Reflow | Co-Creating Circular Resource Flows in Cities

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

Deliverable 1.3

THE REFLOW FRAMEWORK

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DELIVERABLE

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Abstract	This report introduces the REFLOW Framework as a supportive model to enable agency and participation of municipalities, SMEs, and citizens' associations in the development of CE practices and governance. After introducing the key terminology informing the REFLOW's understanding of cities' transition towards CE, this deliverable provides the most updated version of the REFLOW Pilot Cities' Circular Action Plans, including their final list of key performance indicators, and main implementation challenges encountered so far. Based on insights from research and practice, as well as from the experience of the first two years of the REFLOW project, the REFLOW Framework integrates key concepts from systems thinking, management accounting, iterative design, and Circular Economy research to understand and describe circular transitions in cities. As a supportive model, the REFLOW Framework enables to unpack the inherent complexity characterising cities' transitions towards Circular Economy, and inform management, governance and implementation of Cities' Circular Action Plans. The Framework described in this deliverable will serve as a baseline to support Cities' Ecosystem Design and the development of the REFLOW Legacy in the last year of the project.

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Keywords	Circular transition; circular design; circular economy challenges; circular economy case studies; regenerative cities.
Statement of Originality	This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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D1.3 v0.2	21 May 2021	Cristiana Parisi, Andrea Beye, Justyna Bekier	CBS	*Revised version based on reviewers' comments and suggested changes.*
D1.3 v0.3	27 May 2021	Cristiana Parisi, Andrea Beye, Justyna Bekier	CBS	*Revised version based on reviewers' comments and suggested changes.*
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Abbreviations

AGEC	Against Waste for a Circular Economy
B2B	Business to Business
B2C	Business to Customer
CCAP	Cities' Circular Action Plans (D1.2)
CCD	Circular Cities Declaration
CE	Circular Economy
CNR	National Research Council
EMF	Ellen MacArthur Foundation
EU	European Union
FAQ	Frequently Asked Question
GA	Grant Agreement
H2020	Horizon 2020
ICLEI	International Council for Local Environmental Initiatives
KPI	Key Performance Indicator
MDF	Medium-density fibreboard
MDM	Multilevel Design Model
MFA	Material Flow Analysis
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
RCGT	REFLOW Collaborative Governance Toolkit
SME	Small Medium Enterprise
ToC	Theory of Change
TRL	Technology Readiness Level

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WP	Work Package
WPL	Work Package Lead

Consortium Members

No	Name	Short name	Country
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3	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	FRAUNHOFER	Germany
4	POLITECNICO DI MILANO	POLIMI	Italy
5	STICHTING DYNE. ORG	DYNE	Netherlands
6	STICHTING METABOLIC INSTITUTE	METABOLIC	Netherlands
7	MATERIOM LIMITED	MATERIOM	United Kingdom
8	MOUAZAN ERWAN	ECOVALA	Finland
9	ORGANODI GIA TIN ERVNA TIN TEKMIRIOSI KAI TIN PROOTHISI TON OMOTIMON PRAKTIKON	P2P	Greece
10	STICHTING WAAG SOCIETY	WAAG	Netherlands
11	GEMEENTE AMSTERDAM	AMS	Netherlands
12	STICHTING PAKHUIS DE ZWIJGER	PDZ	Netherlands
13	BRINKS MANAGEMENT ADVICE/ TECHNE B.V	BMA	Netherlands
14	AGILE HEAP EV (PROTOTYPES FOR EUROPE)	AH (PROT)	Germany

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15	MCS DATALABS	MCS	Germany
16	COMUNE DI MILANO	MILAN	Italy
17	WEMAKE S.R.L.	WMK	Italy
18	OPENDOT SRL	OD	Italy
19	FAB CITY GRAND PARIS	FCGP	France
20	COMMUNE DE PARIS	PARIS	France
21	ARS LONGA	ARSL	France
22	VOLUMES	VOL	France
23	VEJLE KOMMUNE	VEJLE	Denmark
24	DANSK DESIGN CENTER APS	DDC	Denmark
25	MUNICIPUL CLUJ-NAPOCA	CLUJ	Romania
26	FILIALA TRANSILVANIA A ASOCIATIEI ROMANE PENTRU INDUSTRIA ELECTRONICA SI DE SOFTWARE	ARIES	Romania
27	INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE PENTRU TEHNOLOGII IZOTOPICE SI MOLECULARE-INCDTIM CLUJ-NAPOCA	ITIM	Romania
28	BERLIN WASSERBETRIEBE	BWB	Germany

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1 Introduction

1.1 About REFLOW

REFLOW is an EU Horizon 2020 research project running from 2019 to 2022 which aims to develop circular and regenerative cities. More specifically, it uses FabLabs and makerspaces as catalysers of a systemic change in urban and peri-urban environments, which enable, visualise, and regulate "four freedoms": free movements of materials, people and (technological) knowledge and commons, reduction of materials' consumption, maximization of multifunctional use of (public) spaces and envisaging regenerative practices.

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

1.2 About the Deliverable

The objective of this publication is to enable agency and participation of municipalities, SMEs, and citizen's associations in the development of circular economy practices and governance in cities. The REFLOW Framework described in this deliverable is the result of the project participants' effort to refine the REFLOW Vision of a Circular and Regenerative City and develop a general model that can serve relevant city stakeholders to understand and organize urban transitions towards circular economy. In this regard, the REFLOW Framework should help future cities interested in developing and implementing circular strategies to better capture the complexity of their Circular Action Plans and link planned actions to expected outcomes. This aim is also supported by the final list of Key Performance Indicators (KPIs) selected by the REFLOW Pilots to inform the development of their action plans, as well as by a general description of the methodology applied in REFLOW for the definition of relevant KPIs.

The target audience of this publication is twofold. On the one hand, Chapter 1 reports to the European Commission on the REFLOW progress in the implementation of the project mission, "to understand and demonstrate how the reconfiguration of urban metabolism can enable the transition towards a circular economy". This is done by linking the development of the REFLOW Framework to the ongoing project activities and expected next steps on a Work Package and Pilot level. On the other hand, Chapter 2 and Chapter 3 presents a general model to relevant cities' stakeholders (see Table 1) to understand and organize circular transitions towards CE.

Target Group	Description	Interest in the Project
A – Industry Stakeholders	Urban manufacturers and their associations as well as technology providers, in particular those operating in the domains directly related with REFLOW.	▪ Use of project's results in everyday operations ▪ Training on project's outcomes ▪ Participation in the project's events
B – FabLabs and Makerspaces	Grassroots organizations, open to the public that offer tools and services for digital manufacturing,	▪ Participation in the project's events ▪ Exploitation of project's results ▪ Inspiration for new ideas and application

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	thus promoting social and economic innovation.	
C – Public Administrations	Other EU municipalities which could be interested in adopting CE practices and tools	▪ Exploitation of project's results ▪ Training on project's outcomes ▪ Bilateral participation in events for knowledge exchange
D – EU Associations and Clusters	European initiatives and clusters, e.g., Covenant of Mayors, C40, Fab City Global Initiative.	▪ Inclusion of project's results to collaborative research activities (roadmap, whitepapers) ▪ Dissemination of project's results to their members ▪ Bilateral participation in events for knowledge exchange
E – Circular Economy Stakeholders	Participants, partners, and other relevant stakeholders active in EU projects and other initiatives.	▪ Identification of common topics ▪ Synergies and collaborations for results promotion ▪ Enhancing innovation through results combination ▪ Co-organisation of events
F – Research & Academia	Individuals engaged in research initiatives and/or working in research/academic institutes conducting research on Circular Economy.	▪ Further advancements on the project's research ▪ Extension / reuse of the project's innovative technologies to other application domains ▪ Inspiration for future research initiatives based on the project's concept and results ▪ Participation in the project's events
G – Policy Makers	Policy makers at local, regional, and national level, such as public authorities, regulatory agencies, and ministries.	▪ Evaluation of the project's Social-Technological-Economic-Environmental-Political (STEEP) aspects ▪ Definition of future innovation directions taking into account the project's acquired knowledge and experience
H – General Public	End users who benefit from the project outcomes.	▪ Use of project's results in everyday operations ▪ Understand the benefits offered by the project ▪ Take part in the activities of the project

Table 1: Target Audiences for Dissemination and Communication from the REFLOW GA, Part B

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1.3 About the REFLOW Framework: Background Information and Terminology

1.3.1 Objectives and Definition of the REFLOW Framework

The REFLOW Framework is defined as a supportive model to enable agency and participation of municipalities, SMEs, and citizen´s associations in the development of circular economy practices and governance in cities. The REFLOW Framework (Figure 1) is inspired by systemic design research on iterative models, circular economy research and experience from REFLOW pilot cities' action plans development and implementation.

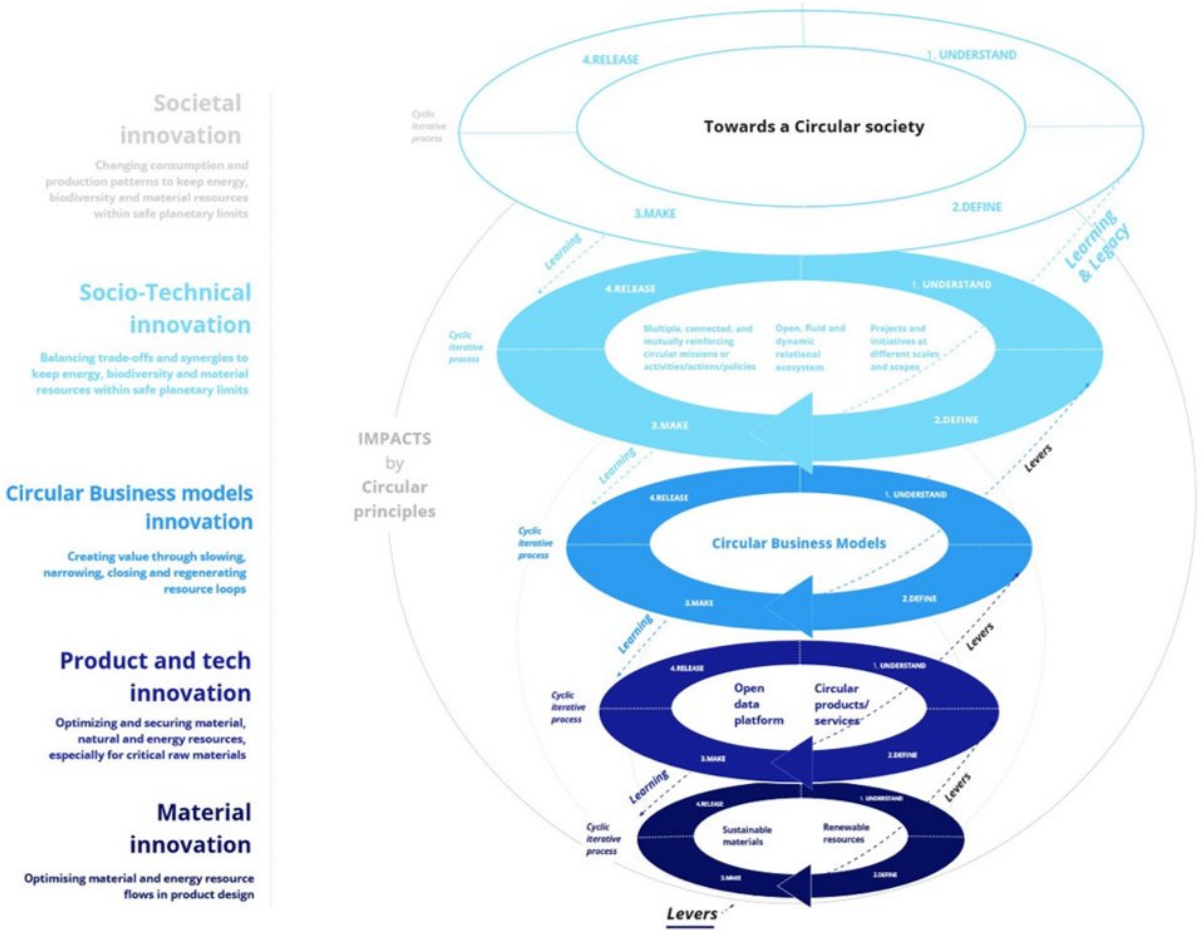

Figure 1: The REFLOW Framework. Source: Copenhagen Business School

As a supportive model, the REFLOW Framework is based on the adaptation of Joore and Brezet's (2015) Multilevel Design Model (Figure 2) to support the pilot cities' circular transitions by:

- Providing insights on the development of new products and product-service systems for a circular economy, which can benefit urban and peri-urban environments as well as society as a whole.
- Providing insights on the links between functional problems and broader societal issues relevant in the creation of circular and regenerative cities.
- Supporting the description of the design process, change process and transition process to describe and understand future design-based initiatives for CE transition.

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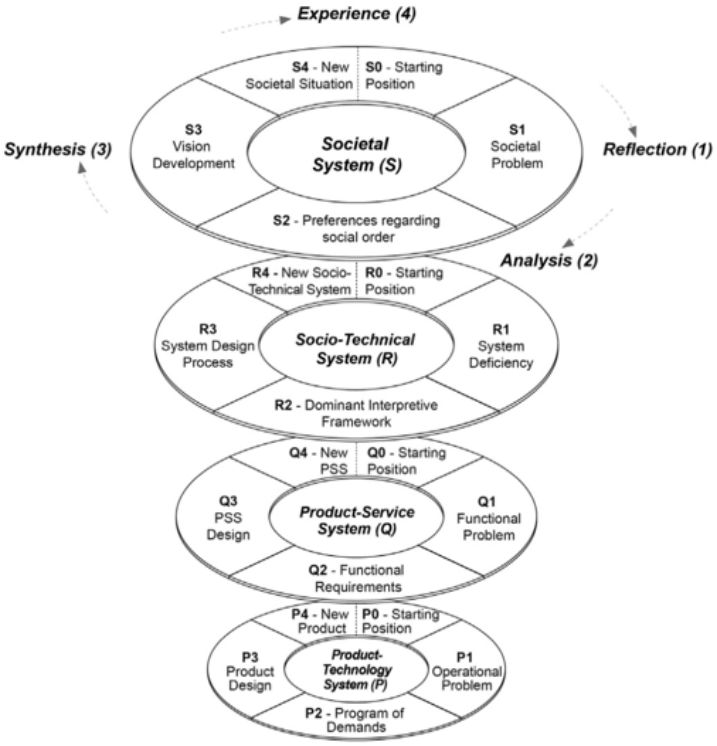

Figure 2: Multilevel Design Model. Source: Joore and Brezet, 2015

1.3.2 From the Cities' Circular Action Plans (D1.2) to the REFLOW Framework (D1.3)

The REFLOW Framework is the result of the processes and activities implemented throughout the second year of the REFLOW project. In this sense, it continues and further develops the work dedicated to the definition of the REFLOW Methodology, in the form of the REFLOW Vision, REFLOW Process and REFLOW work package Resources (WP Resources), to enable the pilot cities' transitions towards a circular economy. Such work was first introduced in D1.2 Cities' Circular Action Plans (CCAP), published after the first year of REFLOW. Key concepts introduced in the CCAP inherently links itself to the content and development of this deliverable, D1.3 The REFLOW Framework.

