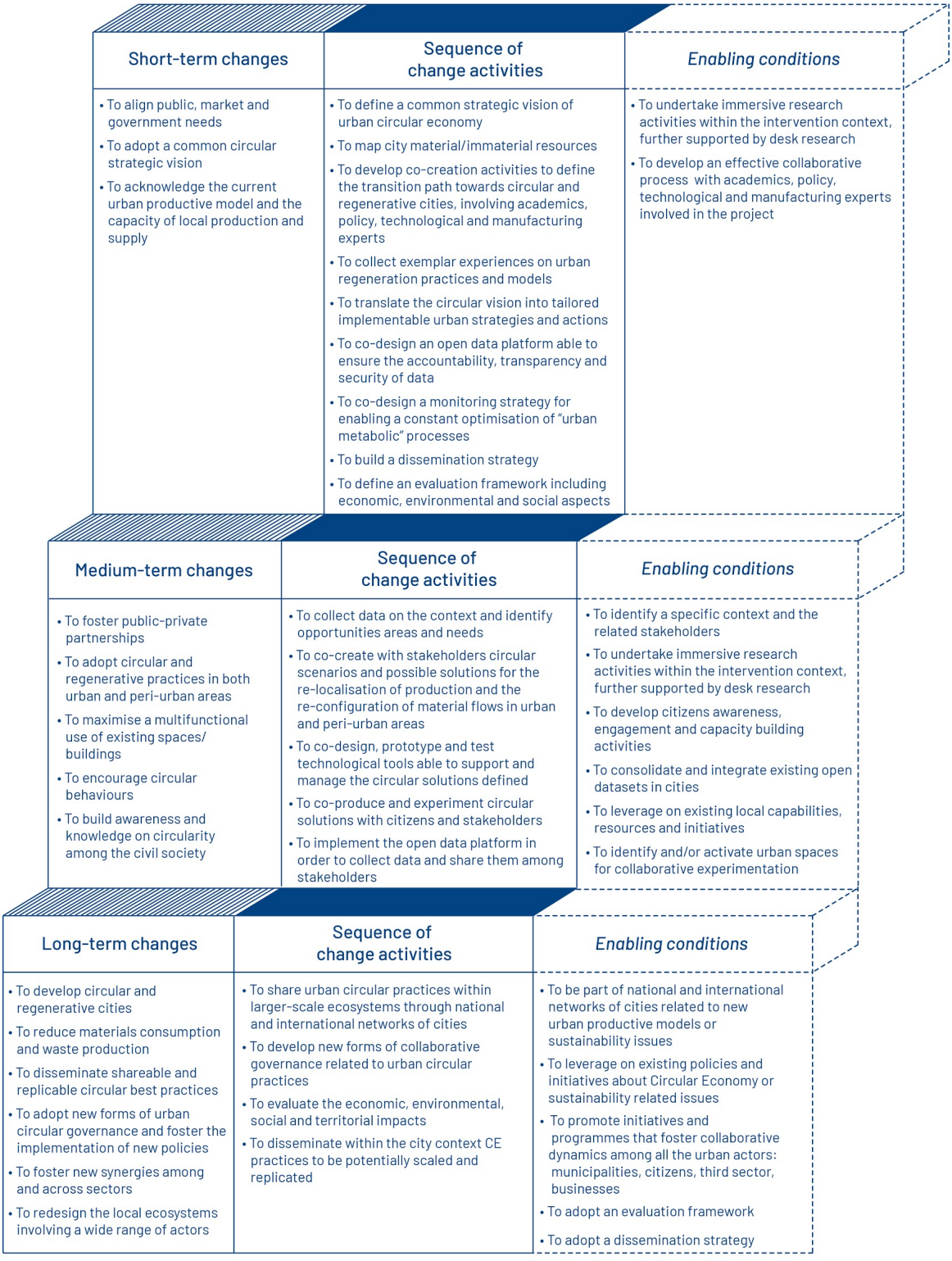
**Figure 4.7**

*Theory of Change for the transition of cites towards Circular Economy*

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# 5. Validation process and methods selected within REFLOW

In this final part, following the chosen methodological approach, we will describe the validation process adopted; it has been described and implemented within this REFLOW advancement (M11), as illustrated in Figure 5.1. As mentioned in the previous sections, we firstly developed the overarching structure of the Theory of Change, by adapting the scheme proposed by Ibrahim, El-Zaart and Adams (2017) for the transition of cities towards circular economy. By doing so, we identified the context baseline, the expected changes and the sequence of change activities on the basis of literature review's findings and best practices.

In this way, we provided an overview encompassing the overall change journey towards the successful implementation of urban circular economy practices, from which we extrapolated the Enabling Conditions that can ensure the successful development of the circular transition path within cities and that is therefore adopted in this document to describe insights stemming from the validation activity. Indeed, the implementation of the validation process will undertake both an *ex post* validation, regarding the REFLOW project actions and milestones accomplished to date, and an *ex ante* validation, regarding what has been envisioned by the City Pilots according to their implementation strategy.

For this reason, the first Validation Phase is related to the REFLOW process developed so far, together with its tools and related outcomes. Moreover, since it is possible to recognise the alignment between the activities defined within the proposed ToC in relation to short-term changes and what should have already been developed by the REFLOW project, the *ex post* validation will be based on the verification of the enabling conditions already identified in relation to the short-term changes. Through validation, it will therefore be possible to provide the REFLOW consortium with a self-assessment tool, to be applied to the activities carried out so far and the objectives achieved. Thereby, it will hopefully allow the reviewing and re-adjusting of the REFLOW change journey, if the expected outputs have not been achieved or if the tools and methods used were not appropriate or sufficient to meet the expected objectives as defined at the outset of the REFLOW project.

Finally, the second validation phase will focus on the Action Plans defined by each Pilot City, by validating the implementation strategy they envision against the Enabling Conditions linked to medium and long-term changes, as identified in this document. Indeed, the *ex ante validation* refers to the activities that have yet to be undertaken, in order to provide the Pilot Cities with useful recommendations and suggestions on how to exploit the potential of their specific context and better define their approaches and strategies for ensuring a successful transition towards circular economy.

The final aim of the described process is therefore to validate the functioning and the replicability of the collaborative approach adopted within the transition process of the REFLOW project and the interventions defined by Pilot Cities to implement circular practices.

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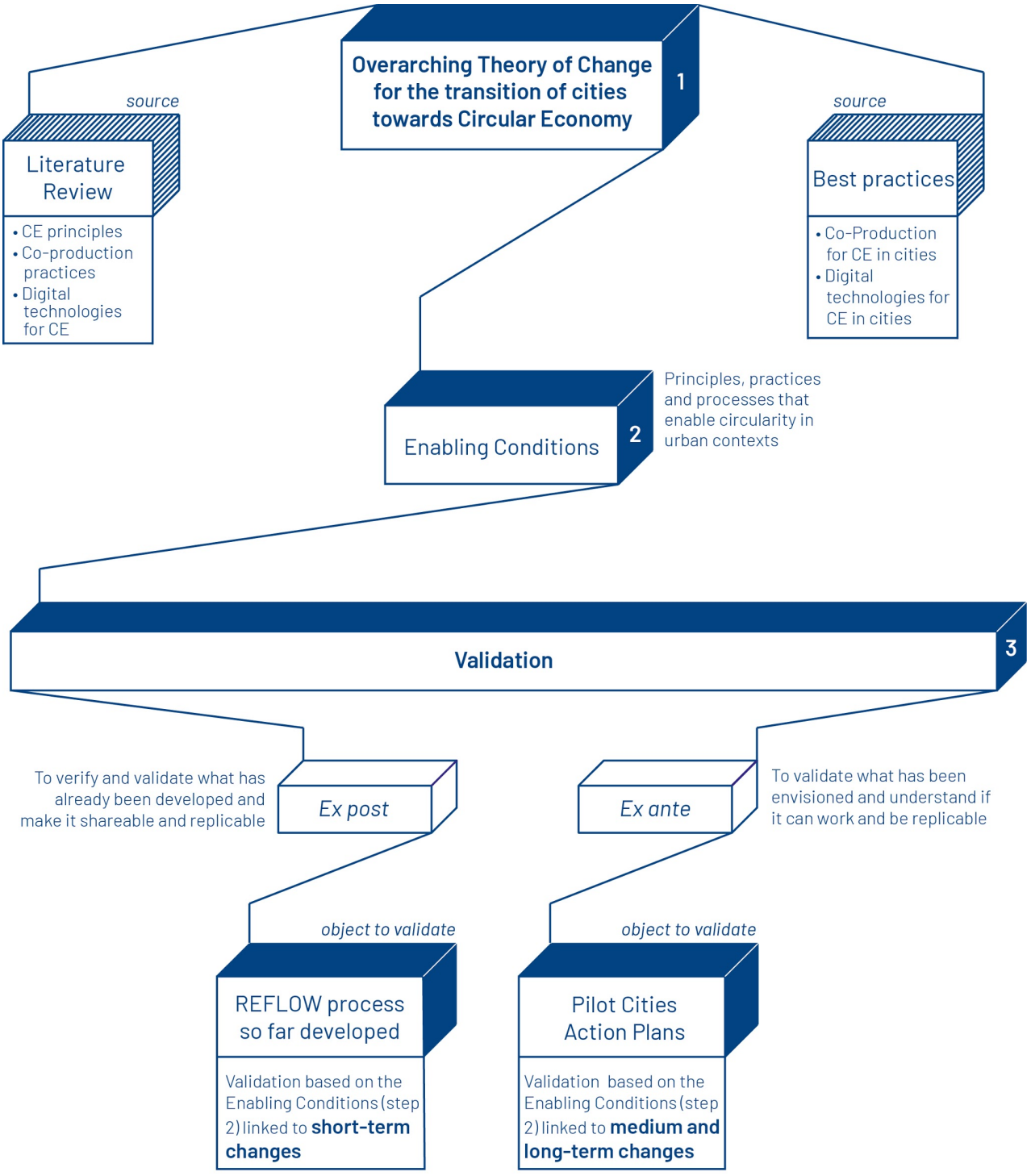
**Figure 5.1**
*Structure of the validation process*

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## 5.1 Ex post validation: the REFLOW process developed so far

As previously mentioned, here below the defined short-term changes and the related actions are used to inform *ex post* validation. The validation process is developed in two main moments:

1. A comparison between the actions and milestones achieved so far by the REFLOW project and the activities defined within the *overarching Theory of Change* in relation to short term changes. It thus provides the overall picture of the first phases of the project (*from month 1 to month 11*) highlighting the related outputs and tools;
2. An analysis of how the process was conducted, by verifying it against the enabling conditions defined in relation to short term changes. This makes it possible to understand if the necessary terms for the successful development of the transition path have been followed.

We will introduce below the actions related to the short-term objectives that will be then used for a reconstruction of the REFLOW process (see Table 5.1).

**Table 5.1**
*Activities related to short-term changes*

| |
|---|
| **A1** To define a common strategic vision of urban circular economy |
| **A2** To map city material and immaterial resources (actors to be involved, material streams, physical and digital infrastructure) |
| **A3** To develop co-creation activities to define the transition path towards circular and regenerative cities, involving academics, policy, technological and manufacturing experts |
| **A4** To collect exemplar experiences on urban regeneration practices and models |
| **A5** To translate the circular vision into tailored implementable urban strategies and actions |
| **A6** To co-design an open data platform able to ensure the accountability, transparency and security of data |
| **A7** To co-design a monitoring strategy for enabling a constant optimization of “urban metabolic” processes |
| **A8** To build a dissemination strategy |
| **A9** To define an evaluation framework including economic, environmental and social aspects |

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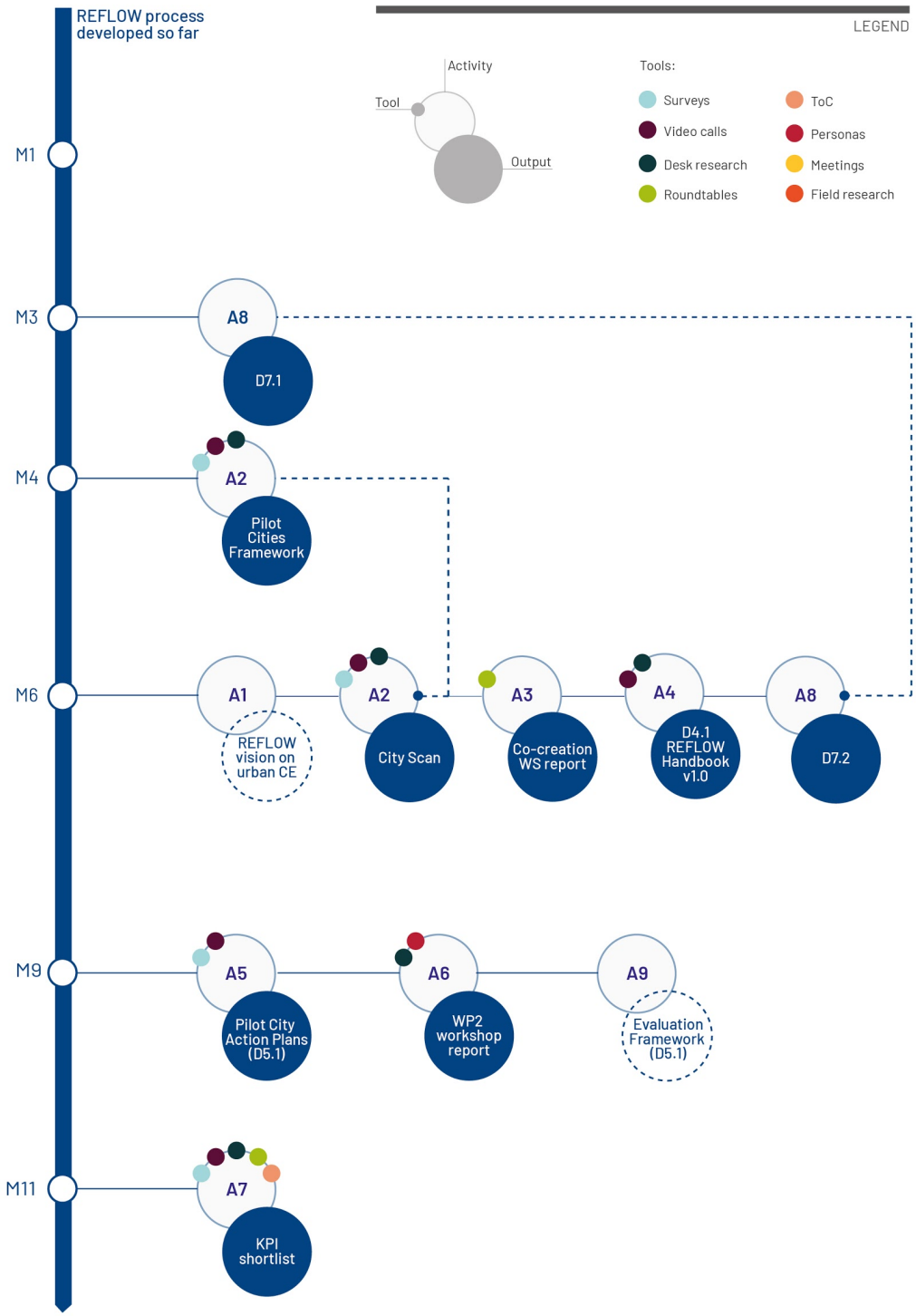
**Figure 5.2**
*The REFLOW process developed so far (including the explicit outputs achieved and the tools used)*