Each of these key concepts are presented in the following sections and can be read as follows: (1) a summary of the concept is provided for understanding and (2) the concepts' connections to their envisioned purpose to the REFLOW Framework and beyond REFLOW are defined.

1.3.3 The REFLOW Vision of a Circular and Regenerative City

The REFLOW Vision describes how REFLOW understands the transition towards becoming a circular and regenerative city. The following REFLOW Vision statement was developed during the first year of the project and presented in D1.2.

"A circular and regenerative city in REFLOW represents an urban system with social and business practices which place equal attention to social, environmental, and economic impact; where technology is open and represents a central enabler of positive social and environmental change; where the urban system ensures and support resilience of social and ecological systems; where governance is collaborative and inclusive; where knowledge is shared, and stakeholders are active and involved" (Parisi et al., 2020, p.91).

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The initial development of the REFLOW Vision (Figure 3) was based on two main elements: (1) the definition of the main theories and approaches applied in REFLOW (2) a survey with the different REFLOW stakeholders. First, the REFLOW Vision was informed by the knowledge underlying the different building blocks of REFLOW, contributing to the development of the Cities' Circular Action Plans. Second, the survey described how the different stakeholders involved in the implementation of pilot cities' action plans understand circular economy.

The REFLOW Framework embodies the updated representation of the REFLOW Vision.

- **REFLOW Framework and REFLOW Vision**: As a supportive general model, the REFLOW Framework has been based on the REFLOW understanding of circular and regenerative cities, and thereby represents the REFLOW Vision.
- **Beyond REFLOW:** The REFLOW Vision aims to drive and inspire future cities' transitions towards becoming circular and regenerative.

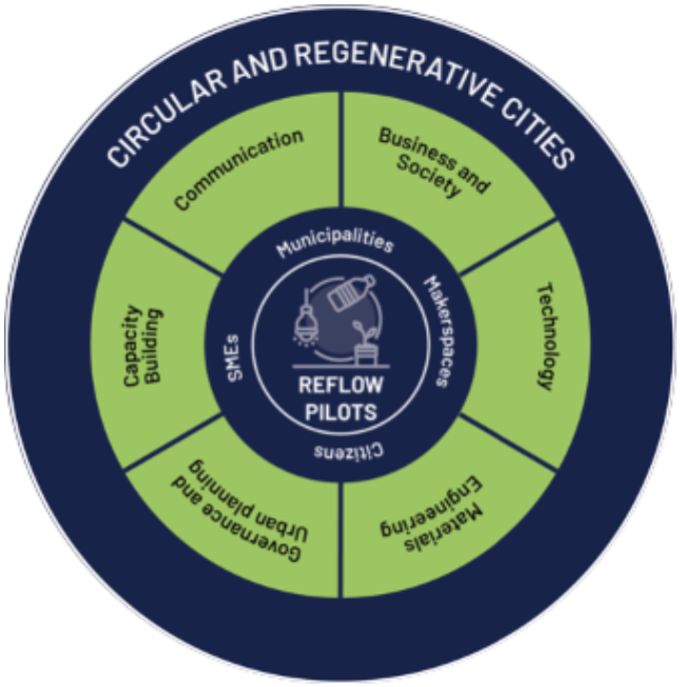

Figure 3: The REFLOW Vision. Source: REFLOW D1.2 - Cities' Circular Action Plans, 2020

1.3.4 Cities' Circular Action Plans (or "Pilot Action Plans")

The Cities' Circular Action Plan (CCAP) is the roadmap for the transition toward circular and regenerative cities. In this regard, the Cities' Circular Action Plan is the result of the collective action undertaken by the different agents involved in the project by work packages (WPs) and pilot cities.

- **REFLOW Framework and Action Plans**: As a supportive model, the REFLOW Framework seeks to unpack the complexity characterising the Cities' Circular Action Plans, and support the actors involved in circular transitions, linking actions to expected outcomes.
- **Beyond REFLOW:** Development and implementation of action plans in REFLOW can provide a baseline or a source of inspiration for future cities interested in implementing circular transitions.

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1.3.5 Pilot Cities (or "REFLOW Pilots" or "Pilots")

The REFLOW pilots consist of the following six cities: Amsterdam, Berlin, Cluj-Napoca, Milan, Paris and Vejle. The selected group of cities includes both large European capitals and average or smaller sized European cities. When we refer to the pilot cities, we refer to the local consortium involved in the development and implementation of the Cities' Circular Action Plan. The local consortiums are composed by representatives of the city's municipality, makerspaces, FabLabs or SMEs. Although all pilot cities seek to co-create and develop CE strategies, each city has chosen a different problem to address, related to one specific material stream. This circumstance makes the different Cities' Circular Action Plans context-specific – not only in relation to the different problems addressed, but also in relation to the different modes of organising.

- **REFLOW Framework and the Pilot Cities:** As a supportive general model, the REFLOW Framework is meant to support the pilot cities in addressing their context-specific challenges.
- **Beyond REFLOW:** The experience of the REFLOW pilot cities is supposed to inform and provide relevant insights for any future city interested in transitioning towards a circular economy.

1.3.6 Work Packages (or WPs):

REFLOW is organised into 9 work packages (WPs) which support the pilot cities in the development of their action plans. A work package consists of a team of experts from multiple organisations responsible for a particular work stream and aspect of the project, including a number of tasks and deliverables to be executed. Based on the focus of the work package, each WP provides the pilot cities with specific expertise and support in carrying out their action plans.

- **REFLOW Framework and Work Packages:** WPs have played a key role in the conceptualization and development of the REFLOW Framework. As a supportive model, the REFLOW Framework fosters the understanding of the relationship between pilot cities and work packages, as well as between the local consortia and team of experts involved in CE transition.
- **Beyond REFLOW:** The experience of WPs can inform and provide insights on the key competences and tasks that can support future cities' action plans development and implementation.

1.3.7 Building Blocks (Infrastructuring dimensions)

The notion of building block has been described in detail in D1.2. A building block describes the theoretical and thematic area within which WPs perform their tasks. Originally, each WP has been related to one or more building block. In other words, building blocks comprise the different theories, methods, and approaches that the REFLOW WPs use to develop their activities. The notion of building block has been revised in the development of the REFLOW Framework to reflect 3 more general dimensions that can drive the development of Cities' Circular Action Plans. These are the strategic, operational, and relational dimensions described in Chapter 3, section 3.4.3.

- **REFLOW Framework and Building Blocks**: the infrastructuring dimensions (strategic, operational, and relational) represent one of the components of the REFLOW Framework as described in Chapter 3.
    - **Beyond REFLOW:** The infrastructuring dimensions will inform understanding and implementation of the processes of collaborative governance related to the transition towards CE, as described in section 3.5.3.

1.3.8 REFLOW Process

The REFLOW Process describes the key practices and elements to take into consideration in the organization and governance of circular transitions towards CE. The work on the REFLOW Process has been described in D1.2, with a focus

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on the coordination mechanisms introduced to facilitate alignment and coordination and address the challenges identified. The REFLOW Process is informed by two key elements. First the Theory of Change (ToC) of REFLOW describes the causal pathway that links the project activities, outputs and outcomes. Second the Circular Design Thinking Framework, informed by the Ellen MacArthur Foundation Circular Design guide (EMF, 2020) and principles from design thinking and managerial accounting, provides a baseline for continuous improvement and coordination. The implementation of the REFLOW Process through the second year of the project has led to the development of the REFLOW Framework.

- **REFLOW Framework and REFLOW Process:** The REFLOW Framework responds to the need of generalizing the key learnings from implementing the REFLOW Process, and to provide a supportive model for future cities willing to become circular and regenerative.
- **Beyond REFLOW:** Key learnings as well as resources developed throughout the implementation of the REFLOW process will provide future cities the opportunity to replicate REFLOW actions and implement their transition towards CE.

1.3.9 REFLOW WP resources

REFLOW resources refer to instruments, tools or methods developed by WPs to enable the development and implementation of Cities' Circular Action Plans. Some of the resources, such as the REFLOW Framework, are developed in collaboration between more work packages when synergies are identified. The updated list of REFLOW Resources is included in Section 3.5.2.

- **REFLOW Framework and REFLOW Resources:** The REFLOW Framework is one of the REFLOW Resources developed throughout the project. Moreover, the REFLOW Framework provide insights on how other REFLOW Resources are used in the implementation of Cities' Circular Action Plans.
- **Beyond REFLOW:** REFLOW Resources will be accessible to other cities that want to implement their transition towards circular economy.

1.3.10 REFLOW Pilot Solutions

REFLOW Pilot Solutions refer to the circular solutions developed by the REFLOW pilot cities throughout the project. These broadly refer to instruments, tools, methodologies, governance and business models ideated, prototyped or tested by the pilot cities within the project. Some resources are built upon REFLOW Resources by leveraging on the collaboration between WPs and pilot cities. The updated list of REFLOW Pilot solutions is included in Section 3.5.1.

- **REFLOW Framework and REFLOW Pilot Solutions:** The REFLOW Framework provides insights on how different pilot solutions are developed and linked to the expected outcomes of the pilot cities.
- **Beyond REFLOW:** REFLOW Pilot solutions will function as a source of inspiration or opportunities for new collaborations with other cities that want to implement their transition towards circular economy.

1.4 Outline of the Following Sections

Deliverable 1.3 – The REFLOW Framework is structured in three main chapters. Chapter 1 has reported REFLOW progress in implementing the project mission. The subsequent chapters of D1.3 are outlined as follows:

Chapter 2 presents the most updated version of the REFLOW Pilots´ Action Plans, thereby providing an in-depth description of the six circular transitions taking place within REFLOW. This section also provides the final list of KPIs defined by the pilot cities as well as the main challenges encountered in the action plans implementation. Chapter 3

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presents the description of the REFLOW Framework as a supportive model to organize and guide cities' circular transitions. The chapter begins by describing the key elements concerning the development of the REFLOW Framework. In particular, it outlines the objectives and definition of the REFLOW Framework and positions the model in relation to other existing frameworks and initiatives supporting circular economy transitions in Europe. The chapter further outlines the methodological approach and the links between the REFLOW Framework and ongoing work packages and pilots' activities. Finally, Chapter 3 concludes by describing the REFLOW Framework. This consists of a general model developed in REFLOW to represent and organize cities' circular transitions. This section describes the logic and terminology of the REFLOW Framework wrapping up with envisioned next steps related to its implementation in the final year of the project and beyond.

2 Pilot Action Plans and Final List of KPIs

This chapter presents the action plans of the six REFLOW pilot cities. The objective of this chapter is to demonstrate the process of circular transition in cities describing the activities implemented by each of the pilot cities, as well as their expected outputs, outcomes, and impacts. The action plans are supplemented with Key Performance Indicators (KPIs) developed through an iterative process by the pilot cities.

The action plans presented in this deliverable are a continuation of the action plans outlined in REFLOW Deliverable 1.2 - Cities' Circular Action Plans. The case studies included in Deliverable 1.2 described the pilot projects in terms of their city context, project details, and challenges encountered in the transition from linear to circular economy and included the description of next steps. This Deliverable – D1.3, builds on these case studies to showcase the envisioned pathway of change from linear to circular practices in the pilot cities, and to demonstrate how progress on such a transition can be measured via KPIs.

As such, pilot city action plans can provide a deeper understanding of intricacies of circular transition for any city that aims to follow a similar path. They also provide a foundation for a practical application of REFLOW Framework, which will be illustrated with examples in Chapter 3.

The chapter is organized as follows: first, Section 2.1 presents the methodological approach to development of action plans and the KPIs, outlining different processes that supported their formulation and further refinement. Next, the individual action plans of the REFLOW pilot cities are presented in Section 2.2. Lastly, Section 2.3 is dedicated to concluding remarks.

2.1 Action Plans Methodological Approach

The following section presents four key processes that supported the development of action plans in the REFLOW pilot cities. First, the Theory of Change methodology and the iterative process of its development in REFLOW is described. The next sub-section describes the development of Key Performance Indicators through a co-creation process and provides a short description of the overall impact assessment approach in REFLOW. The last two sub-sections outline the supporting processes of WP-Pilot alignment and co-design workshops, respectively, which proved to be valuable moments of interaction and collaboration in refining the pilot city action plans.

2.1.1 Theory of Change

The Theory of Change (ToC) is used in REFLOW as a baseline for common understanding in the project. The methodology links activities, outputs, and outcomes by describing the pathway to change, through which the REFLOW pilot cities and the project itself expect to generate desired impact. In this regard, using the Theory of Change as a baseline in the project provides an understanding of the dynamic nature of the REFLOW system, upon which coherent alignment and

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coordination processes can be further developed. Moreover, the Theory of Change is employed as a monitoring and evaluation tool at the pilot-level, mapping and narrating the six pilot cities' journeys as they evolve and unfold over the course of REFLOW.

The Theory of Change is continuously updated throughout the project lifetime across several iterative sessions with each pilot city, to gather longitudinal data that will feed into the quantification of the social impact at the end of the project. In essence, the Theory of Change implements a critical thinking approach into the design, monitoring and evaluation of a program. It provides an explanation of how the stakeholders involved expect to reach desired impact while also identifying financial proxies or indicators, that will map the performance of the key social activities carried out within each pilot city. The Theory of Change plays a key role in the update of the Pilot City Action Plans, which are underpinned by each pilot cities' pathway to change and envisioned impact towards becoming circular and regenerative.

Theory of Change Development

To illustratively present this pathway to change, the Theory of Change is manifested through visual representations and accompanying narratives to exemplify and make sense of the complex relations between the activities carried out, the outputs generated, and the outcomes and impact achieved in addressing the overall challenge at the project- and pilot-levels. Over the course of two years in REFLOW, the Theory of Change model has been adapted in response to the high degrees of complexity and alignment within the pilot action plans as well as across the other work packages in REFLOW. Thus, the development of the ToC model has evolved and migrated onto the online visual collaborative platform, Miro. This tool has provided the flexibility and non-linearity needed to advance updates to the ToC across the series of iterations with the pilot cities.