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According to the overarching Theory of Change, this timeline shows that the dissemination strategy (A8) of REFLOW was defined in two moments corresponding to the deliverable *7.1 - Communication and dissemination plan* submitted in M3 and the deliverable *7.2 - Data management plan* submitted in M6. In M6 the first REFLOW *Co-creation Workshop* took place with the aim of activating a collaborative process between all the consortium partners (A3), using mainly simplified collaborative exercises/roundtables as tools to involve each Pilot City. One of the goals of the *Co-creation Workshop* was to discuss the explicit common definition of Circular Economy at the basis of the REFLOW project's structure and building blocks (A1), that however will be accomplished in the final phases of the project.
During the same workshop the main outputs of the city resources mapping (A2) were shared among the partners:

- the *Pilot Cities Framework*, already shown in M4 and further developed before the Co-Creation Workshop, which provided a first structure and alignment of the Pilot Cities characteristics and needs, followed up by an initial description of possible pilot scenarios;
- the *City Scan*, consisting in a flowchart where the material streams chosen by each Pilot were illustrated.

The activity dedicated to the collection of best practices about governance frameworks and approaches, policies and initiatives (A4), delivered in M6 the *REFLOW Handbook v.1.0* that provided Pilots with some starting points for collaborative governance design. Pilots' circular strategies and actions were defined in M6 through the development of their *Pilot City Action Plan* (A5) within deliverable *5.1 - Detailed Pilot Planning and Evaluation Framework*. An evaluation framework providing an assessment strategy for Pilots was part of the same document (A9), though operating evaluation guidelines to be adopted were not fully described. Moreover, for facilitating the initial development of the REFLOW OS (A6) a co-creation workshop with three Pilot Cities was held in M9.
Finally, as a first step for defining an urban monitoring strategy (A7), a series of online co-creation sessions were conducted with each Pilot City in order to define both common and specific Key Performance Indicators (KPIs).

In the following table, the activities developed and already completed within REFLOW are further analysed and described in relation to the enabling conditions linked to short term changes.

**Table 5.2**
*Ex post validation - The REFLOW process developed so far*

| *Enabling conditions related to short-term changes* | *The REFLOW process developed so far* |
|---|---|
| *To undertake immersive research activities within the intervention context, further supported by desk research* | In order to map the Pilot Cities urban metabolism, *City Scans* have been developed and visualised by conducting desk research on existing open datasets, further integrated with other data provided by each Pilot in relation to the chosen material stream.<br>A number of city level policies and strategies in the field of sustainable urban development have been collected through desk research, allowing to identify forms of collaborative governance as a strategic means to |

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| | |
|---|---|
| | design and implement such strategies. As a result, the REFLOW *Handbook v 1.0* has been delivered.<br>Regarding the development of the REFLOW *Open Data Platform* a desk research has been conducted to provide Pilots with tech scenarios and a list of examples and inspirations.<br>For the selection of final KPIs to be adopted by Pilot Cities, a first extensive list has been defined through a review of best practices and sources related to EU directives, International indicator and datasets, academic and non-academic documents. |
| *To develop an effective collaborative process with academics, policy, technological and manufacturing experts involved in the project* | In order to activate a collaborative process ensuring the complete involvement of the pilot cities in the whole project lifecycle, a first REFLOW *Co-creation Workshop* with all the consortium partners was held. The workshop involved each Pilot through roundtables addressing social impacts; IT infrastructure and tools; circular engineering; governance and urban strategies on CE; capacity building and knowledge transfer; communication and dissemination.<br><br>By engaging the REFLOW Building Blocks through surveys and video calls, a collaborative approach was adopted to feed into the Pilot Cities Framework.<br><br>A co-creation workshop with three Pilot Cities has been conducted to support the initial development of the REFLOW *OS*.<br><br>Moreover, online co-creation sessions with each Pilot City led to the selection of a short list of KPIs to be adopted for the monitoring of Pilot activities in the six REFLOW cities. |

What emerges from this validation phase is that several activities of the REFLOW project have been conducted mainly through desk research methods. This happened for the actions concerning the analysis of the specific context of each Pilot - such as the Pilot Cities Framework and the *City Scan* - and those that involved the Pilots themselves for a first definition of tools useful for the development of their change journey - such as the *Open Data Platform* and KPIs. However, more field research is indeed needed to better scope out challenges and needs in the Pilot Cities, and thereby to define more comprehensive interventions. Therefore, we may argue that REFLOW can further benefit from more in depth, grounded research, tapping into those critical aspects - strategic, operational, relational, in the first instance - that are still under development or finalisation.
Finally, we can observe that a collaborative approach has been adopted to accomplish most of the activities described above, that specifically involved different tools ranging from video calls to online surveys. However, on the basis of what

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has been previously stated, the further definition of the Pilots City Action Plans and their implementation strategy will surely benefit from a collaborative construction process carried out in the field.

## 5.2 *Ex ante* validation: The Pilot Cities Action Plans

This paragraph describes the process followed for the validation of each Pilot envisioned change journey, as interpreted from D5.1. The conditions previously defined in relation to mid-term and long-term changes, as well as change actions, will be used here to validate the intervention strategy planned by the Pilots. A table format will be used to recap and summarise the initial set of actions that the Pilot Cities had planned to implement by the end of the project. Another table will show how (and if) each of the conditions have been addressed within the Pilot Cities Action Plans. Finally, according to the preliminary results of this validation, not yet checked with the Pilot Cities, a number of insights and suggestions for the Pilots are provided in order to eventually adjust and/or refine their transition plan within REFLOW.

In order to finalise the Pilot validation process, our main reference has been the information contained int Action Plans described within deliverable *5.1 - Detailed Pilot Action Plans and Evaluation Framework; in fact, to date this is the core project document that contains public information about the circular strategies and relevant set of activities envisaged by each REFLOW pilot cities*. After providing a brief description of each Pilot at the outset of the project, including its context and main objectives in REFLOW, validation is performed according to two main moments:

- firstly, an overall picture of each Pilot envisioned change journey is provided. For this purpose, a table format is used to describe the type of action planned, methods and tools used to perform it and expected outputs/outcomes. This table helps highlight the overall situation of actions, with respect to the overarching Theory of Change for the transition of cities towards Circular Economy defined within D1.1;
- subsequently, the table related to the enabling conditions is completed. All the conditions that were not identified in the Pilot Action Plans are then listed below and a comment on the partially described conditions, with some suggestions based on literature findings, is provided. By identifying possible gaps within the already developed Pilot Action Plans, we aim to foster collective reflection within the Pilot Cities and across the REFLOW Consortium, in order to strengthen the forthcoming phase and eventually tap into such gaps through iterative design, planning and implementation, as it is core to the REFLOW approach.

For the completion of the two tables, both the actions explicitly defined as such by the Pilots (i.e. those included in the GANTTs) and what is reported more extensively in the context and objectives description part are used. This means that the actions defined by the Pilots were added to the table as "change activity", although in many cases the description given by the Pilots is more similar to a set of objectives than to actual pragmatic strategies, plans, actions or roadmaps.

### 5.2.1 Amsterdam: Pilot situation at the outset of the project

In 2020, the city of Amsterdam and the Amsterdam Metropolitan Region kick-start a new circular strategy with the vision to become a thriving, regenerative and inclusive city for all citizens while respecting planetary boundaries. Moreover, the city signed the national Circular Economy Pact to achieve a Circular Economy by 2050. The sectoral

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priorities for Amsterdam and its regional partners are the building sector, the food sector and consumer goods. Within consumer goods, textile products are of main interest. Indeed, in 2020 the city of Amsterdam is renewing its textile collection procedures, focusing on better strategies to implement this activity. The status quo – when it comes to textiles – is far from being circular, and the ecological and human/social footprint is large and untenable. Textiles flow into the region, the quality of textiles decreases (fast fashion) and, although demand for recycled materials is growing, general commercial uptake is still far away. Moreover, cities have the responsibility for the collection, sorting and treatment of textiles, but cannot improve this chain alone; it requires wide scale organisation and cooperation at local, national, European and global level. Within the REFLOW project, the Amsterdam Pilot focuses on textiles used by consumers and companies, the ways textiles are discarded and reused, and how textile waste can be brought back into the material flow. It will especially focus on the increase of home textiles to be recycled and made circular, by supporting diverse collection methods that actively engage citizens, while providing feedstock for the recycling industries and creating supply for different markets. The Amsterdam REFLOW challenge is to change the textile material stream from linear to circular in the Amsterdam region. To achieve this, the Amsterdam Pilot is built as a wide stakeholders engagement process that consists of two complementary scenarios that feed into each other:

- a short-term impact *citizen scenario* focuses on citizen engagement in the collection of home textiles and clothing in the most efficient way for recycling and therefore saving them;
- a long-term impact *industrial scenario* aims at creating an exchange system (platform) involving industry (from sorting companies to mechanical recycling, up to those involved in crafting regenerated materials) and entrepreneurs (designers, product designers / developers and local shops), and connecting these different businesses by demand and supply.

#### *5.2.1.1 Validation of the Amsterdam Action Plan*

The table below has the aim of drawing an extensive picture of the Amsterdam Pilot transition path, through providing an overview of the planned actions with respect to those described within the overarching Theory of Change for the transition of cities towards Circular Economy. As previously mentioned, this validation phase is based on the change activities and enabling conditions described within the abovementioned Theory of Change and linked to medium and long-term changes. This first moment is aimed to inform the next validation phase, showing which actions the Pilot plans to accomplish (or not) and which methods and tools it intends to adopt for achieving the expected outputs and/or outcomes. This visualisation helps clearly highlight the elements that might be missing in the envisioned change journey, whether they are planned actions, methods and/or tools, outputs/outcomes.

**Table 5.3**
*Comparing the overarching Theory of Change with the Amsterdam Pilot Action Plan*

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| | ***Amsterdam Pilot Action Plan*** | | |
|---|---|---|---|
| ***Sequence of change activities related to medium-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 10**<br>To collect data on the context and identify opportunities areas and needs | Workshop focused on the identification of the market needs | Workshop series | - Identification of the market needs |
| **Change Activity 11**<br>To co-create with stakeholder circular scenarios and possible solutions for the re-localisation of production and the re-configuration of material flows in urban and peri-urban areas | Hands-on workshops with creatives and citizens on manipulating / upcycling material which could facilitate behavioural change and feed ideation of circular textiles | Local hands-on workshops with creatives and citizens | - Knowledge exchange<br>- Feeding ideation of circular textiles |
| **Change Activity 12**<br>To co-design, prototype and test technological tools able to support and manage the circular solutions defined | Create live tracking garments/home textiles in the city – tags/bins | Workshop series | - Live tracking garments/home textiles in the city – tags/bins |
| **Change Activity 13**<br>To co-produce and experiment circular solutions with citizens and stakeholders | - Hands-on workshops with creatives and citizens on manipulating / upcycling material which could facilitate behavioural change and feed ideation of circular textiles<br>- Development of a platform that does track & trace; proves how a | Workshop series | - Live tracking garments/home textiles in the city – tags/bins, which could facilitate behavioural change and feed ideation of circular textiles |

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| | | | |
|---|---|---|---|
| | material is following a circular flow and cycles and investigates and incentives business opportunities along the chain, promoting and mapping the businesses involved in the recycling of materials | | |
| **Change Activity 14**<br>To implement the open data platform in order to collect data and share them among stakeholders | - Development of a platform that does track & trace; proves how a material is following a circular flow and cycles and investigates and incentives business opportunities along the chain, promoting and mapping the businesses involved in the recycling of materials<br>- Testing of the platform | Workshop series | - Platform implementation and test results<br>- This platform will showcase the full circle and also incentive the development of better sorting machines, better methods of yarn spinning out of recycled fibres, etc., while provoking transparency and cultivating citizen involvement |
| ***Sequence of change activities related to long-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 15**<br>To share urban circular practices within larger-scale ecosystems through national and international networks of cities | *To be defined* | *To be defined* | *To be defined* |
| **Change Activity 16**<br>To develop new forms of collaborative governance related to urban circular practices | Facilitate the connection and the exchange in the marketplace between entrepreneurs and the sorting companies | *To be defined* | Manufacturers and entrepreneurs will decrease the amount of virgin fibres used in the production for textile as |

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| | | | |
|---|---|---|---|
| | | | they will and understanding the value of textile waste |
| **Change Activity 17**<br>To evaluate the economic, environmental, social and territorial impacts | *To be defined* | - Definition of GA KPI's,<br>- Definition of Additional KPI's (related to each activity) | *To be defined* |
| **Change Activity 18**<br>To disseminate within the city context CE practices to be potentially scaled and replicated | Promote the use of recycled resources, decrease the use of only virgin fibres | *To be defined* | *To be defined* |

The general overview illustrated through the above table provides the necessary elements through which to describe and validate the *Amsterdam Pilot Action Plan* in relation to enabling conditions linked to medium and long-term changes, as shown in the following table.

**Table 5.4**
*Ex ante validation of the Amsterdam Pilot Action Plan*

| ***Ex ante validation – Amsterdam Pilot Action Plan*** | |
|---|---|
| *Enabling conditions related to medium-term changes* | *Amsterdam Pilot Action Plan* |
| To identify a specific context and the related stakeholders | A first list of possible stakeholders to be involved has been drafted. |
| To undertake immersive research activities within the intervention context, further supported by desk research | A workshop for the identification of market needs has been planned.<br>Small entrepreneurs, manufacturers and sorting companies will be involved in a workshop dedicated to the collection of information for developing an online platform and sharing data/information. |
| To develop citizens awareness, engagement and capacity building activities | With the aim of engaging citizens of all ages and facilitating behavioural change, public events, like talks and workshops, for instance in public libraries (i.e. maakplaatsen), fablabs and other public platforms, will take place. Moreover, local brainstorm sessions with |

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| | |
|---|---|
| | citizens will provide information on how to collect more effectively within the neighbourhoods, and educational programs for students will promote circular textile use in fashion design. |
| To consolidate and integrate existing open datasets in cities | *To be defined* |
| To leverage on existing local capabilities, resources and initiatives | A network analysis will be useful to distinguish the niche of the Amsterdam region belonging to the circular textile landscape. |
| To identify and/or activate urban spaces for collaborative experimentation | *To be defined* |
| | |
| *Enabling conditions related to long-term changes* | |
| To be part of national and international networks of cities related to new urban productive models or sustainability issues | Addressed through the actual challenge scoping based on the 2025 goals, 2030 and 2050, both city, national and international level. |
| To leverage on existing policies and initiatives about Circular Economy or sustainability related issues | The creation of advice documents for policies will push the implementation of recycled textiles.<br>Moreover, the Pilot City has the aim of designing policies for the implementation and adoption of tracking labels and/or smart bins. |
| To promote initiatives and programmes that foster collaborative dynamics among all the urban actors: municipalities, citizens, third sector, businesses | Through dedicated contracts and policies by the municipality, collection activities through retailers, libraries and other public indoor spaces will be promoted and organised.<br><br>The traditional governance model for the textiles chain will be rethinked through strengthening public awareness using thought-provoking articles that foster national debate and debate among hubs. |
| To adopt an evaluation framework | *To be defined* |

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| | |
|---|---|
| To adopt a dissemination strategy | Two-fold communications campaign, the first addressing citizens and behavioural change with events and workshops and the second with industry partners to promote the 2025 sustainable goals. |

We can observe from the table above that the following conditions were not explicitly mentioned but might be already addressed within the *Amsterdam Pilot City Action Plan*.

Enabling conditions related to medium-term changes:

- to consolidate and integrate existing open datasets in cities;
- to identify and/or activate urban spaces for collaborative experimentation.

Enabling conditions related to long-term changes:

- to adopt an evaluation framework;

The Amsterdam Pilot drafted an initial list of possible stakeholders to be involved, in fact this first output can be considered the starting point for further defining a specific context of intervention and the related stakeholders, thus highlighting which potential opportunities and barriers for collaboration they enable. Workshops are identified as the main instrument for collecting data about market needs, and insights and information for the implementation of an open data platform; nevertheless, this field activity can be supported by other research activities. For instance, desk research may provide quantitative data to be further integrated with qualitative research findings. In this regard, ethnographic research tools and methods, such as participant observations and interviews, can facilitate qualitative data collection. A report on the context baseline or a resources grid can help the Amsterdam Pilot identify and understand the urban set of resources and competences to be involved and to be harnessed for the implementation of the envisaged urban scenario. This tool will serve as support for the Pilot network analysis on those already involved in the regional circular textile landscape. Finally, for supporting the creation of new local policies at urban level, as one of the objectives described within the City Action Plan, a further urban analysis can help recognise potential in already existing policies and initiatives.

### 5.2.2 Berlin: Pilot situation at the outset of the project

The Berlin Pilot is focused on heat waste, an issue which is almost invisible to citizens. For this reason, facilities that are easily accessible to civil society, such as makerspaces and coworking places, are to be equipped with waste heat technology. For example, sewers, pumping stations and sewage pressure pipes can be understood as low-temperature district heating networks. Moreover, water plays a key role in the metabolic cycle of metropolitan regions and, among other purposes, it is used for heating. This function plays an important role in the built environment, which was chosen as the main field of application in the Berlin Pilot.
All processes that use energy produce heat waste. In a sustainability perspective, we should explore how it can be re-channelled into the urban metabolic system. Thereby, the Berlin Pilot aims to identify where wasted heat potential lies in the metropolitan area and address citizens' awareness about the productive potential of water. This will be pivotal in

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getting better use of wasted heat to become the standard, not the exception. Berlin wants to reuse waste-heat to enable water-heating to be used in buildings' heating systems. The aim is to upscale the solution involving anyone which is producing it. The Berlin Pilot has two main objectives:

- in a short-term perspective, to create a thorough data basis for identifying matches between heat waste generating and consuming properties;
- in a long-term perspective, to make Berlin the European pioneering metropolis for the data-driven use of waste heat, with particular emphasis on productive enterprises and places of relevance for the civil society. Ideally, such Pilot activities should use the wasted heat to produce physical consumer goods that would otherwise be imported into the metropolitan region.

#### *5.2.2.1 Validation of the Berlin Action Plan*

The table below has the aim of drawing an extensive picture of the Berlin Pilot transition path, through providing an overview of the planned actions with respect to those described within the overarching Theory of Change for the transition of cities towards Circular Economy. As previously mentioned, this validation phase is based on the change activities and enabling conditions described within the abovementioned Theory of Change and linked to medium and long-term changes. This first moment is aimed to inform the next validation phase, showing which actions the Pilot plans to accomplish (or not) and which methods and tools it intends to adopt for achieving the expected outputs and/or outcomes. This visualisation helps clearly highlight the elements that might be missing in the envisioned change journey, whether they are planned actions, methods and/or tools, outputs/outcomes.

**Table 5.5**

*Comparing the overarching Theory of Change with the Berlin Pilot Action Plan*

| | ***Berlin Pilot Action Plan*** | | |
|---|---|---|---|
| ***Sequence of change activities related to medium-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 10**<br>To collect data on the context and identify opportunities areas and needs | Mapping<br>Desk and field research with relevant stakeholders | Qualitative interviews | - Report on desk and on-field research |
| **Change Activity 11**<br>To co-create with stakeholder circular | Research grounding<br>The action identifies the possible scenarios of | Knowledge exchange | A catalogue of all possible waste-heat measures and needs and opportunities |

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| | | | |
|---|---|---|---|
| scenarios and possible solutions for the re-localisation of production and the re-configuration of material flows in urban and peri-urban areas | projects - system - process - product - service solutions that have particular characteristics of innovation linked to REFLOW's approach to CE | | |
| **Change Activity 12**<br>To co-design, prototype and test technological tools able to support and manage the circular solutions defined | Multi-stakeholder workshops series<br>The action encompasses a series of co-creation workshops which bring together relevant stakeholders from the consortium and external stakeholders for *implementation* related work | Co- creations workshops (2 cycles of multi-stakeholder workshops, consisting in 2 workshops) | - Insights about tech selection, sourcing and implementation |
| **Change Activity 13**<br>To co-produce and experiment circular solutions with citizens and stakeholders | Execution of interventions in the real built environment | - Urban hubs<br>- Demonstrators installations<br>- Waste heat technology | 6 waste-heat-related interventions in the Berlin built environment |
| **Change Activity 14**<br>To implement the open data platform in order to collect data and share them among stakeholders | Multi-stakeholder workshops series<br>The action encompasses a series of co-creation workshops which bring together relevant stakeholders from the consortium and external stakeholders for *data* related work | Co-creation workshops (2 cycles of multi-stakeholder workshops, consisting in 2 workshops) | - Insights about data source and management |
| ***Sequence of change activities related to long-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |

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| | | | |
|---|---|---|---|
| **Change Activity 15**<br>To share urban circular practices within larger-scale ecosystems through national and international networks of cities | *To be defined.* | *To be defined.* | *To be defined.* |
| **Change Activity 16**<br>To develop new forms of collaborative governance related to urban circular practices | *To be defined.* | *To be defined.* | - Establish a supportive and inclusive type of governance around the new resource flow(s)<br>- Energy-economic optimisation of production hubs as Private-Public Partnerships (PPPs)<br>- To reduce bureaucratic barriers for users of waste heat and to ensure that civil society initiatives can benefit when larger sites emit waste heat that would otherwise be wasted |
| **Change Activity 17**<br>To evaluate the economic, environmental, social and territorial impacts | *To be defined.* | - Redefinition of initial GA KPI's | *To be defined.* |
| **Change Activity 18**<br>To disseminate within the city context CE practices to be potentially scaled and replicated | Transfer of insights into physical interventions in the built environment which can trigger replications | - Information events<br>- Dissemination of starter kits<br>- Construction workshops<br>- Urban farming installations | - Proactively addressing users of suitable objects in reference quarters |

The general overview illustrated through the above table provides the necessary elements through which to describe and validate the Berlin Pilot Action Plan in relation to enabling conditions linked to medium and long-term changes, as shown in the following table.

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**Table 5.6**
*Ex ante validation of the Berlin Pilot Action Plan*

| ***Ex ante validation - Berlin Pilot Action Plan*** | |
|---|---|
| *Enabling conditions related to medium-term changes* | *Berlin Pilot Action Plan* |
| To identify a specific context and the related stakeholders | All types of relevant stakeholders (both from the municipal and the civil society) will be identified, thus multiple local consortium partners and other external parties will be involved to both participate with written and verbal inputs in discussions and brainstorming sessions, and benefit from the pilot implementation.<br>A core consortium of four main partners has been identified (Berliner Wasserbetriebe (BWB) , Agile Heap e.V., Fraunhofer FOKUS, MCS Data Labs); other further local partners to be involved belong to the following groups of actors: i) public stakeholders, ii) civil stakeholders, iii) waste-heat consumers/production hub partners.<br>The interventions, that include processed rainwater (for instance, by utilising waste heat and installing urban and rooftop farming applications), will be placed on flat roofs and other flat open spaces of the city, where the engagement of citizens will be fundamental |
| To undertake immersive research activities within the intervention context, further supported by desk research | Mapping activities, through desk and field research with relevant stakeholders, will produce a final report.<br>Interviews will be used for gathering qualitative data. |
| To develop citizens awareness, engagement and capacity building activities | Capacity building, citizen engagement and education activities revolve around possible insights from the interventions, that can potentially trigger replications and behavioural change. Indeed, the aim is to proactively address users through information events, starter kits and topical workshops, such as urban farming installations. |
| To consolidate and integrate existing open datasets in cities | Berlin Pilot has already identified existing tools and support systems, like software for data modelling, to be used in the open dataset construction (i.e. GIS, InfoWorks). A plan on a series of multi-stakeholder workshops focused on data has been provided: the actions are orchestrated into 5 design |

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| | |
|---|---|
| | cycles, and the water supply and waste water treatment company, BWB, is the main actor involved in this phase. Other data can be provided by the digital monitoring and information system of BEK and the annual monitoring reports of the senate. |
| To leverage on existing local capabilities, resources and initiatives | Specific competences within the City Pilot will be provided by the Berlin core consortium, that is:<br>- Berliner Wasserbetriebe (BWB) as a municipal company that works on water supply and waste water treatment field,<br>- Agile Heap EV, the local makerspace, as pilot coordinator,<br>- Fraunhofer FOKUS, supporting the implementation of the ICT framework,<br>- MCS Data Labs, supporting the implementation of the sensor framework and the measurement technology. |
| To identify and/or activate urban spaces for collaborative experimentation | Real physical objects with waste heat and complementary energy sources will be developed into urban production hubs. Moreover, urban flat roofs will be used as places for solutions experimentation. |
| | |
| *Enabling conditions related to long-term changes* | |
| To be part of national and international networks of cities related to new urban productive models or sustainability issues | *To be defined.* |
| To leverage on existing policies and initiatives about Circular Economy or sustainability related issues | The Pilot City leverage on the Berlin Energy and Climate Protection Programme 2030 (BEK 2030) that contains around one hundred measures preventing climate change and promoting efficient use and saving of energy sources, as well as the adoption of renewable energies.<br>With regards to this, the Pilot project aims at developing a waste heat map in a web application and interventions at neighbourhood level and coupling with complementary energy sources urban sites. |

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| | |
|---|---|
| To promote initiatives and programmes that foster collaborative dynamics among all the urban actors: municipalities, citizens, third sector, businesses | Urban farming installations and other neighbourhoods' interventions could foster collaborative urban dynamics. |
| To adopt an evaluation framework | *To be defined.* |
| To adopt a dissemination strategy | The urban/neighbourhood physical interventions are themselves the first means of dissemination, thus proactively involving users in their reference quarters. Moreover, dissemination events, starter kits and topical workshops have the aim of disseminate the Pilot work. |

We can observe from the table above that the following conditions were not explicitly mentioned but might be already addressed within the Berlin Pilot City Action Plan.