The initial model created by each pilot city was developed over a series of calls and meetings with the pilot partners to design the first version of the Theory of Change in February 2020. Pilot cities were supplied with Word document templates where pathways to change were filled out according to the pilot-specific impact and interventions.

The first iteration of the ToC took place in March 2020 with guidance from WP1. During this process, the pilots continued to further define their pathways to change with specific focus on the underlying assumptions, which describe the necessary preconditions for change to occur. This version was used to inform the pilot case studies presented in D1.2 Circular Cities' Action Plans.

In preparation for the second Theory of Change iteration, the pilot ToC models were converted from Word document templates onto the online visual collaborative platform, Miro in response to the increasing need for flexibility when addressing high degrees of complexity in the pilot interventions (Figure 4). During this conversion, internal discussions among WP1 took place to align on the concepts used within the ToC and what each concept addressed. These concepts centred around the core elements of the Theory of Change, which includes challenges, activities, outputs, outcomes, and impact. Further, during these discussions within WP1, the addition of distinguishing between the range of outcomes achieved between mid- and long-term outcomes was added to further clarify causality. Following this refinement, drawing upon a variety of pilot resources, inputs were mapped out into causal pathways by WP1, ready to be validated by the pilot cities during the second iteration.

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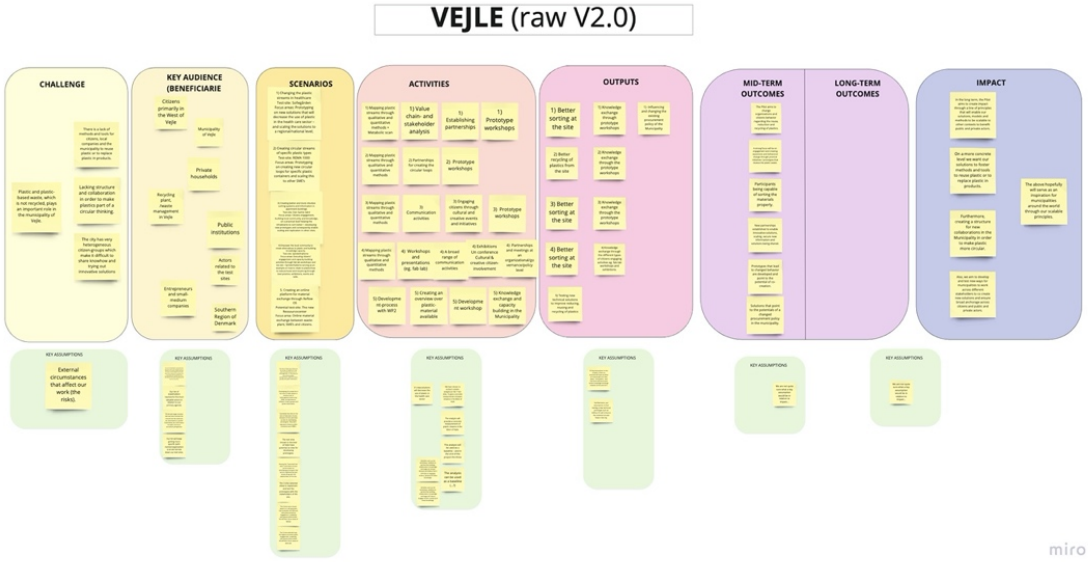

Figure 4: Vejle's Theory of Change Version 2.0 before the iteration session in September 2020.The image displays the initial conversion from the ToC on Word to Miro

The second iteration took place in September and October 2020 with the objective to validate and refine the causal pathways within each pilot. Additionally, the iterative sessions provided an opportunity to align on understandings of the purpose and concepts used in the ToC with the pilot cities. The series of the second iteration sessions with the pilots focused largely towards understanding the overall pathway to change of each city. This process started off with refining the core challenge of each pilot and moving towards understanding what they envisioned as their overall impact triggered by their intervention. To map out the causal pathways, connecting lines were added to the ToC Boards to delineate the causal relationships across the pilot cities' scenarios, beneficiaries, activities, outputs, outcomes, and impact (Figure 5). Following this second iteration, the ToC development process for each pilot was captured and released in a re-iterated version of the ToC Board on Miro, together with a ToC Iteration Report depicting the evolution and current state of the pilot cities' ToC narratives.

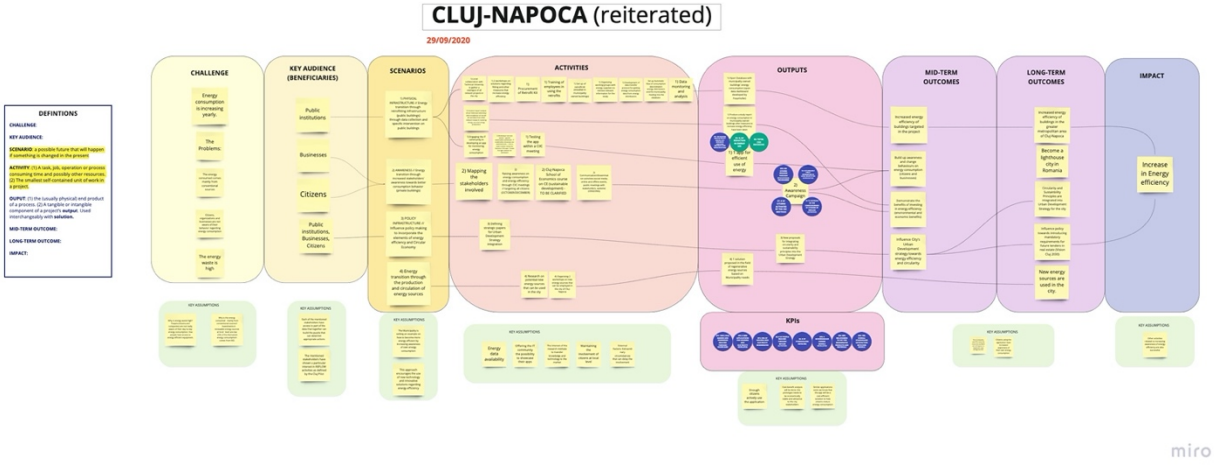

Figure 5: Cluj-Napoca's ToC Board on Miro following the second ToC iteration in September 2020

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The third iteration took place across February to March 2021 with the overall objective to validate the pilot specific KPIs and to connect these with the activities and outputs carried out in each pilot intervention. Furthermore, the iteration served as an opportunity to identify any shortcomings or gaps within the KPI targets, monitoring and descriptions before their finalisation in M24. In preparation for these iteration sessions with the pilot cities, the ToC Board visualisations were updated to include the KPIs stipulated in the GA, in addition to the KPIs co-created by the pilots (Figure 6). Over the course of these iteration sessions, questions regarding the refinement of the KPIs' descriptions surfaced across the pilots and how this redefinition could be worked around and achieved through specific activities and outputs. In addition to the pilots own internal discussions regarding their KPIs, follow-up sessions with specific pilots were also carried out to progress and further link the activities and outputs stated in their ToCs to specific KPIs. Further details of the development of the KPIs are explored in the next section.

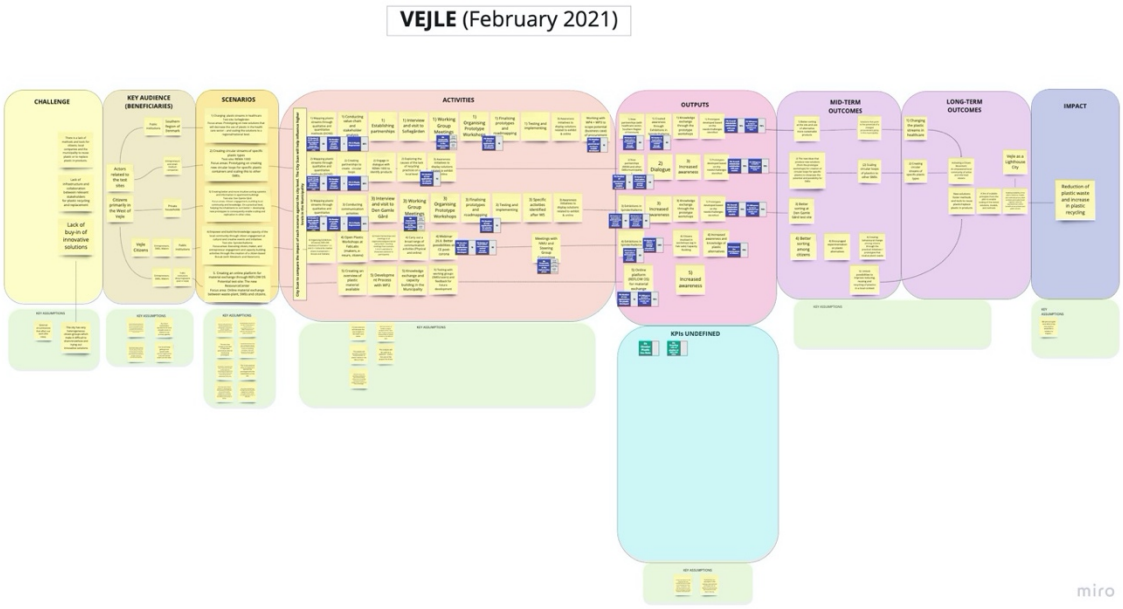

Figure 6: Screenshot of Vejle's ToC iteration from February 2021. KPIs were added and validated during this iteration session

2.1.2 Development of Key Performance Indicators

The need to assess the state of the art, progress and impacts of circular economy has been long recognized, with at least four benefits of performance measurement practice highlighted (OECD, 2020):

- Measuring progress and communicating impacts can raise awareness of the circular economy and related opportunities;
- Performance measurement can provide a better understanding of benefits and costs by type of activity, and hence 'make the case' for circular economy;
- Adequate and specific information can trigger action in terms of, for instance, setting policy priorities;
- Measurement and monitoring frameworks help assessing progress and performance of circular economy initiatives, identifying what works and which areas should be improved in the way forward.

To date, a vast number of indicators related to circular economy has been developed. However, different sources emphasise different metrics, and the categorisations and groups of indicators also vary between sources. For instance, EU Eco-innovation Action Plan (2021) suggests circular economy indicators based on three groups: (1) sustainable

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resource management, (2) societal behaviour, and (3) business operations (EU 2020). On the other hand, OECD divides circular economy indicators into five categories: (1) environment, (2) governance, (3) economic and business, (4) infrastructure and technology, and (5) jobs, and further breaks down this classification into 33 sub-categories and 11 sectors (OECD, 2020). The most recent inventory prepared by OECD collected 474 circular economy indicators that can be employed by governments at local and national levels (OECD, forthcoming).

As no one-size-fits-all solution exists for the measurement of a circular economy transition, it was important for the REFLOW pilot cities to identify and calibrate a set of Key Performance Indicators (KPIs) that would reflect their city context and focus of their respective project and support their progress towards circular economy in the most fitting way.

D3.1 - Circular Principles and Indicators, delivered in M12 by WP3, introduced the impact assessment approach used in REFLOW and outlined the methodology used in the development of environmental (and, in part, also socio-economic) KPIs. This methodology is summarized in brief below and expanded with the elements that led to development of socio-economic KPIs.

Impact Assessment in REFLOW

The impact assessment process of REFLOW is primarily coordinated by WP1 and WP3, where WP1 is tasked with overseeing the KPI development and monitoring activities associated with social and economic impact, while WP3 oversees the KPI development and monitoring activities associated with environmental impact.

From the project's beginning, each pilot city in REFLOW has been working with a set of pre-defined KPIs included in the REFLOW Grant Agreement (2019). These KPIs, which have been defined before the project kick-off, are similar across all six pilot cities. Out of the set of 9 KPIs, only 2 are pilot-specific (with Berlin being an exception, since the list has been updated later in the project). They have been purposefully designed as such, with categories broad enough to apply to all pilot cities. These KPIs – called proposal KPIs in the project - address different areas of circular economy, including both an environmental and socio-economic focus.

Moreover, WP1 and WP3 collaborated on the development of the methodology for KPI co-creation - a process designed to facilitate the development of additional environmental and socio-economic KPIs in the REFLOW pilot cities. These KPIs are called co-created KPIs in the project. The results of this process were presented in D3.1 (environmental KPIs), and the additional socio-economic KPIs are demonstrated in each pilot city action plan in this deliverable.

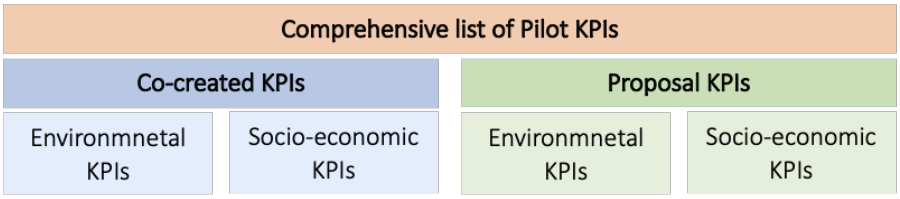

Figure 7: Indicative structure of Key Performance Indicators in REFLOW pilot cities

KPI Co-Creation Process in REFLOW

The process of KPI co-creation has been implemented in REFLOW with an overarching goal of equipping pilot cities with a comprehensive set of KPIs relevant to their unique contexts, objectives, and activities. This process has been carried out in three distinct stages:

Stage 1: Initiation was facilitated jointly by METABOLIC (WP3) and CBS (WP1) and involved both the groundwork in the form of the 'KPI long list' preparation as well as the engagement of each pilot city in shortlisting and assessing relevance of the selected KPIs via a stakeholder survey.

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Stage 2: Calibration involved modifying and refining of the socio-economic and the environmental KPIs as well as establishment of their related monitoring approach. This step was completed via a co-creation process coordinated individually with the pilots either by WP1 or WP3 (depending on the socio-economic or environmental theme of the KPIs).

Stage 3: Consolidation where the calibrated environmental, socio-economic, and 'proposal KPIs' were consolidated into a comprehensive KPI list for each pilot city, further refined and finalized during the second co-design workshop in M23 of the project (see description below for further elaboration of this process).

Individually, the KPI co-creation activities entailed:

KPI long list: in a joint effort, METABOLIC (WP3) and CBS (WP1) conducted a literature review of sources from leading institutions, organizations, and think-tanks to identify social, economic, and environmental KPIs that support quantifying and measuring circular transition. EU directives, global indicator datasets (published by leading institutions such as e.g., OECD; EMF) and academic sources have been identified, analysed, and consolidated into a KPI long list representing best practice in the field, with a final count of 120 indicators. Further details of the long-listing process are provided in Deliverable 3.1. (WP3).