Enabling conditions related to long-term changes:

- to be part of national and international networks of cities related to new urban productive models or sustainability issues;
- to adopt an evaluation framework.

The Berlin Pilot already defined a set of actions to be undertaken for building the open dataset, as well as tools and software systems to be adopted. Within the platform design process, it will be useful to integrate these first guidelines with an analysis of existing dataset to be incorporated. This activity may also be accomplished by establishing a fruitful dialogue with a specific context of intervention and the actors that are part of it.

### 5.2.3 Cluj-Napoca: Pilot situation at the outset of the project

Cluj-Napoca is one of the few middle-sized cities in Romania, which is growing strongly both economically and demographically, currently needing to match expectations for a highly liveable environment with a growing density and legacy of high-rise neighbourhoods. This generates a constant inner flow of population, a demand for housing and an ever-growing need for energy. For this reason, the municipality is considering authorising at least 250 hectares of new neighbourhoods for real estate development.

From a policy point of view, Cluj-Napoca recently developed the Integrated Strategic Plan, drafted for the whole metropolitan area, which set out the framework for development until 2030. The strategic plan introduced a paradigm change in comparison with previous planning attitudes, working inclusively and convincing local actors to start from the identification of local needs and only afterwards looking at funding opportunities. In REFLOW, Cluj-Napoca will be focusing on energy, its consumption evolution and the impact of investments made in energy efficiency and, since legislation regarding energy is out of reach of for Romanian local authorities, the City Pilot will leverage on both the Integrated Strategic Plan and the National Energetic Strategy for 2030, which, among others, sets energy related strategic objectives:

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Within the REFLOW Pilot, the objectives for Cluj-Napoca are:

- to prove how the measures taken to date have impacted the energy efficiency of selected buildings and involve the identified stakeholders in implementing and furthering those measures;
- to disseminate the information gathered at household and business level; to encourage different actors in the ecosystem to propose new ideas regarding renewable energy sources to be integrated in the city's strategy for a circular economy.

*5.2.3.1 Validation of the Cluj-Napoca Action Plan*

The table below has the aim of drawing an extensive picture of the Cluj-Napoca Pilot transition path, through providing an overview of the planned actions with respect to those described within the overarching Theory of Change for the transition of cities towards Circular Economy. As previously mentioned, this validation phase is based on the change activities and enabling conditions described within the abovementioned Theory of Change and linked to medium and long-term changes. This first moment is aimed to inform the next validation phase, showing which actions the Pilot plans to accomplish (or not) and which methods and tools it intends to adopt for achieving the expected outputs and/or outcomes. This visualisation helps clearly highlight the elements that might be missing in the envisioned change journey, whether they are planned actions, methods and/or tools, outputs/outcomes.

**Table 5.7**
*Comparing the overarching Theory of Change with the Cluj-Napoca Pilot Action Plan*

| | ***Cluj-Napoca Pilot Action Plan*** | | |
|---|---|---|---|
| ***Sequence of change activities related to medium-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 10**<br>To collect data on the context and identify opportunities areas and needs | Analysis of energy consumption in municipality owned buildings and public lighting hubs | *To be defined.* | To observe impact of investments in energy efficiency |
| **Change Activity 11**<br>To co-create with stakeholder circular scenarios and possible solutions for the re-localisation of production and the re-configuration of | *To be defined.* | *To be defined.* | To encourage different actors in the ecosystem to propose new ideas regarding renewable energy sources to be integrated in the City's strategy for a circular economy |

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| | | | |
|---|---|---|---|
| material flows in urban and peri-urban areas | | | |
| **Change Activity 12**<br>To co-design, prototype and test technological tools able to support and manage the circular solutions defined | To develop and test apps and software that contribute to monitoring and reducing energy consumption at organisational and citizen level | Cooperation provided by Transilvania IT Cluster | Mobile applications for efficient use of energy |
| **Change Activity 13**<br>To co-produce and experiment circular solutions with citizens and stakeholders | *To be defined.* | *To be defined.* | To involve the identified stakeholders in implementing and furthering the measures already taken |
| **Change Activity 14**<br>To implement the open data platform in order to collect data and share them among stakeholders | *To be defined.* | *To be defined.* | *To be defined.* |
| ***Sequence of change activities related to long-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 15**<br>To share urban circular practices within larger-scale ecosystems through national and international networks of cities | *To be defined.* | *To be defined.* | *To be defined.* |
| **Change Activity 16**<br>To develop new forms of collaborative governance related to urban circular practices | To involve citizens in the co-creation of future local governance tools regarding energy | Public meetings and debates within the Centre for Civic Imagination and Innovation | Future local governance tools regarding energy |

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| | | | |
|---|---|---|---|
| **Change Activity 17**<br>To evaluate the economic, environmental, social and territorial impacts | *To be defined.* | - Definition of GA KPIs<br>- Concepts for Additional KPIs to be developed (related to the main goals) | *To be defined.* |
| **Change Activity 18**<br>To disseminate within the city context CE practices to be potentially scaled and replicated | - To disseminate to the public the information gathered about energy consumption in municipality owned buildings and public lighting hubs<br>- To engage stakeholders | - Public meetings and debates within the Centre for Civic Imagination and Innovation<br>- Annual or bi-annual meetings with stakeholders | - To raise awareness on energy efficiency<br>- To promote consumer education at the citizen`s level<br>- To keep stakeholders posted about the progress of the project |

The general overview illustrated through the above table provides the necessary elements through which to describe and validate the Cluj-Napoca Pilot Action Plan in relation to enabling conditions linked to medium and long-term changes, as shown in the following table.

**Table 5.8**
*Ex ante validation of the Cluj-Napoca Pilot Action Plan*

| **Ex ante validation - Cluj-Napoca Pilot Action Plan** | |
|---|---|
| *Enabling conditions related to medium-term changes* | *Cluj-Napoca Pilot Action Plan* |
| To identify a specific context and the related stakeholders | Municipality owned buildings and public lighting hubs have been identified as the context of intervention.<br>The city core consortium includes three partners: the Municipality of Cluj-Napoca (as the Pilot coordinator), Aries Transilvania and the National Institute for Research and Development of Isotopic and Molecular Technologies (ITIM).<br>Other stakeholders providing specific knowledge and competences around different fields were already identified, though other stakeholders will be involved according to their potential contribution to the pilot. |
| To undertake immersive research activities within the intervention context, further supported by desk research | The Pilot project includes an analysis of energy consumption in municipality owned buildings and public lighting hubs. |

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|---|---|
| To develop citizens awareness, engagement and capacity building activities | Public meetings and debates in Cluj-Napoca Centre for Civic Imagination and Innovation will be organised in order for specialists to transfer knowledge in topics of interest to both citizens and civil society at large.<br>Indeed, dedicated workshops and debates are aimed at raising awareness on energy efficiency and promoting behavioural changes in energy consumption. In this way, citizens will get informed, to then become an active part in the project, while proposing ideas for the pilot. |
| To consolidate and integrate existing open datasets in cities | *To be defined.* |
| To leverage on existing local capabilities, resources and initiatives | Beside the city core consortium, other stakeholders providing knowledge and competences around different fields are:<br>- Aries Transilvania, that will map the energy suppliers, disseminate information and bring together the stakeholders;<br>- Transilvania IT Cluster, that will support the development and test of apps and softwares for monitoring energy consumption;<br>- ITIM, that owns competences in the field of regenerative energy sources. Some solutions will be proposed for integrating the long-term development of the municipality plan;<br>- The Energy Cluster, that will support and stimulate the cluster's companies in the development of alternative systems of energy in the metropolitan area;<br>- CIIC (Centre for citizens' innovation and creativity), that will foster citizens in proposing ideas about energy behaviours and in the use of the tools developed by the project.<br>Other stakeholders, according to their knowledge and experience in energy fields (i.e. EU funded projects), will be involved to share insights and best practices from their experience. |

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| | |
|---|---|
| To identify and/or activate urban spaces for collaborative experimentation | *To be defined.* |
| | |
| *Enabling conditions related to long-term changes* | |
| To be part of national and international networks of cities related to new urban productive models or sustainability issues | Cluj-Napoca Pilot expressed the aim of building and maintaining a strong network with other European Cities and institutions to get the municipality closer to new ideas and technologies in the field of energy. |
| To leverage on existing policies and initiatives about Circular Economy or sustainability related issues | Since legislation regarding energy is out of reach of for Romanian local authorities, Cluj-Napoca will leverage both on the National Energetic Strategy for 2030, which, among others, sets energy related strategic objectives (i.e. energy security, sustainable development and competitiveness), and on the urban Integrated Strategic Plan which provides guidelines for the development until 2030.<br>Energy security is regardless one of the key pillars of local governance, that will certainly be prioritised in the next years. The city is in fact implementing investment projects on energy efficiency and the mitigation of climate change, most of all by leveraging on EU fundings. |
| To promote initiatives and programmes that foster collaborative dynamics among all the urban actors: municipalities, citizens, third sector, businesses | *To be defined.* |
| To adopt an evaluation framework | *To be defined.* |
| To adopt a dissemination strategy | The dissemination activities promoted by the City Pilot are aimed on one hand at sharing public information about energy consumption in public contexts (public owned buildings and lighting hubs), to raise awareness on energy issues and promote behavioural change at citizen level, through public meetings and debates.<br>On the other hand, through annual or biannual meetings, stakeholders will be kept posted about the progress of the project and engaged. |

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We can observe from the table above that the following conditions were not explicitly mentioned but might be already addressed within the Cluj-Napoca Pilot City Action Plan.

Enabling conditions related to medium-term changes:

- to consolidate and integrate existing open datasets in cities;
- to identify and/or activate urban spaces for collaborative experimentation.

Enabling conditions related to long-term changes:

- to promote initiatives and programmes that foster collaborative dynamics among all the urban actors: municipalities, citizens, third sector, businesses;
- to adopt an evaluation framework.

The Municipality of Cluj-Napoca, in addition to the core local consortium, identified other stakeholders and the expertise they will provide to the Pilot project. Although, by narrowing down to a more specific context of intervention, it will be possible for the Pilot to reach different categories of stakeholders to be involved, for instance, in the next phases of co-production. Their participation will thus not depend only on their competences and knowledge about a specific topic, but rather on their engagement in the delivery of the final solution(s). The Pilot project includes an analysis on energy consumption in public spaces, even though it is not clear which will be the approach and the methods and tools adopted. Therefore, quantitative data gathering activities to be supported with qualitative data gathering on the field is suggested. Finally, the idea of building and maintaining a strong network with other European cities is clearly expressed, this will for sure enable the dissemination of the Pilot results within an international ecosystem. The identification of existing networks Cluj-Napoca is already part of will certainly serve this purpose.

### 5.2.4 Milan: Pilot situation at the outset of the project

Given the increasing interest in food boosted by Expo 2015 "Feeding the Planet. Energy for Life", in recent years the Municipality of Milan has promoted a coordinated set of policies and initiatives aimed at supporting and stimulating innovative activities in rural and urban agriculture, food processing and distribution, food education and culture. As a milestone of this process, the "Milan Food Policy" supports city government to make the city more sustainable starting from food-related issues. It focuses on actions that unfold in the short, medium and long term and promotes anything already available that can contribute to the implementation of food policies. At the same time, the municipality of Milan strongly supported open/social innovation projects developed by Fab Labs, makerspaces, and other citizen/community labs which act in the metropolitan area, launching the strategic program "Manifattura Milano" aimed at facilitating the establishment of a new urban manufacturing community. Milan decided to implement a Pilot focused on "Circular Markets" which aims at merging existing background and competences, grounded in the local ecosystem of actors working on agri-food and peri-urban agriculture. It incorporates the so-called "Fab-city perspective" as a new urban model of transformation and shaping cities. Many of Milan's Municipal Covered Markets, built from the 1940s through the 1960s as centers of commerce and connectors between rural and urban communities in Italy, now suffer from high vacancy rates, decaying facilities and declining community interest within neighbourhoods with viable commercial alternatives. Recognising that Markets present a unique opportunity to contribute to the transformation of neighbourhoods and to promote sustainable change, the Municipality is looking to develop a strategy for markets to

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anchor local culture, food traditions and healthy eating; to promote social integration to complement public sector initiatives; to build capacity among local stakeholders and community partners; and to create economic impact for vendors and local businesses. Short-term and long-term objectives related to the Milan Pilot are:

- to spread circular practices in the agrifood field among the traders of the covered municipal markets, activating *market laboratories*, transform them in local community hubs, and involving citizens and companies in the development of circular agri-food chains and partnerships;
- to develop a circular agri-food Pilot project connecting agricultural activities in peri-urban areas to municipal covered markets developing different circular and tech solutions for sustainable food logistics and transportation activities, smart food transformation, distribution and conservation processes.

#### *5.2.4.1 Validation of the Milan Action Plan*

The table below has the aim of drawing an extensive picture of the Milan Pilot transition path, through providing an overview of the planned actions with respect to those described within the overarching Theory of Change for the transition of cities towards Circular Economy. As previously mentioned, this validation phase is based on the change activities and enabling conditions described within the abovementioned Theory of Change and linked to medium and long-term changes. This first moment is aimed to inform the next validation phase, showing which actions the Pilot plans to accomplish (or not) and which methods and tools it intends to adopt for achieving the expected outputs and/or outcomes. This visualisation helps clearly highlight the elements that might be missing in the envisioned change journey, whether they are planned actions, methods and/or tools, outputs/outcomes.