Shortlisting of KPIs: the next step in the process was orchestrated by METABOLIC (WP3) with support from CBS (WP1), where co-creation meetings were arranged with each pilot city to review the KPI long list and select KPIs of highest relevance and interest to each pilot city team. The meetings were intended to support pilot city teams in assessing and refining the KPIs, in order to ensure their appropriateness and feasibility in terms of e.g., data collection and monitoring. The shortlisting of KPIs took place in M09-M10 of the project. Further details of the shortlisting process are provided in Deliverable 3.1. (WP3).

Stakeholder survey: in a process spearheaded by METABOLIC (WP3), an online survey was created and circulated among each pilot city's consortium members. The purpose of the survey was, as described in D3.1., to (1) share, prioritize and validate the results of KPI shortlisting with the local stakeholders of each pilot city; (2) to collect information regarding data availability and monitoring approaches for the environmental KPIs; and (3) to secure buy-in and agreement from local stakeholders to lead monitoring efforts on the specific KPIs. A tangible result of the survey was a ranking of all shortlisted KPIs, illustrating which KPIs were the most and least supported by the stakeholders in each pilot city. A detailed description of the methodology used in survey design, data collection and analysis are provided in Deliverable 3.1. (WP3).

Calibration of *proposal KPIs* and socio-economic *co-created KPIs*: at this stage of the process, individual meetings with pilot cities were scheduled and conducted in order to calibrate the shortlisted KPIs to best reflect each city's context and ambitions. The objective of these meetings was to refine the formulation of KPIs and establish ambitious but realistic targets, as well as to define the monitoring approach for each of the KPIs. While environmental KPIs were calibrated ahead of Deliverable 3.1. due in M12 of the project, socio-economic KPI calibration process started in M15. During the first calibration meetings with pilot city teams, it became evident that a similar process of calibration was also needed in relation to the 'proposal KPIs' - i.e., KPIs that were stipulated for each pilot city in the REFLOW Grant Agreement. Therefore, to accommodate this need and establish a comprehensive set of demanding, but achievable KPIs, further meetings were scheduled to calibrate the formulation and targets of the 'proposal KPIs' where necessary.

Consolidation of results and review in co-design workshop: to ensure further alignment and cohesiveness of the KPI calibration processes, the results of environmental, socio-economic and 'proposal KPI' calibration were merged into one coherent KPI list, and further discussed with the pilot city teams during individual sessions at the second REFLOW co-design workshops in April 2020 (M23 of the project). Each city team attended a session facilitated by members from both WP1 and WP3 in order to make any last adjustments and finalize the entire list of KPIs. This presented an opportunity for pilot city teams to revise some of the environmental KPIs, established a year earlier in D3.1, and refine

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them according to the most current situation in their pilot projects. The results of this process are presented in the pilot city action plans in this deliverable, where any changes to the previously established KPIs ('proposal KPIs' from the Grant Agreement, or environmental KPIs from D3.1.) are highlighted and justified.

2.1.3 WP-Pilot Alignment

The alignment between work packages and pilot cities have been ongoing throughout the duration of REFLOW, taking place across a series of meetings and workshops. Accordingly, this alignment has been a key supporting process for the development of the pilot cities' action plans. Following the first year of the project, the collaboration between the WPs and pilot cities intensified across regular online meetings with the focus on operationalising the pilot city action plans introduced in D1.2 - Cities' Circular Action Plans. Online Miro boards were used to materialise synergies, timelines, deadlines, objectives, scenarios, activities, and expected outputs of each pilot city action plan (Figure 8). This process followed the Pilot Canvas Approach, initially developed in WP4, with further refinements and iterations to the canvas provided by WPL inputs. The boards are meant to be a living document that the pilots and the WPLs use to foster ongoing collaboration and alignment.

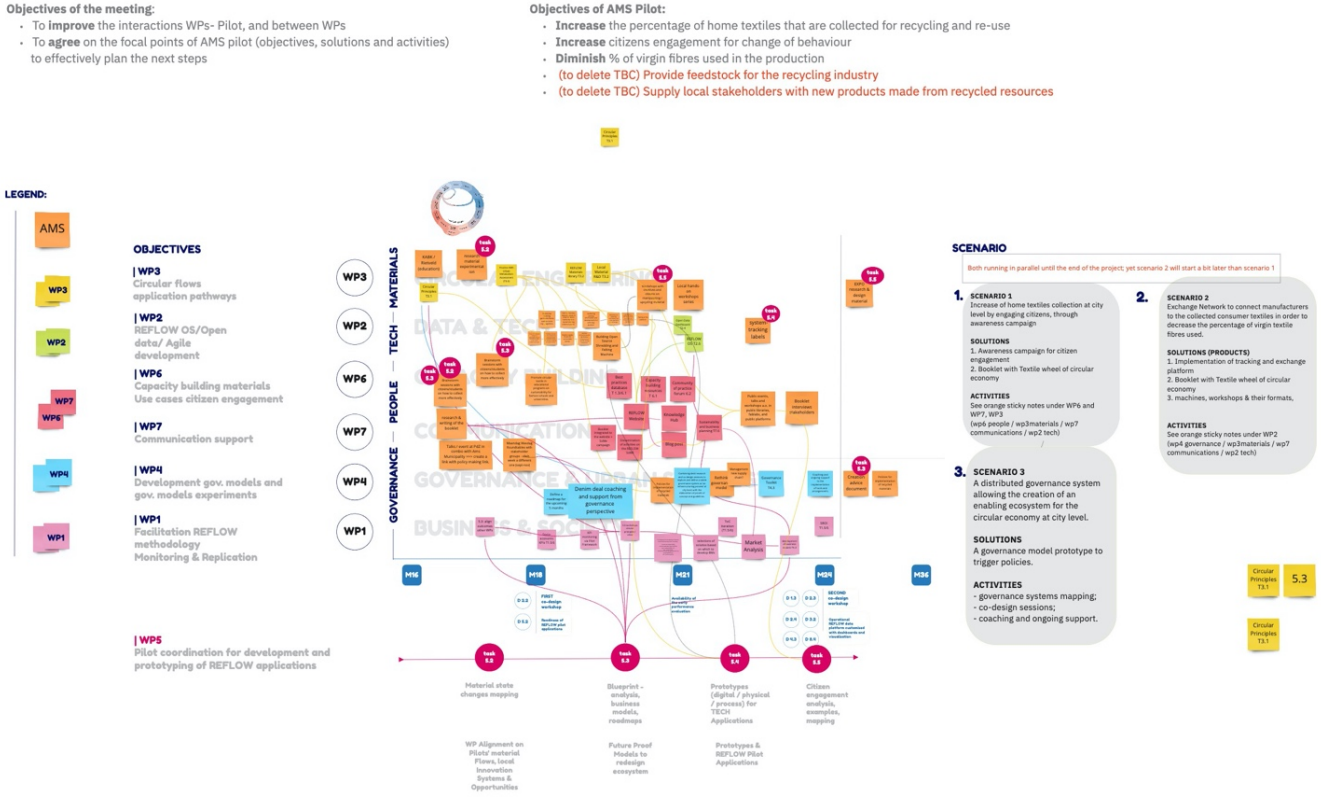

Figure 8: WP-Pilot Alignment for the Amsterdam Pilot Action Plan

2.1.4 Co-Design Workshops (T1.4)

Lastly, two co-design workshops as part of T1.4 were arranged by WP1, with CBS as WP leaders supported by the other task participants. These co-design workshops took place during the second year of the project in M17 and M23 with a twofold objective: first, the workshops were an important moment of assessment and intermediate evaluation of work done by the pilot cities and the work packages; second, they served the purpose to "ground in a wide, common vision

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the following design choices for the subsequent iterations" (REFLOW Grant Agreement, 2019). The co-design workshops also offered an additional opportunity for the pilot cities and work packages to discuss and align activities, with presentations as well as plenary and group sessions providing space for knowledge sharing and learning. In this capacity, the workshops were an important contribution to the process of refining pilot action plans, allowing pilot cities to make necessary adjustments in line with new information and feedback obtained during the sessions.

The First Co-Design Workshop: M17

Purpose

The focus of the first workshop was twofold:

Tech: To give the pilots a hands-on perspective and some relevant tools to point to the potentials of using the tech-solutions that are being developed within the project. Furthermore, the pilots were to unpack these potentials and elaborate on the implementation of the solution. The session was organised to help the pilots with translating what could be complex tech-solutions to their users, and how to make it relevant to them.

Visioning: A conversation was held to create awareness in the consortium about the Legacy of the project and on what that means to the different partners in the project. Hence, the discussion and mapping were started to identify the most crucial insights and learnings from REFLOW activities that should potentially be integrated into the REFLOW Legacy.

Organisation and output

The workshop was organised virtually due to the COVID-19 situation. Therefore, slides were prepared to present the topics of the day and introduce the working sessions before moving into smaller groups in individual breakout rooms.

For the tech session, individual pilot Miro boards had been prepared which allowed the pilot teams to work individually with the presented design tools. Hence, this allowed the pilots to move forward at the pace that made the most sense to them and to spend more time and energy on the steps and exercises that created the most value in the stage that they were at that specific time. The individual boards were also of help to the pilots to further develop and plan their next steps.

The intention was to introduce a design approach that met specific challenges on how to include a user's perspective when developing solutions, guidelines and tools that could be relevant in many aspects of the project. In the visioning session, a focus on facilitating a discussion across the consortium and outside some of the small teams that the participants usually work in was carried out. This would allow the consortium to share experiences and at the same time take first steps towards co-developing the REFLOW Legacy. This also took place in smaller breakout rooms where individual Miro boards with "reflection questions" were prepared. To support the alignment of the consortium, the insights and main takeaways from the visioning group work were presented in a plenary wrap-up discussion. The output of the session was subsequently clustered and fed into the further process of developing the REFLOW Legacy.

The Second Co-Design Workshop: M23

Purpose

The purpose of the second workshop was to invite all the project partners to an open discussion across the consortium. Whereas the focus at the first workshop was to zoom in on the ongoing work of the pilots and WPs and how it could relate to the Legacy to create awareness of the output of REFLOW, the second workshop focused specifically on the Legacy aspect: i.e., the value that REFLOW creates, the potential users of REFLOW Legacy and the shared narrative, as well as how the project organises as a consortium concerning the Legacy.

The discussion was organised in three steps to get all partners to consider and reflect on:

- What is the REFLOW Legacy and how does it create value for cities?

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- Who are the potential users and how can they apply the output?
- What is the REFLOW Legacy narrative and how do we organize ourselves to engage other cities?

Organisation and output

The workshop was organised as a virtual workshop due to the COVID-19 situation. Beforehand the team had designed and prepared a Miro board for each group, where they were guided through the exercise in simple steps. The participants were divided into small arbitrary groups to discuss a set of questions regarding the REFLOW Legacy. The groups organised across the consortium to make sure that there were different perspectives for each topic in the groups and to enhance cross-disciplinary knowledge exchange across the consortium. The input from the group work was subsequently clustered and processed to identify the most important themes for future work with the REFLOW Legacy.

2.2 Pilot Action Plans

The following six sections (2.2.1 to 2.2.6) illustrate the pilot city action plans. The action plans are descriptions of cities' current and planned activities, expected outcomes and envisioned impact, as well as a reflection on the key learnings and challenges encountered over the course of last year.

Action Plan Narratives: Reading Guide

The structure of each pilot city action plan is consistent across all six cities. The action plans are structured as follows:

1. A pilot city context is introduced to paint a picture of the key issues each city focuses on, the key beneficiaries or stakeholders involved, and the political and economic setting that the pilot city team operates in. While much of this information has already been reported in D1.2 - Cities' Circular Action Plans, this part builds on the descriptions from D1.2 with a brief summary and any relevant updates.
2. A pathway to change section provides a description of the activities in each pilot city and the results they are expected to bring. Essentially, it describes how the desired change will be achieved in each pilot city.
3. Envisioned impact presents the long-term change each pilot city aims to contribute to with their activities.
4. Two lists of KPIs – this deliverable presents both the modifications made to the initial set of KPIs included in the project proposal and later formalized in the REFLOW Grant Agreement, as well as the final list of KPIs which will be used in the project evaluation and performance assessment. A detailed reading guide to the section outlining KPIs is presented below.
5. Key learnings and challenges are reflected upon in the last part of each pilot city action plan.

Key Performance Indicators: Reading Guide

This deliverable presents the final list of KPIs for each REFLOW pilot city. Each list is comprised of KPIs from three sources: (1) the proposal KPIs, written into the Grant Agreement; (2) the co-created environmental KPIs reported previously in D3.1.; and (3) the co-created socio-economic KPIs.

However, as the proposal KPIs had been developed well before the project start, some pilot cities chose to reformulate specific KPIs and/or modify their targets to better reflect the current context and scope of their projects. Therefore, during the calibration process of the co-created KPIs, the proposal KPIs were also considered and discussed, and the results of their calibration are demonstrated in this deliverable.

Each pilot action plan presented in this chapter is supplemented with two tables:

- A list of modifications to the proposal KPIs, including new descriptions and targets where needed, as well as justification for the suggested change;

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- A final list of KPIs, including the modified proposal KPIs, and both environmental and socio-economic 'co-created KPIs'.

A final list of KPIs of each pilot city includes the following elements as seen in Figure 9 followed by a provided description of what each element refers to below.

Source	KPI	Target	Monitoring approach			
			Scale	Regularity	Stakeholders	Lead organization

Figure 9: Elements presented in each pilot city's final list of KPIs.

- **Source**: indicates whether the KPI originated from the project proposal (GA), Deliverable 3.1. (D3.1) or was calibrated for this deliverable (D1.3). KPIs originating from D3.1 are inherently more environmentally focused, as their development was facilitated by WP3.
- **KPI**: presents the final (calibrated) description of the KPI.
- **Target**: refers to the target based on which pilot cities will be evaluated at the end of the project.
- **Monitoring approach**: outlines how the progress on a given KPI will be monitored. This includes:
    a. **Scale**: whether the KPI is monitored on a neighbourhood, city, test site, or national scale.
    b. **Regularity**: how often the data should be analysed and reported.
    c. **Stakeholders**: who are the key groups the given KPI observes.
    d. **Lead organization**: which partner organization from the pilot city consortium is responsible for data collection and monitoring of progress.

2.2.1 Amsterdam

2.2.1.1 Narrative of the Action Plan

Amsterdam Pilot City Context

The Amsterdam pilot within REFLOW focuses on the way textiles are discarded and reused and how they can be brought back into the material flow, concentrating on home textiles in particular. The current problem is two-fold: home textiles are often wrongly discarded due to (1) a lack of awareness and (2) sub-optimal ways of collecting textiles. On top of that, 67% of home textiles that are collected will eventually be incinerated rather than being reused. Simultaneously, the commercial uptake is missing and the demand for recycled materials is moving at a slow pace. The Amsterdam pilot has outlined two interconnected scenarios that tackle these challenges: a short-term scenario focusing on behavioural change among its citizens, and a long-term scenario focusing on industrial impact and aiming to increase the provision of feedstock for the recycling industry, and, in turn, to increase the supply of products made of recycled resources.

The pilot operates within the context of the City of Amsterdam which aims to be a thriving regenerative and inclusive city for all citizens with respect for the planetary boundaries. By 2050, the city aims to become fully circular, reaching two milestones along the way: to reuse/recycle 65% of all its household waste by 2025 and to reduce the use of raw resources by 50% by 2030. Through multiple initiatives, the city actively promotes and stimulates new ways of thinking and cooperation between different stakeholders.

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Amsterdam Pilot City – Pathway to Change

The Amsterdam pilot organises its activities based on two interconnected scenarios – one in the short-term (Citizen Scenario) and one in the long-term (Industrial Scenario) – all of which collectively aim to spearhead the transition of textile material flows from linear to circular in the Amsterdam region. Together, these two interconnected scenarios feed into a third scenario focusing on policy. The Policy Scenario runs alongside the Amsterdam pilot's activities, tackling policies and governance issues in relation to Amsterdam's circular goals.

To usher the transition from a linear to a circular textile flow, the Amsterdam Pilot has designed a strategy guiding their pathway to change. The strategy pinpoints distinct focal points connected with the short- and long-term scenarios, while developing an overarching roadmap for the last year of REFLOW and beyond. The strategy is outlined as follows:

- Increase the quantity of textiles collected and recovered, driven by proper discarding practices at the citizen-level
- Increase the textile feedstock for the recycling industry through an increased quantity of properly discarded textiles at the citizen-level
- Increase the supply of products that contain recycled fibres based on an increase of proper discarding practices and an increase of recovered textile feedstock
- Link supply and demand stakeholders through operationalising and designing of the 'Textile Wheel' at each stage, driven by the increased feedstock of correctly discarded and collected textile
- Decrease the discarding of textiles and extend the textile life-cycle by repairing, reusing and revaluing these materials through a series of workshops and collaborations with educational institutions
- Explore design for circularity and circular textiles through a series of workshops and public activities

Scenario 1: Citizen Scenario

The Citizen Scenario is a short-term scenario which will increase the collection of home textiles at the city level through a series of activities that raise awareness among citizens to enable citizens' actions and that will ultimately generate behavioural change. The goals of this scenario aim to increase the value of textile and to stimulate correct textile discarding. To reach these desired results, the pilot has planned and carried out a series of engagement, awareness and educational activities with this target group.

To align the stakeholders along the textile waste and recycling value chain, the Amsterdam pilot has finalized the concept of the circular textile wheel which is being widely used as a mental model to coordinate the multiplicity of stakeholders involved. The Amsterdam pilot has published the Amsterdam REFLOW Booklet online[1], based on the circular textile wheel which is developed through a series of 16 chapters. The pilot schedules weekly releases of the booklet chapters, with five chapters being released so far.

The pilot also carries out a series of collaborations with educational institutions as part of this scenario's focus on citizen awareness and action. This has included an important collaboration with the Royal Academy of Arts' (KABK) Master of Industrial Design programme. This cooperation with the industrial design students led to the emergence of pivotal disruptive approaches, research on alternative models for production and business, and the exploration of new and existing materials and manufacturing techniques. The students further researched circular textile in the context of the REFLOW project, combining research and design to develop new systems, materials and services. These results were presented at a public event hosted at Pakhuis de Zwijger.

[1] Read the Amsterdam REFLOW Booklet here: https://waag.org/en/article/amsterdam-reflow-booklet.

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To increase citizen awareness and action, the Amsterdam pilot hosts a series of four online REFLOW workshops. These workshops are designed to teach the participants how to reuse, repair, reduce, rethink, and recycle their wardrobe. The pilot hosted its first two workshops in M22 and M23, providing educational opportunities for citizens to learn how to repair holes in their clothes by revisiting the ancient craft of visible mending techniques, and thereby extending the life-cycle of their existing wardrobe. The pilot hosted their third workshop in M24, providing participants the knowledge and resources for how to revalue old garments by exploring the world of natural dyes. The last workshop will continue to focus on this theme. A handbook including a step-by-step approach of each technique and recordings of the workshops can be found and downloaded online[2].

On April 24th, 2021, the City of Amsterdam became home to the first Swapshop[3], a noteworthy development to the city's circular textile landscape. The Swapshop provides an important space for citizens to give new life to their wardrobe, where citizens can swap their old clothing with other pieces collected by the shop. The space also allows designers and other creatives to buy a small amount of discarded clothes for design projects or other creative purposes. The Swapshop aims to save 15,000 kilograms of discarded textiles each year by giving them a second life.

Scenario 2: Industrial Scenario

The Industrial Scenario is a long-term scenario which focuses on the complementary continuation of the solutions found in the Citizen Scenario. This interconnection between the two scenarios sees the increased number of textiles collected for recycling as an enabler for manufacturers to decrease the amount of virgin fibres used in the production of yarns and textiles. The overall goal of this scenario aims to support industry towards reaching Amsterdam's overarching circular goal targets in 2025, 2030, and 2050.

To facilitate this desired long-term change, the pilot will provide additional process support from an online exchange platform and database, co-developed with different stakeholders, allowing better insight into the available feedstock of materials, ready for re-manufacturing.

The Amsterdam pilot makes further progress towards reaching its desired change by working with and supporting recent initiatives aiming to reduce the textile material flow and that avoid the destruction of valuable textile materials. During the second year of REFLOW, critical discussions began surrounding the concrete textile waste issue in the Amsterdam Region. Transpiring out these discussions, it was revealed that about 5 million disposable isolation gowns were used in Amsterdam healthcare sector. In pursuit of advancing the undertaking of textile recycling at the industry-level, the Amsterdam pilot pushed forward with an important decision to spark the beginnings of replacing the use of disposable gowns in the Amsterdam healthcare sector. To this aim, the Amsterdam pilot works with a group of stakeholders in the Amsterdam healthcare sector while developing alternative reusable products from a technological textile perspective. In M23, the pilot successfully generated the first demonstrators meeting all technical (water repellent by a new non-fluor-based environmentally acceptable finish) and wearability targets.

The outcome of this process included an internally published report on inventories both for cotton and polyester, including an extensive calculation model showing the true cost of the use of textiles in disposable isolation gowns. This was made using the true pricing technique which incorporates Euros/kg of CO_2, dust, water usage, among other factors. Next to that, the Amsterdam pilot produced a one-pager to initiate research using a grafted polymer on textiles jointly with the Italian CNR. These pilot activities further feed into the creating long-term impact by avoiding a significant waste stream of oil-based polypropylene and supporting in the reduction of CO_2 output by 2.6 kilotons CO_2eq[4]/year. In

[2] Find the workshop resources here: https://waag.org/en/article/dont-let-your-textiles-go-waste.

[3] Read more about The Swapshop here: https://www.the-swapshop.com/en/.

[4] CO_2eq stands for Carbon Dioxide Equivalent; it is a measurement unit based on the global warming potential of different greenhouse gases. It measures the environmental impact of one ton of these greenhouse gases in comparison to the impact of one ton of CO_2.

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addition, the use of unwanted chemicals (fluor-based) used during the finishing of these disposable isolation gowns will be minimized and the required finishing chemicals will be replaced by less toxic and less persistent products. Lastly, these pilot activities help to contribute to the overall impact whilst respecting the planetary boundaries by the further prevention of microplastic pollution.

The recently introduced Denim Deal offers significant leverage and momentum for this industrial scenario. The Denim Deal is a coalition of 30 international frontrunners in the denim industry that have agreed to work together towards implementing the standard of at least 5% recycled textile in all denim garments. All parties involved in making and processing the denim garments will participate, from production companies, brands, and retailers, to collectors, sorters, cutters and weavers. Some of these partners have even agreed to have at least 20% recycled fibres in their textiles. This international collaboration aims to make post-consumer recycled denim as the new industry standard. The pilot activities as part of this scenario will further push forward and provide vital contributions to supporting the aims of the Denim Deal.

Moreover, the creation of a working group initiated by the City of Amsterdam in collaboration with the national Dutch Circular Textile Valley and MVO-NL, an organization of frontrunners in sustainability, laid fertile ground for further momentum in Amsterdam's activities towards circularity. The working group, Circular hotel linen, sets out to investigate the options to incorporate the use of linens with recycled fibre content in the hotel industry. The first working group meeting took place in the beginning of M24.

Additionally, the pilot published a report on **"**Business Planning in a Circular Economy", together with BMA Techne's partner, Alcon Advies.

Scenario 3: Policy Scenario

This third scenario focuses on policy support through promoting a distributed governance system among government, business and citizens, allowing the creation of an enabling ecosystem for the circular economy at the city-level. The overall goal of this scenario seeks to align the circular 2025, 2030, and 2050 goals of Amsterdam connecting industry and the local city-level.

To achieve these desired results, the pilot organized an event where different players in the textile industry could be activated and aligned into circular textile discussions. The Amsterdam pilot invited different stakeholders and players within the textile industry to Pakhuis de Zwijger in Amsterdam to discuss issues confronting the textile industry at the event, Monday Laundry Day. Together with the Municipality of Amsterdam and the Amsterdam Economic Board, roundtable talks were organized during this event to incite discussions.

To guide the City of Amsterdam towards its goal becoming circular, the Amsterdam pilot team established a circular textile roadmap as a strategic guideline for the City to reach its 2025 and 2030 circular goals. This roadmap includes green textile deals involving various parties focusing on the improvement of processing and discarding textiles, knowledge building and dissemination of circular principles, awareness among end-users, and the use of circular textiles as a strategy in circular transitions. This roadmap aims to have 50% of the textiles in the closed loop by 2030 and a 30% uptake of recycled material from non-reusable discarded textiles by 2025. To fulfil this ambition, different initiatives are identified that will be established within the upcoming years, including a shared service centre for reparations, a circular fashion innovation lab, the integration of circular principles in textile research and education, the circular buy-in of work-clothing such as protective garments for healthcare, and an awareness campaign targeted towards end-users.

Additional activities

In addition to the activities carried out across the three scenarios defined by the pilot, the Amsterdam pilot curated, attended and participated in a series of public events hosted at Pakhuis de Zwijger. These events covered a series of topics related to textile recycling, reaching out to general public, industry stakeholders, policy makers, FabLabs and

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makerspaces, circular economy stakeholders, researchers, academia and educational institutions, and partners from other H2020 projects. These events are available as a podcast series hosted on the Pakhuis de Zwijger website[5].

Amsterdam Pilot City – Envisioned Impact

Throughout REFLOW, the Amsterdam pilot aims to transform the textile chain - from linear to circular.

The short-term impact the Amsterdam pilot seeks to achieve aims to intensify collaborative efforts with local networks to stimulate a raise in awareness. The Amsterdam pilot aims to facilitate behavioural change and engage its citizen through different learning events to become actively aware of the value of textile waste. The creation of a common know-how on how to extend the lifespan of textile items will lead to informative actions, facilitation, and stimulation regarding proper discarding of textile household.

The long-term impact involves increasing the provision of feedstock for the recycling industry – and in turn, increasing the supply of products made from recycled resources for other stakeholders, consequently leading to the creation of new business opportunities and models. This is achieved through the involvement of different stakeholders to generate demand for recycled textiles or circular fabrics - in particular designers. Moreover, a digital platform will be developed as a tool to engage with the industry and help prove the circularity of the sourced materials.

The Amsterdam pilot wants to increase the value of the textile waste stream by defining the added value of recycling in each step of the textile chain. Supporting diverse collection methods with citizens will provide feedstock for the recycling industries, and in turn, increase the demand for the supply of newly produced products out of recycled resources.

2.2.1.2 Final list of KPIs

Modifications to KPIs established in the REFLOW Grant Agreement

The following table presents and justifies any modifications made to the KPIs stipulated in the REFLOW Grant Agreement. The modifications are a result of the iterative process of KPI co-creation, described in the methodology section.

KPI description in REFLOW GA	New description *(if relevant)*	KPI target in REFLOW GA	New target *(if relevant)*	Justification for changes
P1: Number of textile specific city resources identified (materials, infrastructures, etc.)		100		
P2: Number of specific textile streams identified		10		
P3: Number of governance / business models developed	Number of business models developed	5		
P4: % textile regenerated (current 20% of complete stream)		40%	25%	Amsterdam tackles the material stream as a whole (textiles) in this KPI. Additionally, 'regenerated' is defined as reuse, recycle and refurbished (keeping

[5] The podcasts can be found here: https://dezwijger.nl/podcasts.

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				the material as long as possible in the loop). The target was changed from 40% to 25% as this target was deemed as too ambitious to reach by the end of the project.
P5: Overall stakeholder satisfaction with new models	*Removed from the KPI list.*	80%		
P6: Number of new applications for textile waste developed	Number of new initiated developments for textile waste developed	10		The Amsterdam pilot defines "new application" as new initiated developments, such as the Denim Deal, MRA, Stadpas action and more.
P7: Willingness to pay for regenerated products and materials	*Removed from the KPI list.*	80%		There is no use case in which the pilot can measure this KPI in addition to having no methodology or knowledge on how to measure 'willingness'.
P8: Number of local makers and business reached through showcases		2,000		
P9: Number of citizens engaged through educational programmes		500		

Table 2: The Amsterdam pilot's modified KPIs

Final list of KPIs, including additional environmental indicators

The following table presents a consolidated list of KPIs for Amsterdam pilot city, including the modified KPIs from the Grant Agreement (GA) and the environmental KPIs based on Deliverable 3.1. (D3.1).