**Table 5.9**
*Comparing the overarching Theory of Change with the Milan Pilot Action Plan*

| | ***Milan Pilot Action Plan*** | | |
|---|---|---|---|
| ***Sequence of change activities related to medium-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 10**<br>To collect data on the context and identify opportunities areas and needs | Mapping<br>Desk and field research on the Municipal Markets. | - Ethnographic observation<br>- Interviews | - Report on desk and on-field research |
| **Change Activity 11**<br>To co-create with stakeholder circular scenarios and possible | Research grounding<br>The action identifies the possible scenarios of projects - system - process - | - Knowledge exchange<br>- “Market laboratories” | - Catalogue of circular solutions for covered markets<br>- Report of needs and |

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| | | | |
|---|---|---|---|
| solutions for the re-localisation of production and the re-configuration of material flows in urban and peri-urban areas | product - service solutions that have particular characteristics of innovation linked to REFLOW's approach to CE | | opportunities areas of markets<br>- Scenarios for markets experiments<br>- Spreading circular practices in the agrifood field among the traders of the covered municipal markets |
| **Change Activity 12**<br>To co-design, prototype and test technological tools able to support and manage the circular solutions defined | Co-design lab and co-design workshops<br>The workshops will concept the emerging projects-system-process-product-service solutions | Creation of a Co-design lab (2 cycles of co-design lab consisting in 6 co-design workshops) | - Emerging projects-system-process-product-service solutions |
| **Change Activity 13**<br>To co-produce and experiment circular solutions with citizens and stakeholders | Prototyping experiments<br>The workshops will be organised within the markets in physical space defined as "Circular Food Labs" involving external stakeholders, customers, citizens and market managers. | - Prototype workshops (2 cycle of prototyping experiments, consisting in 6 prototyping workshops)<br>- Use cases derived from the results of the previous co-design activities | - CE solutions prototypes |
| **Change Activity 14**<br>To implement the open data platform in order to collect data and share them among stakeholders | Creation of a lab on circularity (Enzyme Lab) | Enzyme Lab | - To set up a demo of an open data platform on circular agrifood system that can be used by all the actors and citizen involved to implementing PSS solutions |
| ***Sequence of change activities related to long-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 15**<br>To share urban circular | *To be defined.* | *To be defined.* | *To be defined.* |

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| | | | |
|---|---|---|---|
| practices within larger-scale ecosystems through national and international networks of cities | | | |
| **Change Activity 16**<br>To develop new forms of collaborative governance related to urban circular practices | - Creation of the Food Milan Council<br>- To experiment with a new policy model for neighbourhood trade in Milan, in which public spaces (markets) are enhanced by commercial activities focused on circularity, involving key players of the local agri-food supply chain. | - Markets as community hubs and neighbourhood attractors | - To upgrade the existing urban food policy<br>- To promote a new culture of food, health and the environment<br>- To enhance public spaces as drivers for local economy in peripheral areas of Milan<br>- To involve the business world to participate in public and private partnership processes<br>- To experiment shortening and smartening bureaucratic processes related to agri-food |
| **Change Activity 17**<br>To evaluate the economic, environmental, social and territorial impacts | - To analyse the impact of logistic processes in the production of a virtuous system of urban consumption;<br>- To analyse and optimise the logistic support system | - Definition of GA KPIs<br>- Additional KPIs to be developed | - To enhance how circularity between producers, transformers and consumers of local products could become financially and socially sustainable<br><br>- To understand and improve city metabolism |
| **Change Activity 16**<br>To develop new forms of collaborative governance | - Creation of the Food Milan Council<br>- To experiment with a new policy model for | - Markets as community hubs and neighbourhood attractors | - To upgrade the existing urban food policy |

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|---|---|---|---|
| related to urban circular practices | neighbourhood trade in Milan, in which public spaces (markets) are enhanced by commercial activities focused on circularity, involving key players of the local agri-food supply chain. | | - To promote a new culture of food, health and the environment<br>- To enhance public spaces as drivers for local economy in peripheral areas of Milan<br>- To involve the business world to participate in public and private partnership processes<br>- To experiment shortening and smartening bureaucratic processes related to agri-food |

The general overview illustrated through the above table provides the necessary elements through which to describe and validate the Milan Pilot Action Plan in relation to enabling conditions linked to medium and long-term changes, as shown in the following table.

**Table 5.10**
*Ex ante validation of the Milan Pilot Action Plan*

| ***Ex ante validation - Milan Pilot Action Plan*** | |
|---|---|
| *Enabling conditions related to medium-term changes* | *Milan Pilot Action Plan* |
| To identify a specific context and the related stakeholders | The Milan Pilot planned to involve representatives of the covered municipal markets (i.e. AssoFood and Confcommercio) for a first selection among the 23 markets. The criteria for the market's selection are based on different initial assets that can contribute to create a fertile environment which can be activated through co-design labs and workshops:<br>- Material and immaterial resources: to be adopted in the new circular urban Metabolism; |

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| | - Strategic territorial localisation: as starting point to consolidate the markets as community and neighbourhood hubs;<br>- Local active networks: to activate local-based partnerships to guarantee a long-term view of the proposed activities;<br>- Open-mindedness of markets' managers: traders potentially ready to face the challenge of the circular economy as an opportunity to develop new business activities.<br><br>In relation to the strategic areas of development of the workshops, the Pilot will later involve an extended network of stakeholders belonging to different categories:<br><br>- Private companies as start-ups in agri-food chain or peri-urban farmers of Milan;<br>- Social enterprises as independent local producers, NGOs and neighbourhood associations;<br>- Institutions and public companies managing the general fruit and vegetable market of Milan or Agricultural institutions.<br><br>Finally, a more detailed list of other possible actors is provided in relation to their potential role in the project. |
| To undertake immersive research activities within the intervention context, further supported by desk research | Milan Pilot aims to map the different existing networks of local producers, transformers, distributors and consumers to identify areas of fostering and facilitating a local economy by the use of systems and product-service solutions based on open technologies and open business models<br>Desk and field research (ethnographic observation, interviews) will be carried out on the Municipal Markets:<br>- the desk analysis aims to analyse the dynamics related to logistics, conservation, transformation, management of the waste cycle of the whole supply chain;<br>- the field research aims to observe all the stakeholders involved with a focus on practices, |

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| | |
|---|---|
| | configuration of places, range of activities and stimulating the emergence of needs in terms of circular economy. |
| To develop citizens awareness, engagement and capacity building activities | In order to involve citizens on circular agri-food chain issues and on the fight against food waste, a series of engagement and capacity building activities have been envisioned:<br>- public thematic events;<br>- awareness campaigns;<br>- "Market laboratories".<br>Furthermore, the presence of fab labs within the markets will contribute to creating hybrid spaces aimed at actively involving citizens/clients, thus transforming commercial spaces into places of culture and knowledge sharing. |
| To consolidate and integrate existing open datasets in cities | Milan aims to capture data of existing indie (independent, sustainable, energy savvy, socially inclusive, economy-of-scope based) agrifood production, transformation, distribution and consumption activities all across Milan metropolitan area.<br>Moreover, the Pilot hypothesises to test Block chain technology, which is already applied on the traceability of large-scale and long-distance products, on small peri-urban and rural-urban supply chains. |
| To leverage on existing local capabilities, resources and initiatives | By focusing on "Circular Markets" the Milan Pilot aims at merging existing background and competences grounded in the local ecosystem of actors working on agrifood and peri-urban agriculture with the so-called "Fab-city perspective", as a new urban model of transforming and shaping cities that shifts how they source and use materials from. |
| To identify and/or activate urban spaces for collaborative experimentation | Within the Pilot the municipal covered markets are intended as places for experimentation, where circular solutions will be co-produced through the engagement of citizens, companies and other urban actors. Moreover, the market culture embedded in these urban places will also be addressed when aiming to promote a transformation |

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| | |
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| | process able to integrate open innovation and circular economy. |
| | |
| *Enabling conditions related to long-term changes* | |
| To be part of national and international networks of cities related to new urban productive models or sustainability issues | *To be defined.* |
| To leverage on existing policies and initiatives about Circular Economy or sustainability related issues | In order to support the Guidelines for renovation of covered municipal markets, approved by the City Council in 2017, the Pilot envisaged the integration of the markets within the social and urban fabric and the involvement of citizens and enterprises to promote a new culture of food, health and the environment.<br>It is also among the intentions of the Milan Pilot to stimulate new forms of open innovation for upgrading the existing urban food policy.<br>Indeed, the Milan Pilot has the aim of creating synergies between the REFLOW project and other sustainability/circular food related initiatives (also contributing to implement and upgrading them), that is:<br>- periodic exhibition events (i.e. Seeds and Chips and Tuttofood),<br>- research and innovation projects involving private and public actors, citizens and associations;<br>- thematic events (i.e. Animated Market),<br>- existing policies and urban development strategies (i.e. Milan Food Policy, Manifattura Milano). |
| To promote initiatives and programmes that foster collaborative dynamics among all the urban actors: municipalities, citizens, third sector, businesses | Citizen engagement activities, creation of user groups, awareness campaigns and public thematic events will take place inside the municipal markets.<br>Moreover, the Pilot envisioned the creation of the Food Milan Council, a body designated to promote the participation of various actors of the food system |

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|---|---|
| | (producers, traders, experts, associations, etc.) within the decision processes related to food policies. |
| To adopt an evaluation framework | The Milan Pilot has the aim to analyse and optimise the logistic support system and use it as a source of data to understand and improve city metabolism. |
| To adopt a dissemination strategy | *To be defined.* |

We can observe from the table above that the following conditions were not explicitly mentioned but might be already addressed within the Milan Pilot City Action Plan.

Enabling conditions related to long-term changes:

- to be part of national and international networks of cities related to new urban productive models or sustainability issues;
- to adopt a dissemination strategy.

The Milan Pilot expressed the intention to use the results of the logistic support system analysis as a source of data to understand and improve city metabolism. This can represent a starting point for the definition of a broader and more detailed evaluation strategy, which also concerns other effects resulting from the implementation of circular practices.

### 5.2.5 Paris: Pilot situation at the outset of the project

With about 2,274,880 inhabitants for a surface of about 105 square km, Paris is one of the densest cities all over the world. The city is the first tourist destination worldwide, and a leading city for conventions and exhibitions concentrating a huge number of events and temporary structures in France. 450 exhibitions with 1000 trade shows are held every year, attracting nearly 10 million of professional visitors out of the 32 million tourists. This sector of activity, which is important in the capital, produces a large amount of waste of wood and packaging that is used only for a short period of time. In this ecosystem of different actors (designers, event planners, site managers, waste management companies) there is a lack of specific agents taking care of coordinating the flow and life cycle of materials involved in the sector. As part of the implementation of its Circular Economy Plan, Paris is carrying out several actions aimed at promoting reuse activities, both with professionals and individuals, creating a large hub for reused materials, setting up a reuse platform for office equipment and standardising purchasing procedures to encourage reuse. In parallel, Fab City Grand Paris is a local network of makers, designers, architects, urban farmers and innovators engaged in the rise of the circular and collaborative economy in the Parisian urban area. The REFLOW Paris Pilot focuses on creating specific conditions for these agents in order to coordinate the use and reuse of materials in the context of fairs, large scale events and temporary structures sectors. To achieve that, the Paris Pilot will develop four different interventions: a tracking label, a set of tools for scanning resources, a waste management protocol and an incubation program. More specifically, the Pilot first aims to create a circular protocol and a set of digital tools that could be generally implemented in the city and the region for other events and temporary structures, then aims to consolidate a circular economy, by developing tracking labels for materials and a circular economy certification for trade fairs and events.

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Within REFLOW, the general objective of the Paris Pilot is to build a circular economy approach for events production and temporary activities aiming to coordinate the use and reuse of wood materials in the territory of the Great Paris. Short-term and long-term objectives are:

- to understand and accompany the sector's actors in adopting circular supply chains by developing technological solutions and new business models;
- to develop an active lobbying activity towards the European institutions and other relevant stakeholders to upgrade waste regulations.

### *5.2.5.1 Validation of the Paris Action Plan*

The table below has the aim of drawing an extensive picture of the Paris Pilot transition path, through providing an overview of the planned actions with respect to those described within the overarching Theory of Change for the transition of cities towards Circular Economy. As previously mentioned, this validation phase is based on the change activities and enabling conditions described within the abovementioned Theory of Change and linked to medium and long-term changes. This first moment is aimed to inform the next validation phase, showing which actions the Pilot plans to accomplish (or not) and which methods and tools it intends to adopt for achieving the expected outputs and/or outcomes. This visualisation helps clearly highlight the elements that might be missing in the envisioned change journey, whether they are planned actions, methods and/or tools, outputs/outcomes.