Source	KPI	Target	Monitoring approach			
			Scale	Regularity	Stakeholders	Lead organization
GA	**Number of textile specific city resources identified (materials, infrastructures, etc.)**	100	MRA	End of project	Circularity in hotel linen: 20 stakeholders present in 1st meeting	AMS
GA	**Number of specific textile streams identified**	10	International	End of project	Hotel linen, isolation gowns, denim, clothing, workwear	AMS
GA	**Number of business models developed**	5	National	End of project	Citizens, industry, policies	WAAG
GA	**% of textile regenerated**	25%	Total of all identified streams	End of project	Overall	WAAG/AMS/BMA

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	(current 20% of complete stream)					
GA	**Overall stakeholder satisfaction with new models**	80%	National	End of project	Overall	AMS
GA	**Number of new initiated developments for textile waste developed**	10	National	End of project	Citizens, industry, policies	AMS/WAAG/BMA
GA	**Number of local makers and business reached through showcases**	2,000	National	End of project	Local makers and businesses	AMS/WAAG/BMA/ PDZ
GA	**Number of citizens engaged through educational programmes**	500	National	End of project	Citizens, students, teachers	AMS/WAAG/PDZ
D3.1	**% of textiles diverted from incineration**	20%	Neighbourhood	Beginning and end of project period, with expected projections	Manufacturers, entrepreneurs, industries, community of Amsterdam, Sympany.	Municipality
D3.1	**Amount of AMS textiles with a second life through REFLOW OS**	3 Swapshops x 15 kg = 45 kg	User – dependent on REFLOW OS	Baseline from OS and then end of project period	Manufacturers, entrepreneurs, industries	WP2 leader
D3.1	**% of reduction in textile waste found in mixed waste**	20%	Neighbourhood	Annually	Municipality, citizens, Sympany.	Municipality
D3.1	**CO2 reduction through REFLOW activities**	Reduction of 2.6 kton	City-wide	Interim report and at the end of the project	Anton, Ger AMS pilot	Municipality

Table 3: The Amsterdam pilot's final list of KPIs

2.2.1.3 Key learnings and challenges

Based on the key challenges the pilot outlined in D1.2 - Cities' Circular Action Plans (CCAP) after the first year of REFLOW, the pilot managed to tackle some of these challenges and to gain useful learnings from them. The efforts in the second year of REFLOW within the Amsterdam pilot focused on how to reshape these challenges and on how to let these work to its advantage.

Alignment of different local and national initiative and activities to create purposive directional movement, not isolated actions & the complexity of stakeholder alignment

Throughout the two scenarios (short-term and long-term), the Amsterdam pilot aims to closely engage and collaborate with a large range of stakeholders, ranging from citizens to industry. However, developing mutually beneficial

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partnerships is a complex task that requires the understanding of the needs, requests, and benefits for each of the stakeholders involved.

The development of the circular roadmap enforces the pilot to succeed in setting clear goals and aligning all stakeholders involved in order to create a collaborative objective. This roadmap identified different areas in which sustainable innovation should and can be developed. These areas allow for the framing of targeted goals specified to the stakeholders involved, overcoming the complexity of different stakeholders within the textile industry while simultaneously fostering true engagement through tangible goals. The Denim Deal, which includes different players within the denim industry is one of these results.

Unexpected pandemic and social isolation

The COVID-19 pandemic enforced all activities to be held online, creating the opportunity to reach a broader public, in the Amsterdam area as well as in other parts of the Netherlands. The diversity and the amount people reached throughout all the events benefited from this online environment and was more than initially expected. This broader reach has fuelled enhanced synergies between different projects in the Netherlands (e.g., the Circular Textile Twente Project, in which textile recycling technology is developed). The content created among these events is still being shared and disseminated.

Unexpected pandemic and social isolation – In the Context of Recycling

The Amsterdam pilot also experienced an increase in momentum due to the closed borders measures in Europe. It enforced the need for actual change and strengthened the attention given to textile recycling and circular economy in general.

Besides the above mentioned, the Amsterdam pilot has also been experiencing beneficial outcomes from the fact that REFLOW is an EU-funded project and is independent of any commercial investment. It contributes to an accelerating positive impact on the development of a connected ecosystem within the textile industry and it fosters a great willingness to participate among all stakeholders.

Lastly, the Amsterdam pilot wants to point out the beneficial effect of working in a multidisciplinary and complementary team. The fact that each partner has their own expertise and can contribute their own knowledge enables the pilot to be flexible and shift easily when specific knowledge is required.

2.2.2 Berlin

2.2.2.1 Narrative of the Action Plan

Berlin Pilot City Context

The Berlin pilot within REFLOW focuses on wastewater heat recovery. This resource covers an area considered of high relevance when tackling climate change challenges. In a city of 3.6 million people, high amounts of wastewater are being produced, both from private households and from industrial sites. Adding to this problem is the fact that this wastewater is not being captured for heat recovery. Much of the wastewater is still warm or even hot when it enters the drainage system. As such, this wastewater resource provides a technical possibility in the capturing of its heat energy and feeding this back into the system, be it for heating or cooling activities. Existing hardware, consisting of pipes, pumps, and other components lay the infrastructural foundations upon which can be tapped into to facilitate the recovery of wastewater heat. Currently, the overall potential wastewater heating capacity is 275 megawatts out of which 3 megawatts are being recovered (Gürtler, 2020). The challenge for increasing the usage of wastewater heat lies predominantly in the availability of data from both a quality and quantity perspective. Typically, only large cities have

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the information technology infrastructure, and the data sets necessary in helping to close the gap between data needs and availability.

Driving up demand for wastewater heat is hampered by the lack of awareness among potential users and a disconnectedness between potential users and the water utility. To address this challenge, the Berlin pilot develops an application that will enable users to identify whether their property is available for wastewater heat recovery, a connection between user and BWB is being established. Communication activities are designed within the REFLOW project to identify which communication tools are best suited to raise awareness and generate interest.

In recovering wastewater heat, the Berlin pilot operates in a highly regulated market setting with difficult-to-access data. In this context, the pilot expects other European cities to be similar to Berlin's market structure, i.e., highly, or at least partly regulated. The learnings of the pilot will ease future exploitation efforts as access to sufficiently large and meaningful data sets is of critical importance to adapt the technology in other cities.

Berliner Wasserbetriebe (BWB), Berlin's public water utility company and partner in the REFLOW consortium, has great expertise and knowledge in the area of water management. As such, BWB is an innovation leader in its industry and a respected member in relevant associations including their active participation in public-funded research projects. Being in this position for one of Europe's largest cities, BWB is of tremendous value to the Berlin pilot. The company has a rich set of data which is necessary and useful for implementing the project in Berlin. While addressing data privacy and security issues, the data itself forms the foundation for developing the REFLOW application that will allow users to see whether their property has access to wastewater heat. While the Berlin municipality itself is not a formal part of the project, connections between Berlin pilot members and the city exist. At various occasions, city representatives have been involved in the project in referring contact partners or giving input on data availability. Moreover, the City of Berlin is committed to implementing circular economic practices and material flows. Based on (1) BWB being a REFLOW consortium partner and (2) CityLAB being a cooperation partner to the Berlin Pilot, the Berlin pilot team is convinced that Berlin is interested in becoming an innovation leader if it comes to wastewater heat recovery.

Importantly, a relationship to CityLAB Berlin (CityLab) has been established. The CityLAB describes itself as a "public experimental laboratory for the city of the future; here, representatives from government, civil society, academia and start-ups collaboratively develop new ideas for how to both ensure and enhance the liveability of Berlin as a city". The Berlin Pilot and CityLab have agreed to collaborate in the areas of dissemination and exploitation.

The benefits of the pilot's intervention are obvious: by recovering heat from wastewater, an energy resource can be used that otherwise is lost. Early analysis indicates that the generated energy output is larger than the energy input required to recover the wastewater heat. If this holds true, then indeed an important criterion is met for encouraging the use of this energy source within Berlin and beyond. Therefore, main beneficiaries would be all parts of society that are committed to a more circular economy.

Berlin Pilot City – Pathway to Change

The Berlin pilot's pathway to change contains five major components for which the acronym TAIIX has been assigned: (1) technology development, (2) awareness raising, (3) generating interest, (4) implementation and (5) exploitation or replicability. TAIIX consists of several activity strings aimed at focusing the work of the Berlin pilot on strategic outcomes that will shape the pilot's success and its long-term impact.

Technology development

At the forefront of the pilot's activities is the development of a user-centred application. This web-based application shows an interactive street map with buildings. A user can enter the address of their building upon which coloured highlights will indicate whether their building is in an area in which wastewater heat is accessible. An informative section will contain a list of FAQ's and provide details about the technology and its benefits. Recent communication activities, such as the REFLOW Berlin video and blog articles will be linked to or integrated. Sign-up for BWB information shall be

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made possible. The map integrates street and building information as well as data of pipes and pumps; this is necessary in order to have the app showing results of wastewater heat availability. The application is a change to the current less prominent approach of BWB and shall lead to a significantly increased number of inquiries.

Awareness raising

A key ingredient to success will be raising the awareness rate of wastewater heat among the general public as well as property owners and managers. Various activities will take place, such as the cooperation with CityLab. This organization will support by utilising its network for REFLOW dissemination and exploitation in Berlin, in particular to the general public in Berlin and Berlin-based relevant decision makers. All pilot partners and specifically BWB will reach out to their own networks. A 3D miniature display is planned to be installed at CityLab, whereas on-going COVID-19 restrictions have the potential to modify this activity. The video and blog postings disseminated across social media platforms and other meaningful spaces and possibilities for awareness.

The Berlin pilot is aware that with a limited budget, a significant increase in awareness, particularly among the general population, cannot be achieved. However, the Berlin pilot intends to link activity and impact in order to assess which media tools are most useful, thereby providing future guidance to BWB and/or a later spin-off.

Generating interest

The main aim of the communication activities is to generate interest among a defined target audience. This target group includes property owners (private, public, industrial), property managers, property developers, city representatives, relevant bloggers and journalists, and other decision makers. A special target audience has been described for replicability of the pilot. Various levels of interest will be monitored as part of these communication activities. This is done through the monitoring of:

(1) general interest of users and interaction with BWB;

(2) subscription to a newsletter;

(3) expressed definite interest to adapt wastewater heat recovery technology;

(4) the estimated potential impact of such interest.

This structured approach to measuring interest will allow the Berlin pilot to forecast the potential amount of post-REFLOW implementations. In the likely absence of realised and concluded implementations during the REFLOW project, due to the long lead-times, the Berlin pilot considers this a fair and valid approach for measuring and forecasting success within Berlin. By doing so, continued change is encouraged as pilot participants will focus now and later on parameters they can largely influence.

Implementation

It is unlikely that significant implementations will occur during the REFLOW project itself. This is caused by the length it takes to get to a functioning application, following all strategic and technology development steps that already have taken place and long lead times from definite user interest to conclusion of an implementation. Regardless of this situation, the number of implementations represent a relevant cornerstone of project success. The Berlin pilot will include technical tools to establish a linkage between interest generated through the app on the one side, and implementations triggered on the other side. As such, a fair measurement of success is possible. While a concrete number of implementations might indeed only be realised after the project ends, it still represents a major selling argument for its replication across other cities.

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Exploitation or replication

The 'X' in TAIIX stands for exploitation beyond the city of Berlin. The target group consists of European cities around or above 500,000 inhabitants, as likely only these cities possess the technical infrastructure and know-how to adapt the solution, European cities that are below the 500,000-citizen threshold but have a focus on water or wastewater in their circularity efforts, and industrial and scientific parks and zones. At the time of authoring this report, about 40 cities have been identified; the number will increase somewhat in the near future. Additionally, about 35 other stakeholders have been identified.

Other stakeholders include researchers in wastewater, energy or climate change topics, foundations and other organizations that have an interest in water circularity, and financial organizations that support cities in financing investments in circular economy activities.

While some informal reach-out has already taken place to target group members that are known to Berlin pilot members, a more structured, yet informal reach-out is planned to start in M25. A limited group of around ten cities and other stakeholders will be approached in order to understand their interest in adapting wastewater heat technology for their circularity efforts, understand their information needs in terms of technical know-how, financial assistance and awareness raising, get their feedback on our approach of reaching out to comparable cities in an interesting and meaningful way and to understand their willingness to further interact with the Berlin pilot.

Based on the outcome of this initial outreach, the Berlin pilot will thereafter refine its outreach and approach around M32. A larger number of target group members is used to identify firm interest in collaborating with the Berlin Pilot team during or post REFLOW; this will include answering the question of how a potential Berlin spin-off would financially be rewarded for its post-project efforts. The learnings and conclusions from this second and refined outreach will contribute to the business plan development.

Berlin Pilot City – Envisioned Impact

The Berlin pilot can be considered successful when it will lead to a significantly increased interest in wastewater heat recovery and triggered additional inquiries to adapt the technology. Practically, this means that over time, more private households, industrial sites, technology parks, building owners and managers, property developers and other stakeholders subscribe to this technology. As a consequence, the pilot would expect the consumption of this form of energy to increase in absolute numbers (megawatts) although this is difficult to measure at this point of time. The pilot cannot make claims to the share of this energy form as part of all energy being consumed, with the reason being that the Berlin pilot cannot influence overall energy consumption. In fact, in a strong winter, the share of recovered wastewater heat might shrink if overall energy consumption goes up.

As there are long lead times to implement the technology, the concrete impact in completed implementations will not be seen during the lifetime of this project. However, the Berlin pilot aims at building the foundation for achieving and measuring this type of impact for the post-project period. It involves having the app developed and operational before the end of the project and the development of a business plan that will show the economic and social viability of post-project continuation of activities.

Communication will play an important role in achieving impact. It will increase the chance of establishing wastewater heat as an accepted form of circular energy flows and be more often considered by potential users in Berlin and beyond.

Another parameter to determine the Berlin pilot's success will be the interest generated among other cities. The pilot team has begun to analyse the legal and regulatory environment across Europe, to help in the formulation of replication strategies for other cities and thus increasing the impact beyond Berlin. The pilot team considers the project successful if three relevant cities show definite interest in adapting part or whole of the solution developed by the Berlin pilot. As "relevant" the pilot considers those cities that fall within the rather narrow definition of the target group, i.e., either

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around or above 500,000 inhabitants, or cities that are sufficiently large and have access to the required hardware and IT infrastructure.

2.2.2.2 Berlin – Key Performance Indicators

Modifications to KPIs established in the REFLOW Grant Agreement

The following table presents and justifies any modifications made to the KPIs stipulated in the REFLOW Grant Agreement. The modifications are a result of the iterative process of KPI co-creation, described in the methodology section.

KPI description in REFLOW GA	New description *(if relevant)*	KPI target in REFLOW GA	New target *(if relevant)*	Justification for changes
P1: Total volume of waste heat harvested (comparative assessment for previous and future years) measured in megawatt	Total volume of wastewater heat capacity installed in megawatts.	2.2 (2019) 4.4 (2020) 8.8 (2021) 22.2 (2022)	2.2 (2019) 3.0 (2020) 4.5 (2021) 6.0 (Q1 2022)	Revised goals reflect the limited impact REFLOW as a project has on this parameter in the remaining time. The revised KPI description more precisely describes this rather demand-driven factor.
P2: Number of properties with waste heat potential identified	Number of managers or owners of properties with wastewater heat potential who have expressed interest through the REFLOW app, to learn more about the technology.	50	40 (annualized)	This revised KPI more precisely measures the impact the REFLOW app is expected to generate. The goal was revised downwards as the BWB onboarding was expected earlier to happen. The KPI is now annualized but extrapolation will be less reliable the shorter the full functioning app is available.
P3: Number of businesses interacted with through waste heat adoption measured	Number of managers or owners of properties with wastewater heat potential, who have expressed firm interest through the REFLOW app to adopt the technology.	12	9 (annualized)	The revised KPI focuses on the concrete interest of adaptation whereas earlier a rather passive 'interaction' was sufficient. Further, it establishes a link to the REFLOW app. The goal has been reduced to accommodate for the late onboarding of BWB. The KPI has been annualized, same as some other KPIs.
P4: % of waste heat of overall heating	*Removed from the KPI list.*	10%		The Berlin pilot cannot measure this and refer to KPI 1 as the one with close proximity to KPI 4. Besides, the percentage rate (waste heat as part of all heat) is misleading, as REFLOW cannot influence the overall heat consumption.
P5: Number of productive activities facilitated through waste heat supply	Number of realised or near-realised implementations, triggered through the REFLOW app.	10	2 (annualized)	The revised KPI links implementations to the REFLOW app and is therefore more precise than the previous KPI. Nearly realised implementations are included, as it is unlikely that, due to long lead-times between inquiry and completed installation, a full implementation can be reported at all during the project. Post-project, this KPI would focus on complete implementations, only. The number of two implementations represents a share

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				of 5% from all interest generated (2 out of 40) and a share of 22% of serious inquiries (2 out of 9).
P6: Number of citizens and production-oriented business reached through showcases	Number of Berlin-based target group members reached through showcases.	320	320 (annualized)	The rephrased KPI is more precise. The goal has been annualized to adjust for any potential delay caused by the late onboarding of BWB.
P7: Number of citizens engaged through educational programmes	Number of Berlin-based inhabitants engaged through educational programs	220	220 (annualized)	The rephrased KPI now correctly focuses on Berlin inhabitants, this is to distinguish from exploitation activities outside Berlin. The goal is again annualized.

Table 4: The Berlin pilot's modified KPIs

Final list of KPIs, including additional environmental and socio-economic indicators

The following table presents a consolidated list of KPIs for Berlin pilot city, including the modified KPIs from the Grant Agreement (GA), the environmental KPIs based on Deliverable 3.1. (D3.1) and the socio-economic KPIs calibrated in the co-creation process ahead of this deliverable (D1.3).

Source	KPI	Target	Monitoring approach			
			Scale	Regularity	Stakeholders	Lead organization
GA	**Total volume of wastewater heat capacity installed in megawatts.**	2.2 (2019) 3.0 (2020) 4.5 (2021) 6.0 (Q1 2022)	Berlin city level	Quarterly (annualized)	Municipality	BWB
GA	**Number of managers or owners of properties with wastewater heat potential who have expressed interest through the REFLOW app, to learn more about the technology.**	40 (annualized)	Berlin city level	Quarterly (annualized)	Managers and owners of private, public, business and industrial properties. Municipality.	BWB
GA	**Number of managers or owners of properties with wastewater heat potential, who have expressed firm interest through the REFLOW app to adopt the technology**	9 (annualized)	Berlin city level	Quarterly (annualized)	Managers and owners of private, public, business, and industrial properties. Municipality.	BWB

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GA	**Number of realised or near-realised implementations, triggered through the REFLOW app.**	2 (annualized)	Berlin city level	Quarterly (annualized)	Managers and owners of private, public, business, and industrial properties. Municipality.	BWB
GA	**Number of Berlin-based target group members reached through showcases.**	320 (annualized)	Berlin city level	Quarterly (annualized)	Owners and managers of buildings. Journalists and bloggers, city representatives, general population.	AH (PROT)
GA	**Number of Berlin-based inhabitants engaged through educational programs**	220 (annualized)	Berlin city level	Quarterly (annualized)	General population, students, and educators. Journalists and bloggers.	AH (PROT)
D3.1	**Energy return on energy input (EROEI) rate**	Positive ratio	Berlin city level	Once, as reference number from four previous installations	Municipality, owners, and managers of properties	BWB
D3.1	**Estimate on CO_2 emission change**	Reduction in CO_2 emissions	Berlin city level	Once, as reference number from four previous installations	Municipality, manufacturers, educational institutions, industry; journalists and bloggers	BWB
D1.3	**Approached 25 relevant cities by project end for their interest to adopt Berlin REFLOW wastewater heat recovery technology**	At least 3 cities showing high or very high interest to adapt the technology.	Europe	Quarterly	Municipalities, international governmental or near-governmental bodies	AH (PROT)
D1.3	**Approach at least 5 financial stakeholders by project end**	At least 2 indicating their high or very high interest to support and/ or advise cities in their funding needs to adapt the technology.	Europe	Quarterly	Municipalities, financial organizations, private and public investors, foundations	AH (PROT)
D1.3	**Described and evaluated five business models for post-project continuation**	Clear recommendation (go ahead or stop) for post-project exploitation	Project-internal	End of project	Berlin Pilot members	AH (PROT)

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Table 5: The Berlin pilot's final list of KPIs

2.2.2.3 Key learnings and challenges

The Berlin pilot faced a number of critical challenges, most of them being completely or almost completely solved within the second year of the project. Key issues were arising out of the late onboarding of Berlin Wasserbetriebe (BWB), Berlin's water utility and thus a key pilot partner, as well as from the quantity and quality of supplied data. The key learnings and challenges are detailed as follows:

Onboarding BWB

Importantly, the onboarding of BWB took a very long time. This had an impact on the implementation speed within the Berlin pilot. As such, only small portions of necessary data could be obtained. While BWB tried its best to accommodate for the shortcomings arising out of this situation, there were legal barriers that could only be overcome after the formal onboarding of BWB. The situation has been resolved, and the Berlin Pilot team works hard to make up for any delays. The pilot team is confident that remaining obstacles can be addressed in well within time.

Access to Data and the Development of Tech Solutions

A major challenge in the development of tech solutions was and partly still is the collection and normalization of geographical Open Data and the data provided by BWB. While the City of Berlin provides a rich catalogue of maps, land register information and more, the data offers have grown over the years while changing formats and metadata layout. In addition, data availability varies depending on the administrative district. Due to the complexity of the challenge and technical shortcomings on some essential features, the data management architecture and software solutions needed adjustments. A switch to another kind of database management system was necessary. Resulting delays can certainly be coped with during the remainder of the project.

The data integration challenge contributed to the late development of use cases for the planned application. While a lot of effort has been put into taking inventory, gathering, and normalizing the available data in the first months of development, the aforementioned challenges arose only recently following the definition of concrete use cases for the application. Meanwhile, the Pilot team has taken the necessary steps to mitigate risks resulting from this challenge and is very confident both to stay on track with the technical development and to address all issues in a timely and satisfactory manner.

The pilot was also facing a challenge between the domain expertise about utilizing geographical databases in practice and the expertise in data engineering. With the recent definition of use cases and the establishment of a common base line, the pilot is bridging the different expertise sets. The investigations the pilot conducted and the understanding they gain from normalizing geographical databases, as well as the technical solutions the pilot is currently developing, will be applicable to other cities' data. Overcoming this initial challenge that the pilot is facing in Berlin, will result in a set of technical skills and competencies that allow the easy adaptation to other cities in the future.

COVID-19

While COVID-19 in general presents a challenge, it has not posed a major risk to the work in the Berlin pilot. Major hurdles due to COVID-19 led to transformations of work styles among the pilot team members which have since been overcome. However, as for planned workshops and interactive dissemination efforts to third parties, the reach-out is hampered by the challenges represented in solely virtual interaction. The Berlin pilot addresses these challenges and is confident to manage these without significant impact to the overall project outcome.

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Long Lead Times

Another learning and challenge are the limitations of having measurable significant impact on the number of physical implementations during the lifetime of the project: lead-times from expressed definite interest of a potential wastewater heat user to technical implementation may last up to two years. This is due to workflows on the side of BWB and supporting third parties. To overcome this issue, the formulated KPI's focus on measuring interest and initial inquiries of Berlin-based stakeholders but also on the interest of pilot replicability in other cities.

Positive Feedback from Third Parties

Initial feedback of third parties on the Berlin pilot was very positive throughout. Wastewater heat recovery was met with curiosity and interest whenever team members brought up the topic. The project idea was presented in informal, yet structured reach-outs to an Honorary Member of the Club of Rome, to a senior member of the European Investment Bank, to the City of Mannheim, to the former Managing Director of the Rockefeller Foundation and to an author of the 'Climate Finance Decision Making Tree' (ICLEI). In all cases, it was agreed to share more information. This will be done by the team in the next upcoming months as part of its planned outreach. The Berlin pilot assumes the interest is particularly high because few people think about wastewater heat recovery when considering approaches to climate change.

Identifying Data Sources and Integration Possibilities

Knowing from the beginning that data will play a major role in achieving the aimed-for impacts, a key learning is to identify data sources and integration possibilities early on, this as a key priority when reaching out to other cities. The pilot learned that city representatives were very eager to learn about our data use cases and listen to our data needs. This serves as encouragement to seek out Open Data enthusiastic city officials in possible future city endeavours.

Positive Impact Created by Video Production

A small but still relevant learning was the positive impact of the video that was produced by the Berlin pilot. It explains in an easy-to-understand way how the technology works and what its benefits are. As such the video plays a major role in generating interest among target audiences. The Berlin pilot team expects the video to be used widely in its dissemination efforts and will also encourage other cities that are interested in adopting wastewater heat recovery technology, to edit the video for their purposes.

2.2.3 Cluj-Napoca

2.2.3.1 Narrative of the Action Plan

Cluj-Napoca Pilot City Context

The Cluj-Napoca pilot addresses the challenges of reversing the city's increasing energy consumption and waste by introducing more efficient and circular solutions that concentrate on district heating and electricity usage. The pilot project supports the development of innovative urban governance schemes in Cluj-Napoca through the integration of societal, technological and administrative dynamics. Specifically, the pilot works on building a local coalition around technology options for energy transition paths, ensuring the creation and assessment of circular economy possibilities and multi-actor cooperation initiatives. The long-term issues the pilot addresses, revolves around the need for urban sustainability, the critical importance of lowering carbon emissions, and transitioning towards more circular practices, in which the Cluj-Napoca pilot focuses in on energy-efficient behaviours.

The pilot city operates within context of the Municipality of Cluj-Napoca, one of Romania's and Europe's most performant cities in terms of economic growth, innovation and civic engagement. Cluj-Napoca is one of the few mid-

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sized cities that grows both economically and socially, standing out as a lighthouse of social, economic, policy and technology innovation.

Upcoming changes to social, economic and political environment are arranged to take place as the municipality sets out its future Integrated Urban Development Strategy 2030. The Integrated Urban Development Strategy 2030 slates out a series of development plans for the city's evolution until 2030. The strategy further represents a set of policies that mark the combined efforts of actors in the city's ecosystem to ensure inclusive development, aligning the needs of the citizens and local actors as well as with European and global priorities. Since the starting the REFLOW project, the Integrated Urban Development Strategy 2030 is near completion. The forthcoming strategy includes contributions from the Cluj-Napoca pilot members in setting Circular Economy and Energy Efficiency priorities and aligns with the promise of adopting a Circular Economy Action Plan for Cluj-Napoca by 2030.

The pilot's targeted beneficiaries are ecosystem-based, in the sense that, they belong to a variety of stakeholders: public authorities (Municipality of Cluj-Napoca and schools and other public institutions administered by the Municipality), business/industrial clusters (especially ICT and energy but also furniture, agriculture and creative industries), academia (research institutes and universities in Cluj-Napoca) and other civic actors (citizens, NGOs). Since the beginning of the REFLOW project, the pilot members have strengthened their relationship with several actors mapped as key stakeholders for circular economy in the city (for example with the Ernest Lupan Circular Economy Institute, and the Business Faculty of the UBB University in Cluj-Napoca) through punctual cooperation initiatives and events. Moreover, the pilot has brought the topic of circular economy and the particular perspective of energy efficiency to several policy- and business-related environments, such as the development of the RIS 3, the Regional Smart Specialization Strategy, Digital Innovation Hub meetings, and the Transylvanian Clusters International Conference.

Cluj-Napoca Pilot City – Pathway to Change

The Cluj-Napoca pilot's pathway to change is actioned across five activity pillars: (1) pilot management and coordination activities, (2) education, citizen engagement and awareness raising activities, (3) governance-focused activities, (4) stakeholder and ecosystem development activities and (5) solution-oriented activities. Through these activity pillars, the pilot works towards the overall impact of achieving a circular economy transition model for the municipality of Cluj-Napoca. Concretely, the pilot implements these activity pillars across three scenarios, where key activities are sanctioned out to lead the pilot along its pathway to change.

Overseeing the pilot city's action plan and intertwined across the three scenarios is the key activity pillar addressing pilot coordination and management activities. Specific activities relating to the three interconnected scenarios defined by the Cluj-Napoca pilot are as follows:

Scenario 1: Awareness Raising and Ecosystem Support

This scenario focuses on implementing the energy transition in the pilot through increased stakeholder awareness about better consumption behaviour. Desired outputs of this scenario include holding a pilot workshop on circular economy at the Office and developing strong arguments and business models for circular economy delivered to local stakeholders. Further, the pilot seeks to create university curricula by proposing a master's level Circular Economy course and to further raise public awareness of circular economy and alternative energy sources through co-designing the concept of the energy tree.

Working towards the release of these outputs, the pilot has carried out meetings with the stakeholders to map the needs, capabilities and opportunities for action related to energy efficiency and circular economy at the municipal level. Through this mapping, the pilot team recognized the crucial importance of engaging with specific target groups based on their certain ecosystems when connecting them with the pilot's different activity levels. These target groups for the different activities include representatives of all the stakeholders identified in the mapping.

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In certain instances where the level of activity went beyond information and raising awareness, the pilot engaged with higher-level stakeholders on CE topics through seminars and research and modelling. These actors include local authorities, companies, NGOs, and research institutes already committed and developing strategic actions around energy efficiency in the context of CE. As a result, the pilot targets their activities into two main streams of stakeholders. For the wide spectrum of companies and the general public who lack engagement, the pilot focuses on awareness raising activities. For the stakeholders who are already engaged, the pilot focuses on capacity building and solution development.