**Table 5.11**

*Comparing the overarching Theory of Change with the Paris Pilot Action Plan*

| | ***Paris Pilot Action Plan*** | | |
|---|---|---|---|
| ***Sequence of change activities related to medium-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 10**<br>To collect data on the context and identify opportunities areas and needs | <u>Analysis of issues, challenges and actors</u><br>- To identify the actors in the events and ephemeral construction on the territory and the actors of the territory circular economy<br>- Identify the actors with whom the Pilot will work<br><u>Mapping the network</u> | - Data collection | - To understand the issues of the Paris area players in the event industry and construction ephemeral (managers, organizers, designers ...), the circular sector of the economy and the waste management sector<br><br>- To understand the impact |

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| | | | |
|---|---|---|---|
| | - To map the production capacity and material flow in the city<br>Analysis of business models of existing actors and their difficulties in their practice<br>- To Identify business models of the events and temporary construction on the territory and the actors of the territory of circular economy<br>- To conduct a watch of public policies and actions of the city | | of material flows at an event or ephemeral building<br>- To understand the specific challenges of the Paris area in the event industry and temporary construction, the circular sector of the economy and the waste management sector<br>- To identify public policies and action plans at the city level |
| **Change Activity 11**<br>To co-create with stakeholder circular scenarios and possible solutions for the re-localisation of production and the re-configuration of material flows in urban and peri-urban areas | *To be defined.* | *To be defined.* | *To be defined.* |
| **Change Activity 12**<br>To co-design, prototype and test technological tools able to support and manage the circular solutions defined | To develop open source tools | Experimentations for testing the tools developed | - Carry a traceability protocol of matter as label tracker<br><br>- To build an intelligent storage<br>- To deliver semi-industrial solutions and open tools for helping the sector and SMEs to sustain their activities |

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| | | | |
|---|---|---|---|
| **Change Activity 13**<br>To co-produce and experiment circular solutions with citizens and stakeholders | Design and testing of new economic models (event and reuse) | *To be defined.* | - Design X economic models<br>- Experiment X economic models |
| **Change Activity 14**<br>To implement the open data platform in order to collect data and share them among stakeholders | Co-design REFLOW OS | Prototyping the REFLOW OS application | REFLOW OS application based on the Paris pilots needs and context |
| ***Sequence of change activities related to long-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 15**<br>To share urban circular practices within larger-scale ecosystems through national and international networks of cities | *To be defined.* | *To be defined.* | *To be defined.* |
| **Change Activity 16**<br>To develop new forms of collaborative governance related to urban circular practices | Co-design of public policy solutions<br>Incubate and develop innovative businesses | Incubation program for innovative companies in the sectors of the CE | To Develop new forms of governance for new business models (Incubation) |
| **Change Activity 17**<br>To evaluate the economic, environmental, social and territorial impacts | *To be defined.* | - Definition of GA KPIs | *To be defined.* |
| **Change Activity 18**<br>To disseminate within the city context CE practices to be potentially scaled and replicated | Disseminate and communicate the REFLOW actions | - Spreading news about the incubation and education program<br>- Conducting communication actions<br>- A handbook of good practices will be delivered | -To promote the solutions developed by the REFLOW consortium<br>- The handbook will help the actors (sector and SMEs) and explain how to |

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| | | | use and apply the REFLOW semi-industrial solutions |

The general overview illustrated through the above table provides the necessary elements through which to describe and validate the Paris Pilot Action Plan in relation to enabling conditions linked to medium and long-term changes, as shown in the following table.

**Table 5.12**
*Ex ante validation of the Paris Pilot Action Plan*

| ***Ex ante validation - Paris Pilot Action Plan*** | |
|---|---|
| *Enabling conditions related to medium-term changes* | *Paris Pilot Action Plan* |
| To identify a specific context and the related stakeholders | The identification of actors and their current business models will be supported by an analysis on the impact of material flows and ephemeral buildings at events and their key players, and on the circular economy territorial ecosystem. These activities will be useful also to understand the specific challenges affecting the Paris area in the event industry and temporary construction, the circular sector of the economy and the waste management sector.<br>Firms and big corporations of events and temporary construction sector with an interest in circular economy, and local makers and designers willing to be incubated will be identified to be involved in the development of open source and technological solutions.<br>Furthermore, the Paris Pilot already provided a detailed key actors and stakeholders grid including the description of their possible role in the co-creation process. It is divided into the following categories of actors:<br>- Makers and space of the Parisian ecosystem<br>- Events & event manager<br>- Event organisation<br>- Waste collectors<br>- Temporary space manager |

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| | - Space for event<br>- Associations |
| To undertake immersive research activities within the intervention context, further supported by desk research | Following the analysis of issues, challenges and actors related to the events and temporary construction on the territory, the production capacity and material flow in the city will be mapped through data collection. |
| To develop citizens awareness, engagement and capacity building activities | In order to raise awareness about CE practices and engage citizens and society, services associated tools (related to the tracking label, new practices for companies, the database and storage) will be developed within the REFLOW project and later disseminated. |
| To consolidate and integrate existing open datasets in cities | The Paris Pilot identified the Petit palais and the Cité des sciences/Universcience as the main Spaces for events which could give access to data useful for the development of the project. |
| To leverage on existing local capabilities, resources and initiatives | Paris is characterised by a dynamic scene of urban innovators and changemakers in addition to a long tradition of local production and urban craftsmanship. Within this context the Fab City Grand Paris - a local network of makers, designers, architects, urban farmers and innovators committed to fostering a circular and collaborative economy - will help the Pilot to implement the so-called Fab City approach, together with the support of political institutions for the enhancement of digital innovation. |
| To identify and/or activate urban spaces for collaborative experimentation | The Paris Pilot identified the Petit palais and the Cité des sciences/Universcience as the main Spaces for events which could provide material for the experimentation of circular solutions. |
| | |
| *Enabling conditions related to long-term changes* | |
| To be part of national and international networks of cities related to new urban productive models or sustainability issues | *To be defined.* |

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| | |
|---|---|
| To leverage on existing policies and initiatives about Circular Economy or sustainability related issues | The Pilot leverages on the Paris' innovation strategy, whose one of the main goals is to tackle the challenges of circular economy and sustainable economic development at a city scale. Thanks to it Paris has also been awarded the Capital of Innovation 2017 title by the European Commission. Moreover, the Paris Pilot planned to conduct a watch of public policies and actions at the city level, in order to later provide reglementation solutions identified with stakeholders. |
| To promote initiatives and programmes that foster collaborative dynamics among all the urban actors: municipalities, citizens, third sector, businesses | In order to develop innovative businesses and consolidate "soft skills" of companies, the Paris Pilot envisioned the activation of an incubation programme for innovative companies in the sectors of the CE. |
| To adopt an evaluation framework | *To be defined.* |
| To adopt a dissemination strategy | The Pilot envisioned to conduct communications actions in order to spread news about the incubation and education programme that will be developed within the project and promote the solutions defined by the REFLOW consortium. Moreover, among the dissemination activities, a handbook of good practices will be delivered to guide interested actors on how to use and apply the REFLOW semi-industrial solutions. |

We can observe from the table above that the following conditions were not explicitly mentioned but might be already addressed within the Paris Pilot City Action Plan.

Enabling conditions related to long-term changes:

- to be part of national and international networks of cities related to new urban productive models or sustainability issues;
- to adopt an evaluation framework.

The Paris Pilot envisioned data collection activities in order to have a complete overview of the social, political and environmental scenario related to the events and temporary construction sector. This activity needs therefore to be supported by suitable approaches and tools; it is thus suggested to support quantitative data gathering with qualitative research findings, perhaps provided by ethnographic research tools and methods. Moreover, in addition to the data that the identified spaces for events (the Petit palais and the Cité des sciences/Universcience) could provide, it would also be

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useful to involve other interested parties capable of providing additional data that help build a more complete picture for the implementation of an effective open data platform.
Finally, on the basis of the collaborative approach promoted within the REFLOW project, it is suggested to better define it both for the planned experimentation activities and for the incubation program for innovative companies in the sectors of the CE, which could benefit from collateral initiatives able to involve also other actors of the urban scene.

### 5.2.6 Vejle: Pilot situation at the outset of the project

Vejle is part of the Rockefeller 100 Resilient Cities. Therefore, Vejle has a strong focus on creating citizen-resilience, environment-resilience and digital-resilience. The municipality of Vejle wants to promote circularity alongside a growing population, a growing consumption and a shift in the welfare-system, where citizens and companies play a bigger part by self-help and being resilient to preventing the challenges of tomorrow. By combining technology, design-driven methods and including stakeholders in the challenge, the Vejle Pilot aims at making plastic circular and reducing its need. Indeed, plastic and plastic-based waste, which is not recycled, play an important role in the municipality of Vejle. The city already has a well-developed welfare system and environmental awareness is generally strong in the city; indeed, one of the challenges in the city of Vejle, is to create methods and possibilities, so that citizens, local companies and the municipality have proper tools to reuse plastic or to replace a bigger amount of it in products. The whole project builds upon a design thinking method, which connects to Fab Labs and prototyping workshops and “Vestbyen in Vejle” is the test area. The Vejle Pilot aims to bring innovation into action and connect civil society, companies and public institutions when developing new solutions to reduce the need for plastic and co-creating circular strategies for plastic as a resource together with local stakeholders. Within the REFLOW project, the Vejle Pilot will map and analyse the plastic streams in specific sites of the west part of the city. Furthermore, the focus is on engaging stakeholders, designing new solutions and developing new (and improved) business models responding to short-term and long-term objectives for the public and private sector, that is:

- to engage citizens, entrepreneurs and small-scale companies through new creative engagement methods as well as working within the municipality at policy level. The overall goal is to achieve 25% plastic regenerated on specific selected sites developing scalable operational and business models and methods;
- to promote organisations and citizens behavioural change regarding the reuse, reduction and recycling of plastics, by engaging and creating awareness through practical incentives/prototypes that revalue the plastic waste and the development of scalable solutions and methods.

#### *5.2.6.1 Validation of the Vejle Action Plan*

The table below has the aim of drawing an extensive picture of the Vejle Pilot transition path, through providing an overview of the planned actions with respect to those described within the overarching Theory of Change for the transition of cities towards Circular Economy. As previously mentioned, this validation phase is based on the change activities and enabling conditions described within the abovementioned Theory of Change and linked to medium and long-term changes. This first moment is aimed to inform the next validation phase, showing which actions the Pilot plans to accomplish (or not) and which methods and tools it intends to adopt for achieving the expected outputs and/or

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outcomes. This visualisation helps clearly highlight the elements that might be missing in the envisioned change journey, whether they are planned actions, methods and/or tools, outputs/outcomes.

**Table 5.13**

*Comparing the overarching Theory of Change with the Vejle Pilot Action Plan*

| | ***Vejle Pilot Action Plan*** | | |
|---|---|---|---|
| ***Sequence of change activities related to medium-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 10**<br>To collect data on the context and identify opportunities areas and needs | - Plastic analysis (about plastic streams on 7 specific sites in the West of Vejle)<br>- Plastic analysis (about the different types of plastic used in Vejle) | *To be defined.* | - Plastic analysis report/ baseline<br>- Overall report on plastic types used in Vejle<br>- Identification of specific test sites by the Steering committee |
| **Change Activity 11**<br>To co-create with stakeholder circular scenarios and possible solutions for the re-localisation of production and the re-configuration of material flows in urban and peri-urban areas | - Execution of events and workshops with different stakeholders<br>- Co-create circular strategies for plastic as a resource – together with local stakeholders from both public and private sector and citizens | Actively using design thinking as a method to involve local stakeholders and secure co-creation | Development of 2-3 new business models |
| **Change Activity 12**<br>To co-design, prototype and test technological tools able to support and manage the circular solutions defined | To develop new tech applications | - Workshops<br>- Collaboration with FabLab<br>- Collection of data from plastic analysis<br>- Integration of expert knowledge + matchmaking between decision makers and solution providers | - New insights on developing tools/ applications to help future development projects<br>- Tools for others outside the project to use and get inspired from<br><br>- Potential to scale solutions to benefit even |

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|---|---|---|---|
| | | | more citizens, businesses and municipalities |
| **Change Activity 13**<br>To co-produce and experiment circular solutions with citizens and stakeholders | Implementation of prototypes for test sites | - Prototyping workshops<br>- Implementation plan for test sites | Prototypes for test sites |
| **Change Activity 14**<br>To implement the open data platform in order to collect data and share them among stakeholders | *To be defined.* | *To be defined.* | *To be defined.* |
| ***Sequence of change activities related to long-term changes*** | *Planned actions* | *Methods/tools* | *Expected outputs/outcomes* |
| **Change Activity 15**<br>To share urban circular practices within larger-scale ecosystems through national and international networks of cities | The municipality intends to work together with surrounding municipalities to bring knowledge about circular economy into the public sector, bigger companies and into the everyday life of citizens. | *To be defined.* | To bring knowledge about circular economy into the public sector, bigger companies and into the everyday life of citizens. |
| **Change Activity 16**<br>To develop new forms of collaborative governance related to urban circular practices | - Partnership agreements with housing associations and other actors of the civil society<br>- The Pilot aims to identify potential barriers among stakeholder for a sustainable transformation (and present them at a policy level) | - Inclusion of experts and collection of knowledge<br>- Ongoing dialogue with project partners | - 3 examples of the project influencing the policy level |
| **Change Activity 17**<br>To evaluate the economic, | - Different evaluation levels have been defined to | - Definition of GA KPIs<br>- Definition of additional | - Report on plastic analysis/endline |

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| | | | |
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| environmental, social and territorial impacts | specify the effect of the Pilot initiatives:<br>● Awareness<br>● Knowledge<br>● Engagement<br>○ Reuse<br>○ Recycle<br>○ Reduce<br><br>- Plastic analysis<br>- Prototype evaluation | detailed KPIs<br>- Surveys and qualitative interviews | - Evaluation quantitative and qualitative data |
| **Change Activity 18**<br>To disseminate within the city context CE practices to be potentially scaled and replicated | - Give talks and hold/participate in meetings to disseminate REFLOW<br>- Development and launch a list of digital communications tools/channels that can help the Pilot spread the knowledge generated by REFLOW (social media, newsletter, homepage etc.) | - Communication initiatives (e.g. Web, newsletter, video, social media)<br>- Dissemination talks and meetings | -Digital best practice<br>- Providing principles to build, drive and scale similar future projects<br>- Tools for others outside the project to use and get inspired from |

The general overview illustrated through the above table provides the necessary elements through which to describe and validate the Paris Pilot Action Plan in relation to enabling conditions linked to medium and long-term changes, as shown in the following table.

**Table 5.14**
*Ex ante validation of the Vejle Pilot Action Plan*

| ***Ex ante validation – Vejle Pilot Action Plan*** | |
|---|---|
| *Enabling conditions related to medium-term changes* | *Vejle Pilot Action Plan* |
| To identify a specific context and the related stakeholders | "Vestbyen in Vejle" has been identified as the test area. Within it seven sites have been selected, representing both public institutions (elder care center, school and hub for |

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| | entrepreneurship), private companies (retail and construction) as well as public households (apartments and residential neighbourhoods). Among these, the final specific test sites will be chosen by the Local steering-group committee and for each of them a working group will be appointed, consisting of 3-8 people (primarily local and internal from the Municipality and the sites).<br>Other external partners identified are:<br>● Fablab;<br>● Region of Southern Denmark;<br>● Økolariet;<br>● AffaldGenbrug. |
| To undertake immersive research activities within the intervention context, further supported by desk research | A plastic analysis has been carried out to provide a report/baseline about plastic streams on 7 specific sites in the West of Vejle. Moreover, an overall report on plastic types used in Vejle will be compiled on the basis of a second plastic analysis about the different types of plastic used in Vejle.<br>The information collected will allow the Steering committee to identify specific test sites. |
| To develop citizens awareness, engagement and capacity building activities | In order to raise awareness within the CE agenda and change organizations and citizens behaviour regarding the reuse, reduction and recycling of plastics, the Pilot will focus on the engagement of citizens, entrepreneurs and small-scale companies through a series of different initiatives and materials:<br>● Events and workshops with designers/businesses/ citizens/educational system;<br>● 4-5 campaigns/ information-meetings (Unconferences, physical scenarios etc.);<br>● Educational/inspirational materials for students;<br>● Future scenarios.<br><br>In relation to these activities, an ongoing dialogue and cooperation with local Fablab and schools is envisaged. |

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| To consolidate and integrate existing open datasets in cities | *To be defined.* |
| To leverage on existing local capabilities, resources and initiatives | The local steering-group committee, consisting of different stakeholders in different segments, supports the Pilot in achieving the KPI's.<br>The tasks of the committee are to:<br>● Create coherence between REFLOW and its own organisation<br>● Give REFLOW mandate and support and legitimize the Pilot actions<br>● Make overall decisions for the Pilot.<br><br>Among the existing local capabilities and resources the Pilot also refers to *The spinning mill*, the Vejles Center of innovation and creative entrepreneurs consisting of 80 entrepreneurs and companies with under 10 employees. Placed in the western part of Vejle, it also has its share of entrepreneurs with technology-skills. |
| To identify and/or activate urban spaces for collaborative experimentation | The specific sites chosen by the local steering-group committee will be used as test sites throughout the project. |
| | |
| *Enabling conditions related to long-term changes* | |
| To be part of national and international networks of cities related to new urban productive models or sustainability issues | Vejle is already part of *Rockefellers 100 resilient cities of the world*.<br>In relation to local networks, the municipality also works together with surrounding municipalities to bring knowledge about circular economy into the public sector, bigger companies and into the everyday life of citizens. |
| To leverage on existing policies and initiatives about Circular Economy or sustainability related issues | *To be defined.* |
| To promote initiatives and programmes that foster collaborative dynamics among all the urban actors: municipalities, citizens, third sector, businesses | Partnership agreements with housing associations and other actors of the civil society are envisioned. |

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|---|---|
| To adopt an evaluation framework | The Vejle Pilot plans to complete an overall evaluation by the end of the project period to outline the effect that the REFLOW activities and initiatives have had and to define the maturity levels regarding implementing CE.<br>Evaluation activities will be carried out through surveys and qualitative interviews according to the different levels defined:<br>● Awareness<br>● Knowledge<br>● Engagement<br>○ Reuse<br>○ Recycle<br>○ Reduce |
| To adopt a dissemination strategy | The Vejle Pilot planned to develop and launch a list of digital communications tools/channels that can help spreading the knowledge generated by REFLOW (social media, newsletter, homepage etc.) and providing tools for others outside the project to use and get inspired from. Moreover, it has also been envisaged to hold/participate in meetings for the dissemination of REFLOW activities, with the aim of providing principles to build, drive and scale similar future projects. |

We can observe from the table above that the following conditions were not explicitly mentioned but might be already addressed within the Vejle Pilot City Action Plan.

Enabling conditions related to medium-term changes:

- to consolidate and integrate existing open datasets in cities.

Enabling conditions related to long-term changes:

- to leverage on existing policies and initiatives about Circular Economy or sustainability related issues.

The Vejle Pilot already developed an analysis about plastic streams on the 7 specific sites identified and envisioned a second plastic analysis about the different types of plastic used within the city context. However, since the specific approach and methods used to conduct the investigation are not described, it is suggested to clearly define them in order to eventually review the analysis methodology perhaps planning an effective integration between quantitative and qualitative data gathering whether one of the two approaches seem to be neglected.

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Finally, as the process of selecting specific test sites has already been defined in detail, speeding up the choice of urban spaces in which to carry out collaborative experimentation activities could help to better design these activities, by clarifying the collaborative approach that should characterise them and which has not yet been explicitly described.

## 5.3 A final sum up: validating Circular Economy practices within the urban context

This Deliverable is aimed at designing and executing a validation process of Circular Economy co-production practices and the technological infrastructure within REFLOW, in order to provide a shared approach to validation, useful for any actor involved in this kind of transition. As extensively described in the previous Sections, the REFLOW validation process has a twofold purpose. On the one hand, it addresses the REFLOW Consortium's activities from month 1 to month 11, while testing a self-assessment model on the actions that the project has undertaken so far and that works as a starting point for future validation activities. On the other hand, it points to the future by validating the change journey implementation strategy, thus providing recommendations on how to move and work towards the desired circular scenario. In both cases validation can become crucial in further revising and adjusting the trajectory marked by previous actions. Based on the objectives above described, the entire validation process is articulated into *ex-post* and *ex-ante* phases, while addressing two different objects of validation: the REFLOW process developed so far and the Pilot City Action Plans. Validation is grounded in a theoretical baseline built through literature findings and best practices.
The *ex-post* validation is useful to provide a first systematic and chronological overview of the REFLOW process developed until now. What emerges is that collaboration was intended as a way to guide the project since its beginnings, and this leads to deepening the use of approaches and methods able to foster it. In this respect, it should be noted that online tools provided an agile method to rapidly reach everyone around Europe. Indeed, REFLOW extensively used video calls and emails to support collaboration among the consortium partners. Nonetheless, it would be advisable to foster an *action research approach*, especially in relation to Pilots' activities, aimed at developing context based field activities and interventions, which need immersive analysis within the contexts, especially in the early stages of understanding and approving the feasibility, which will inform the next stages of ideation (co-design and co-production of the city Pilots). This means, for instance, to deep dive desk research information through field research activities, and to implement on-field workshops with the local stakeholders. A major weakness that emerges from validation is related to a yet fragmented strategy for sustaining viable circular transitions in the REFLOW Pilot Cities. However, this may reflect and confirm the need to develop such a strategy through learning by doing and experimenting, and to adopt loose circular economy's definitions and concepts that can be improved and adjusted over time.

Moreover, with specific reference to the validation of the REFLOW technological infrastructure, it is possible to compare the objectives and activities initially stated in the DoA with the activities actually carried out in the project and the elements that emerged from the analysis of the supporting literature. The comments on the validation of the technological infrastructure are to be understood as related to the current state of development of the REFLOW research process (month 11) and as an anticipation of the possible structuring elements with respect to the current stage of development of the Action Plans defined by the Pilot Cities.
The REFLOW project has a Building block entirely dedicated to the definition and development of *IT Infrastructure and Tools.* Its objectives are:

- to define the project scenarios and use cases;

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- to identify, collect and analyse functional, non-functional and technical requirements;
- to design the high-level distributed infrastructure architecture and interfaces;
- to design the open data dashboard including APIs and graphical interfaces;
- to integrate and develop Free and Open Source Softwares.

During the first year of the project two Tasks were activated: *T2.1 - Use Case Analysis and Requirements* and *T2.2 - Distributed Architecture Design and Development*. The aim of T2.1 is to analyse use cases, and to collect and analyse user requirements in order to define the technological infrastructure and its tools. The reference deliverable is the *D2.1 - Use Case Analysis and Requirements* (M12), which aims to document the path to define the requirements for the REFLOW technological infrastructure.
The preliminary development of the REFLOW IT tools, based on the agile methodology, has seen the following phases:

- preliminary interviews (M5) with Pilot Cities to identify ideas, visions, needs and stakeholders involved and/or to be involved. The results of the interviews highlighted different levels of maturity of the Pilot Cities and therefore different levels of awareness on the choice of the most appropriate IT solutions;
- generation of technological reference scenarios to stimulate and guide the choice of REFLOW IT Tools by the Pilot Cities presented during the Co-creation workshop (M6). The result of the workshop allowed the Pilots both to make a first choice of a REFLOW IT infrastructure scenario and, for the more advanced Pilots, a more accurate definition of their technological scenario;
- identification of two main technological scenarios for the Pilots (M7-M8): a decentralised economic network, called *REFLOWOS*, which can facilitate the exchange and localisation of materials in real time and the tracking of material flows; a data dashboard, called *Open Data Platform*, which allows to publish, visualise and enrich open data making them usable by local communities;
- organisation of workshops and co-creation sessions (M8-9) related to REFLOW OS and Open Data Platform scenarios to identify the specific needs of the Pilots and develop the first prototypes of IT solutions focusing on functionality, user stories and definition of usage requirements;
- systematisation of user stories with the definition of the first IT infrastructure requirements presented to the Pilot Cities during a project meeting (M9-M12) and creation of use cases. The use cases have been defined to show the possible interactions between software and users and to focus more on REFLOW OS and the Open Data Dashboard, obtaining more requirements that can then be modified or integrated in the 2nd and 3rd year of the project.

Compared to the validation of REFLOW technological infrastructure, two levels of considerations are proposed below regarding the ability to respond to the challenges of CE digitalisation and the comparison with the emerging technological landscape for CE.
The development of activities related to the definition of the REFLOW technological infrastructure is generally consistent with the scientific literature. In particular, they are coherent, and the co-creation activities and processes used to define the scenarios and requirements of the platform combine expertise from different sectors and organisations, being based on participatory activities such as workshops. Another relevant aspect for the validation concerns the choice of open and distributed digital technologies that allow the combined participation of local communities of businesses and citizens by involving them in value co-creation processes.

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In the future development of the Pilots it is necessary to pay attention to the integration of the available data among the various stakeholders and to the communication and learning processes on the use of digital technologies by the stakeholders involved in the Pilot Cities, as they may take time.
Connecting the REFLOW OS and the Open Data Platform with the skills and technologies for digital fabrication (available from partners such as Fab Labs) defines a possible technological asset of REFLOW that allows to test the prototyping of digital product-service solutions for CE. This technological asset is certainly partial if compared to the broader panorama of digital technologies for CE (see Figure 3.3). These technologies, if observed in relation to the general objectives of the project and with respect to the application areas of the Pilots, are, however, to be considered the most accessible and adaptable to operate in non-industrial urban sectors and contexts, where the digitalisation of CE processes crosses the field of open and social innovation. Comparing the REFLOW technological infrastructure with the technological landscape for CE, one consideration emerges: in the REFLOW project capacity building, dissemination and engagement activities are very important. In the same way, the digital technology landscape for CE identifies these activities as relevant, indicating precise technologies that support them. In the definition of the REFLOW technology infrastructure, the connection between open data and distributed ledger technologies with social platforms or data visualisation tools could therefore be more considered. In summary, the digital technologies envisaged by REFLOW can be recognised as valid because:

- they represent a minority but nevertheless significant part of CE reference technological landscape, since they can be used in a non-industrial urban context and are accessible by a variety of subjects considered by REFLOW (companies, citizens and institutions);
- they are appropriate to test, within an urban context, initiatives that must have a social impact, and they are appropriate where the REFLOW project or its Pilots have established a dialogue with the world of industry and services in a perspective of open and social innovation.

With regards to the *ex ante* validation phase, as already mentioned, exclusively the Action Plans contained within deliverable *5.1 - Detailed Pilot Action Plans and Evaluation Framework* were analysed. Indeed, this deliverable describes the initial implementation strategies of the pilots developed from M1 to M8. Here, the Action Plans are described and articulated according to the main objectives and actions they intend to undertake for the development of a circular transition process. In this sense, the validation here proposed does not include the developments of the Action Plans resulting from the work from M9 to M11. Although all the Pilots have been provided with the same framework for the definition of the Action Plan, each of them has compiled it in different ways, given the different cultural and geographic setting, resource stream and starting conditions, as also described in D5.1. Within the validation activity, this made the interpretation of each Action Plan more complex. The development of a common baseline for the future understanding and evaluation of the effectiveness of the evaluation process should be undertaken in light of the inherent contextual differences between the Pilot cities. For this reason, the collaborative and participatory Theory of Change process developed from M9 to M11 will provide a baseline to identify respective level of initial\final maturity. At this time, by carrying out the validation activity, is possible to synthesise a series of considerations and suggestions concerning all the future Pilots' development:

1. Some of the enabling conditions identified in relation to the overarching Theory of Change defined within D1.1 were not always found explicitly described within the Pilot Action Plans. Each Pilot could actually benefit from

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making an explicit inquiry and check of some of the conditions that have not yet been addressed in order to proceed more safely and effectively in the development of the expected change journey, eventually also redefining it;

2. In the previous sections it emerged that the REFLOW technological infrastructure is generally compliant with most diffused practices described in scientific literature. However, the Pilots' definition and use of specific technological solutions by the Pilots is not yet envisaged and planned; thus, there were not sufficient elements provided to undertake a more detailed validation. The co-design process already started for the definition of *REFLOW OS* and the *Open data dashboard* could benefit from a quick identification and materialisation of possible solutions for the collaborative activities to be undertaken within the Pilots' contexts to help them in the construction and implementation of these indispensable infrastructures, necessary to enable data production (baselines) and scenario analysis and foresight;

3. Pilot-specific evaluation strategy is needed as a further enabling condition related to medium-term changes. At this time the Pilot Cities have been involved in the initial development of KPIs that will support the assessment of their social, economic and environmental performance. This activity represents an initial contribution to the definition of the methods for assessing the impacts generated by each Pilot project;

4. The implementation of a pilot-specific dissemination strategy is needed to further enable medium-term changes. While (5 out of 6) Pilots mentioned the intention to adopt a dissemination strategy, at the time of the validation its development was at an initial stage. Developing the dissemination strategy further, represents a very important goal which, integrated with the strategy defined by REFLOW, should also continue beyond the end of the project in order to trigger replication and scalability mechanisms both inside and outside the Pilots' urban area

Finally, the overarching Theory of Change for the transition of cities towards Circular Economy here defined and the related validation process developed, were applied to extrapolate useful considerations about the progress of REFLOW activities as well as to formulate some recommendations about how the change journey of each Pilot may move forward. Moreover, it also represents a good opportunity to revise and eventually readjust the transitions activities envisioned by both the REFLOW project and the City Pilots. The effectiveness of the validation process defined and adopted within this Deliverable opens to the possibility of transforming it into a replicable and scalable methodology which might be applied to other projects committed to the implementation of Circular Economy co-production practices within urban contexts.

A very recent independent report[11] prepared for the European Commission Directorate-General for Research and

[11] See *Categorisation System for the Circular Economy - A sector-agnostic approach for activities contributing to the circular economy* (Hirsch and Schempp, 2020) which highlights among the actions defined as "*Circular Support*" and the related "*Examples of typical investments/projects*" a specific reference to the development of "*... Methodological frameworks and tools for measuring and monitoring of progress in the transition to a circular economy*". This report reports another precise step in its premises: *"... The lack of a commonly accepted and sufficiently inclusive definition and circularity measurement methodology hampers the transition to a more circular economy in multiple ways. Among other things, it hampers the*

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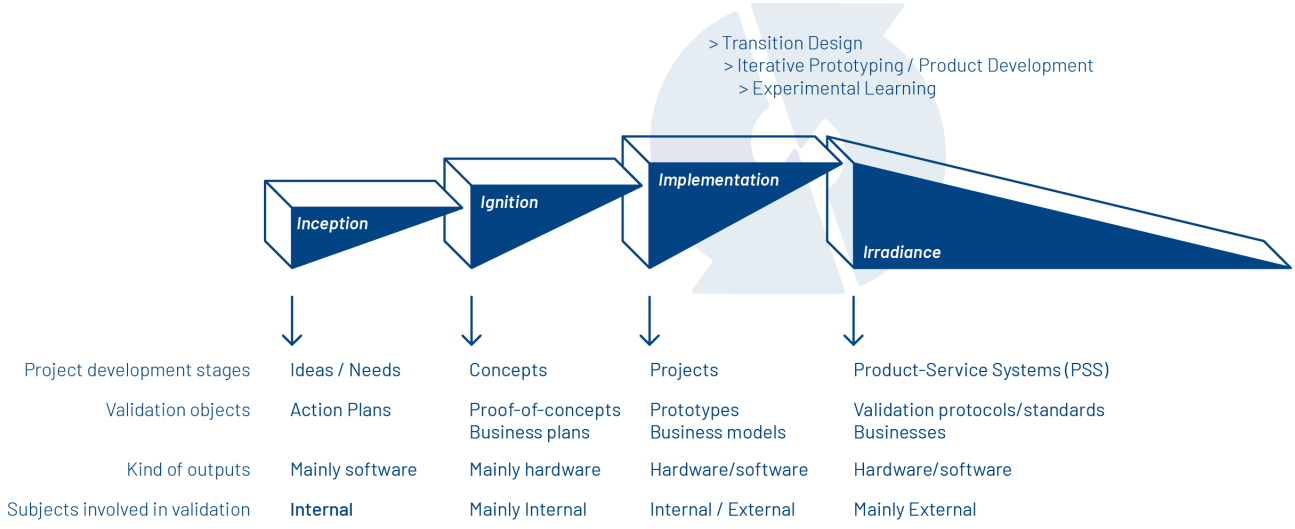
Innovation highlights the question of the "*...lack of a commonly accepted and sufficiently inclusive definition and circularity measurement methodology…"* (Hirsch and Schempp, 2020; p.3) and we think that the definition of a validation model could fit exactly into this space of opportunity. Based on this assumption, the following is an outline containing a proposal for a possible validation approach - the *validation ladder* - for circular actions in cities (Figure 5.3).

**Figure 5.3**
Validation ladder




This ladder tries to connect and integrate the logic of the Nesta Standard of Evidence with the progression of projects with the multi-level as of Geels (see Section 4) for innovation maturity stages, also identifying two levels for validation:

- The first level, following the principle of accuracy in validation, proposes to identify and define a set of validation layers concerning resources, competences, technologies and outputs. This first set can be expanded with other layers concerning places, capabilities, etc. Within this dynamic model it is possible to modulate the level of validation accuracy.
- The second level, following the validation iteration principle, highlights the basic elements for the replicability and scalability of the circular experimental actions. Within a circular experimental action, after the *Ignition* and *Implementation* phases it is possible to validate one or more iterative processes enabling the cities to design and refine the transition path towards a circular system, to continuously develop their solutions, and to implement their circular capacity building.

*development and access to (dedicated or non-dedicated) finance, credit risk assessment, and the transferability and replicability of projects and investments across regions and jurisdictions...".* (Hirsch and Schempp, 2020; p.3).

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# 6. Final considerations and next steps

The REFLOW project wants to build an integrated approach for developing new practices dedicated to innovative and circular urban metabolisms, providing also the adoption of methods and processes for the validation and evaluation of co-design and co-production activities developed within the six Pilot Cities involved in the project. Accordingly, Deliverable *D1.1 - Co-Production Practices in Pilot Cities,* within the REFLOW Building block of *Business design and Co-creation* and in connection with T*ask 1.1 - Ideation,* is conceived to validate the Circular Economy co-production practices and the technological infrastructure defined and envisioned so far by REFLOW itself. Moreover, an ultimate goal of this Deliverable is to provide initial insights and recommendations about the possible replicability and scalability of the validation process here presented in relation to possible other experiences, which want to develop a transition journey towards Circular Economy, that might build upon REFLOW's experience.
To achieve the aforementioned objectives, the work developed within D1.1 is informed by a theoretical grounding built through literature review and best practices analysis, resulting in the identification of key concepts related to the implementation of Circular Economy practices within urban contexts. Among the most relevant findings, the still blurred concept of CE still poses many theoretical and practical challenges to the effective adoption and execution of circular principles in complex contexts, such as cities. In addition, technical, economic, institutional and socio-cultural barriers highlight the need for a systemic and long-term perspective planning in order to enable permanent and impactful CE processes. By addressing a multilevel and systemic dimension, a design driven perspective needs the involvement of different resources and capabilities, enabled through an integrated process of co-creation, co-design and co-production actions. This scenario may be enriched by an action-research approach which strengthens experimentation activities deeply rooted within peculiar local contexts with their unique mix of resources, capabilities and barriers. Furthermore, considering the large amount of data generated by production and the connected energy and materials' life cycles, the adoption of some digital technologies (i.e. distributed ledger technologies) may be pivotal to analyse and process data flows useful for implementing CE practices.
The key concepts above outlined helped define the Theory of Change for the transition of cities towards Circular economy, and they were used as a reference for the main validation tool within D1.1. The Deliverable in fact defined an overarching ToC in order to structure the general *context baseline* necessary to describe how the urban CE takes place, and then identify a series of *desired change goals* (with a long, medium and short-term perspective), a *sequence of activities* that might lead to the desired change and some *enabling conditions* that can influence and determine a successful implementation of these CE practices. Then the validation process has been articulated into two moments:

- an *ex post* validation, which addresses the REFLOW process developed so far by validating the sequence of activities linked to short term changes against the enabling conditions linked to short term changes;
- an *ex ante* validation, which takes into consideration the implementation strategy envisioned by the REFLOW Pilot Cities in their Action Plans by validating the sequence of activities linked to medium and long term changes against the enabling conditions linked to medium and long term changes.

Based on the considerations emerged from the validation activity, a series of first suggestions (which may be further implemented and linked to the other suggestions coming from other Deliverables or Partners) is provided here to help address the forthcoming phases which interest both the Pilot Cities and the REFLOW Consortium:

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- the results achieved so far by the Consortium partners through the effective implementation of mainly online collaborative tools, may be enhanced by strengthening research activities and form of collaboration to be developed directly on the field, in order to successfully implement context based (action-research) interventions within the Pilot Cities;
- in accordance to the objectives and the activities currently under development within the REFLOW Building block *IT Infrastructure and Tools,* keep valuing the capability and community building aspects related to the adoption of digital technologies is relevant to actively engage the various Pilot stakeholders. In addition, the communication of complex data through social platforms and visualisation tools might help to make it more (average) citizen-friendly in terms of awareness and access (i.e. suggesting cases or practices, setting up small showcases/demo for learning and engagement scopes);
- alongside a further selection of KPIs, the definition of an evaluation strategy (which is needed to use them) might be crucial for Pilot Cities to measure not only the expected outcomes but also the possible effective impact of project interventions and capture the entity of the change achieved in the medium/long-term;
- by integrating, within the REFLOW dissemination strategy, a further identification of specific Pilot-related communication tools and/or platforms might enhance the exploitation of REFLOW achievements and support a profitable dialogue within national and international networks of cities related to new urban productive and/or sustainability models.

The suggestions provided above are to be intended in relation to the current state of development of REFLOW (M11) and therefore influenced by the ongoing evolution of the project. In fact, since the validation activity developed in this Deliverable takes into consideration the outputs reached by REFLOW between M1 and M11, we had to consider two factors which may influence its future ongoing evolution:

- the parallel (to D1.1) completion of the other Deliverables (with deadline at M12);
- the impact of the COVID-19 crisis on the overall dynamics of REFLOW and on the specific and local contexts of each Pilot City.

This means that in the coming months, with the further development of the next project milestones, the Consortium has to integrate in an organic way the contents produced so far. With respect to this, the results of D1.1 – the development of a validation strategy and process and its concrete application – constitute an (evolving) starting point that can be used for subsequent validation and evaluation activities foreseen by the REFLOW project (i.e. *Task 1.5 - Validation and Performance Assessment* within the Building Block *Business and Design Co-Creation*).
Moreover, this Deliverable, as it has a relation with the previous *D5.1 Detailed Pilot Planning & Evaluation Framework*, can have contact points with the other deliverables developed in M12 (i.e. *D1.2 - Cities' Circular Action Plans,* which concerns the circularity of the Action Plans elaborated by the Pilot Cities; *D2.1 - Use Case Analysis and Requirement*s, which concerns the technological infrastructure of REFLOW; *D3.1 - Circular Principles*, which concerns methodologies for circular materials flow analyses and management; D4.2 - *The Productive Cities Toolkit - beta*). These four deliverables, after their final submission to M12 might be analysed and aligned by the Consortium and addressed according to the further project developments influenced by relevant externalities such as COVID-19.
The COVID-19 crisis in fact is another ongoing element whose direct and indirect impacts are currently being assessed within REFLOW through the activation of an internal working group focused on COVID-19 Risk Assessment. The

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relevance of this emergency could modify or alter both the iterative nature of this deliverable and the iterative nature of the activities to be developed according to the Pilot Cities Action Plans.
The acknowledgement of these dynamics leads us to identify the following suggestions related to the development of strategies and processes of validation of circular practices and actions in urban contexts (the REFLOW Pilot Cities):

1. *The interdependence between process and object of validation.* The strategy and process of validation must take into account the systemic and dynamic nature of experimental actions for Circular Economy. For this reason, a strategy and validation process evolve together with the different phases of the actions (*ex-ante, in itinere, ex-post)* to be validated.

2. *Validation as a qualitative research activity that stimulates and supports action-research processes for circularity.* The analysis of the scientific literature shows that validation is common to a qualitative research practice that is primarily aimed at observing complex phenomena within their natural settings. This approach can be used to stimulate or support experimental actions to combine, modulate and balance the use of desk and on-field research practices leading to the development of the outputs to be validated.

3. *The accuracy of documentation in validation processes.* Validation is a practice whose effectiveness is closely related to the level of accuracy of the available information. The more certain and precise the information available is, the more accurate validation activities become. In the field of experimental actions for circularity the documentation usable for validation can be characterized by different levels of complexity: for the validation of the initial stages of experimental actions the elements considered are *data or information related to plans*, for the validation of subsequent stages of development the elements to be considered can be *datasets* and *prototypes*.

4. *Validation as a standardizable and outsourceable process.* The study of the literature on validation shows how, as the complexity of an experimental action and its outputs (which therefore have a direct impact on the application contexts) increases, the validation activity from a purely internal point of view tends to involve external actors with different points of view and, once the experiment is over, validation can be modelled or standardized to become a shared, common practice, applicable in several contexts and executable by several subjects.

Starting from these suggestions, how to move on to the definition "of a validation model for circular actions in cities"? How to enable it in terms of *scalability* of this model in other urban contexts outside REFLOW?
The first question to be verified concerns the relevance and usefulness of a model for the validation of experimental project actions dedicated to cities' transition towards circularity.
The assumptions of the REFLOW project foresee the development of a set of conceptual and operational tools to support circular practices in cities. The analysis of the literature has made us understand that there is an emerging repertoire of project tools that stimulate and enable circular project actions.

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Now (M12), the REFLOW project can be positioned at the beginning of the *Ignition* phase of the validation ladder (see Figure 5.3) and this means that we have to integrate and rationalise our knowledge and capability to move from an abstract plan to a concrete and pragmatic one.
We are starting to build a common *repertoire* of tools, processes, technologies that can help us move from ideas to real experiment. We need to put all these things together and start shifting from a basic *what if* to a more defined and detailed real experiment.
By doing this, we will start our itinerary in the project's roadmap moving from a first analytic and conceptual grounding to a real and operational activity plan which may be iteratively developed and assessed to verify its scalability and, in the future, its replicability.

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