Transpiring from the stakeholder mapping meeting, the idea of the energy tree output emerged. While the actual implementation is out of the REFLOW's reach, the pilot continues to pursue the idea through co-designing a concept for the energy tree, as an innovative solution for both the production of energy as well as awareness raising, being planted in a public place as a showcase for the citizens of Cluj-Napoca.

Scenario 2: Physical Infrastructure and Technology Innovation

The objective of this second scenario seeks to realise the energy transition in Cluj-Napoca through retrofitting infrastructure and energy data collection and interpretation. The key output of this scenario is the technological development of the retrofit kit.

To achieve the development of the retrofit kit, the pilot has carried out a collaborative process between local partners and the ecosystem in the design of the solution. The pilot hosted a series of stakeholder mapping meetings where the pilot team identified an important number of actors that were willing to contribute to the development of an innovative, yet affordable solution to increase energy efficiency. Cluj-Napoca then invited these actors to a series of meetings (in a brainstorm-like format) to identify the best pathway for action. The meetings concluded that the pilot would install a hardware – software package (consisting of smart sockets, LED lighting system, light and movement sensors, new electric panels and connections and a smart metering system + monitoring software) in the dormitory of the "Energetic" Highschool in Cluj-Napoca. This solution is cross-cutting through Cluj-Napoca's pilot city action, in the sense that, it will also serve as both a case study and project for current electrical technician students.

Scenario 3: Policy Infrastructure and Political Will

The third scenario sets out to influence policymakers towards integrating energy efficiency and circular economy principles and practices into local policies. The expected outputs of this scenario encompass a catalogue of policy solutions including incorporating circular economy into the Regional Innovation Scheme, the Digital Innovation Hub, and into Cluj-Napoca's Integrated Urban Development Strategy.

Towards achieving these desired outputs, the Cluj-Napoca pilot has defined a list of relevant policies at the local and regional level and opportunities for leveraging the integration of the topic of circular economy. Moreover, the pilot has been actively involved in the drafting of the Integrated Urban Development Strategy 2030. The pilot considers the integration of sustainability and circularity principles into the Integrated Urban Development Strategy 2030 functions as an important long-term bottom-up approach to finding affordable innovative solutions for citizens, SMEs, other actors to become more energy efficient.

Cluj-Napoca Pilot City – Envisioned Impact

The long-term impact the Cluj-Napoca pilot sets out is a functioning transition towards innovative, circular models at the city-level regarding energy efficiency. Further, building an awareness and trust climate in the general public is also a key impact the pilot aims to contribute to. Using the Open Data Dashboard to be more transparent about public consumption of energy is also a key factor in building that transparent trust climate between the public authorities and the general public.

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Cluj-Napoca envisions themselves as a lighthouse city in Romania. The pilot believes that the transition towards circular practices attract the interest from other Romanian municipalities and set Cluj-Napoca as a circular exemplar. Additionally, the pilot foresees their contributions within REFLOW and the overall project itself in contributing to building a circular impact on the city, and across other municipalities in Romania.

Short-term outcomes expected:

- The instalment of the retrofit kit, the observation and analysis on consumption change
- Master level course at the local university
- Local events for dissemination
- Introduction of sustainability and circularity principles in Cluj-Napoca's Integrated Urban Development Strategy
- Development of the energy tree idea to be implemented in the future
- Data on consumption throughout the public buildings owned by the municipality of Cluj-Napoca to be made easily available using the Open Data Dashboard

Long-term outcomes expected:

- More responsible consumption of energy inside the municipality
- More responsible consumption of energy in the local community
- Greater level of awareness on the importance of energy efficiency in the context of circular economy
- Behavioural changes in consumption of materials in general
- Policy changes along with a coherent Circular City Action Plan

2.2.3.2 Final list of KPIs

Modifications to KPIs established in the REFLOW Grant Agreement

The following table presents and justifies any modifications made to the KPIs stipulated in the REFLOW Grant Agreement. The modifications are a result of the iterative process of KPI co-creation, described in the methodology section.

KPI description in REFLOW GA	New description *(if relevant)*	KPI target in REFLOW GA	New target *(if relevant)*	Justification for changes
P1: Number of housing and electricity specific city resources identified (materials, infrastructures, etc.)	Number of public buildings and energy efficiency city resources identified (materials, infrastructure)	150	-	Due to Cluj-Napoca's focus on public buildings with the analysis and retrofitting, the pilot calibrated the KPI for reflect this focus.
P2: Number of governance / business models developed	-	5	-	
P3: % housing and electricity regenerated	% of energy consumption reduced after installation of retrofit kits	35%	15%	The pilot calibrated this KPI because the regenerated electricity is not possible to estimate for individual consumers due to the set-up of information flows

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				from the energy providers/distributors, what the pilot can estimate is the % of energy reduced in the retrofitted buildings and this is what the pilot estimates to be 15%+ in the short term (project) and more on the longer term.
P4: Overall stakeholder satisfaction with new models	-	85%	-	
P5: Number of new applications for housing and electricity developed	Number of tech solutions for energy efficiency developed	6	-	These tech solutions will be developed to different levels of TRL. Some of them will only be at the concept level while others will be tested. The tech solutions tested also include the solutions developed in other WPs and which Cluj-Napoca tests as a pilot
P6: Willingness to pay for regenerated products and materials	Willingness to test and implement the solutions developed	80%	-	While the focus is on public buildings, it is more appropriate to measure the willingness to innovate and test new energy efficiency solutions rather than paying for these solutions (the willingness of citizens to pay is estimated, mentioned within the business models).
P7: Number of local makers and business reached through showcases	Number of energy providers, distributors and businesses reached through project activities	1,000	300	As the type of actors changed in the calibration (larger scale actors), Cluj-Napoca has lowered the KPI estimation.
P8: Number of citizens engaged through educational programmes	Number of citizens engaged through awareness raising and educational programmes	500		Awareness raising activities are included in the educational (non-formal educational) activity category.

Table 6: The Cluj-Napoca pilot's modified KPIs

Final list of KPIs, including additional environmental and socio-economic indicators

The following Table 7 presents a consolidated list of KPIs for Cluj-Napoca pilot city, including the modified KPIs from the Grant Agreement (GA), the environmental KPIs based on Deliverable 3.1. (D3.1) and the socio-economic KPIs calibrated in the co-creation process ahead of this deliverable (D1.3).

Source	KPI	Target	Monitoring approach			
			Scale	Regularity	Stakeholders	Lead organization
GA	**P1: Number of public buildings and energy efficiency city**	150	City	End of the project	Municipality, public authorities, clusters,	Municipality of Cluj-Napoca

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	resources identified (materials, infrastructure)				university, research institute	
GA	**P2 Number of governance/business models developed**	5	City	End of the project	Municipality, clusters	Municipality of Cluj-Napoca
GA	**P3 % of energy consumption reduced after installation of retrofit kits**	15%	Energy high school	End of the project	Municipality, university, clusters, high school	Municipality of Cluj-Napoca
GA	**P4 Overall stakeholder satisfaction with new models**	85%	City	Depending on activities (after each session)	Municipality, public authorities, university, clusters, research institute	Municipality of Cluj-Napoca
GA	**P5 Number of tech solutions for energy efficiency developed**	6	City	End of the project	Municipality (users); university, clusters, research institute (developers)	Municipality of Cluj-Napoca
GA	**P6 Willingness to test and implement the solutions developed**	80%	City	End of the project	Public authorities, citizens, businesses	Municipality of Cluj-Napoca
GA	**P7 Number of energy providers, distributors and businesses reached through project activities**	300	National/ international	End of the project	Businesses and energy providers, distributors	Municipality of Cluj-Napoca
GA	**P8 Number of citizens engaged through awareness raising and educational programmes**	500	City	End of the project	Universities, clusters, research institute	Municipality of Cluj-Napoca
D3.1	**Reduction in energy use**	15%	REFLOW site (building)	Beginning and end of project period.	Municipality, citizens, industries, manufacturers, educational institutes.	Municipality of Cluj-Napoca

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D3.1	**CO_2 emissions**	Equivalent percentage estimation from the reduction of energy use	REFLOW site (building)	Beginning and end of project period.	Manufacturers, entrepreneurs, educational institutes.	Municipality of Cluj-Napoca
D1.3	**Increase in knowledge and awareness about energy efficiency by citizen meetings (workshops, trainings, consultations)**	70% reported increased awareness after event	City	Depending on activities (before/ after each session)	Primary (direct) beneficiaries, citizens, students, educators, businesses.	Municipality of Cluj-Napoca
D1.3	**Number of people reached directly and indirectly by REFLOW communication and dissemination activities**	Directly: 500 Indirectly: 1000+	City	End of the project	Primary and secondary beneficiaries of activities, citizens, universities, businesses	Municipality of Cluj-Napoca
D1.3	**Number and type of stakeholders involved in REFLOW activities**	300 participants 10 categories of stakeholders	City	End of the project	Primary beneficiaries, e.g., meeting/consultation attendees	Municipality of Cluj-Napoca
D1.3	**Number of stakeholders participating actively (contributions and feedback) in relevant policy meetings**	40 participants 2 policy input proposals	City	Depending on activities (before/ after each session)	Citizens (attendees to CIIC meetings)	Municipality of Cluj-Napoca
D1.3	**Availability of public information from REFLOW pilot**	4 press releases 6 blog posts	City	End of the project	All	Municipality of Cluj-Napoca

Table 7: The Cluj-Napoca pilot's final list of KPIs

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2.2.3.3 Key learnings and challenges

Key Learnings

Collaborative Actions: Over the second year of REFLOW, the Cluj-Napoca pilot learned the importance of collaborative action among the pilots and among solutions- and knowledge-provider partners (different WPs). Furthermore, collaborative action within the Pilot itself has been a fundamental and one of the biggest learning points for Cluj-Napoca. Instances where collaborative action was carried out, from the design of actions until the evaluation of actions, it was established that these created the most value in impact and results.

At the level of Pilot city, the same collaboration Cluj-Napoca took was a valuable lesson. Although initially activities were estimated under each partner, the pilot took a collaborative and consultative approach and working as a micro-ecosystem, Cluj-Napoca managed to infuse better quality in the pilot's activities and deliverables.

Customization of Models: The applicability of models is very different depending on materials used, that is why the pilot needs to consider and to develop highly customized modelling when the pilot talks about material and immaterial flows (e.g. Plastic vs Energy).

Key Challenges

COVID-19: In terms of the challenge, certainly one of the biggest challenges was the pandemic, which influenced almost all awareness raising and ecosystem engagement and strengthening activities and which also influenced the type of buildings the pilot targeted for retrofitting. Not only locally, the pandemic influenced the pilot's activities and results, but also internationally, as a lot of the value added for the project was based on the possibilities to travel to other Pilot sites and encourage live exchanges and case studies which could later be formed into a shared modelling for circularity transition in urban contexts.

Low Levels of Circular Economy Awareness and Practices: Another challenge the pilot has tackled is persisting low levels of awareness and practices regarding circular economy, which determined a strong need to conduct dialogues and complex info-sessions with all the stakeholders and beneficiaries the pilot involved in our activities. Whether referring to policy frameworks for circular economy transitions in the cities or business profitability of CE models or individual practices regarding CE, the level of knowledge was quite low, thus embarking on a behaviour- and policy-changing project started from the very first phases of the learning cycle (awareness-knowledge- understanding-applying- convinced practice). This challenge at the local level was also noticed internationally where, the few examples of best practices were not necessarily readily translated into transferable practices. It is therefore a task for the REFLOW project to make this analysis and step towards informed best-practice examples and truly transferable and beneficiary-included "good practices" and CE transition tools.

2.2.4 Milan

2.2.4.1 Narrative of the Action Plan

Milan Pilot City Context

The Milan pilot within REFLOW focuses are on "Circular Markets". The pilot objective is to provide circular economy and long-term sustainable technical solutions on the logistics, transportation, transformation, distribution, and conservation of food that will enable the connection of local peri-urban agricultural areas with municipal covered markets. The Milan pilot's intervention operates within the context of its running long-term strategy towards the promotion of a sustainable food system, all while addressing the global challenge of climate change.

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As an active member in the C40 City Group, Milan provides a dynamic setting for the exploration and implementation of interventions for transitioning towards a circular and regenerative city. The Municipality of Milan builds upon and continues to advance a collection of policies and initiatives, that underpin and foster innovation in food-related matters by bringing together novel constellations of actors, spanning from a variety of institutions and expertise in the both the public and private spheres.

In recent years, Milan has appeared on the global stage as a key city for addressing food-related matters - not least through hosting the well-received World Expo 2015: "Feeding the planet. Energy for Life", in addition to a series of other events and exhibitions that have paved the way for the next generation of initiatives. The "Milan Food Policy" is just one example of the important initiatives that have materialized within the innovative and forward-thinking municipality. The policy pushes the nine municipalities of Milan Metropolitan to rethink and reconsider the system by which their citizens are fed and how this system could be restructured to become more sustainable in the light of climate change. Furthermore, the city has implemented efforts to restore and promote manufacturing within the urban through its program, "Manifattura Milano", working towards the formation of an enabling ecosystem that supports new job creation, regeneration of the suburbs, and social cohesion. Through this platform, Milan seeks to support the vibrant and growing community of FabLabs, makerspaces, and other civilian initiatives willing to merge social innovation with university structures and business expertise, to experiment and produce solutions to a variety of problematic areas including, but not limited to, agri-food, manufacturing, and digital technologies.

Within the municipality's context as a forward-thinking and innovative space for emerging solutions, the Milan pilot's starting point begins with taking stock of the covered municipal markets that dot the city's landscape. The municipal markets have historically served as meeting places between the rural and the urban but now suffer from degradation and decay as a result of low demand. The Milan pilot seeks to tackle this macro-level problem by undertaking the reactivation of its covered municipal markets as sites where circular economy logic is implemented at the neighbourhood scale. Additionally, the opportunity to work on a public physical asset such as the covered markets, subsequently activates indirect actions that address related problems such as tracking food flows at city level, starting from its general market (Foody Hub managed by SoGeMI) to prevent waste, and upcycling the waste that is produced into other by-products.

In addressing this problem, the direct beneficiaries of the Milan pilot actions are targeted across three scenarios which each represent different levels of engagement. These include the direct beneficiaries: SoGeMI, Amsa, Morsenchio Municipal Market, large retailers, logistic neighbourhood delivery service, local NGOs, and local start-ups. Furthermore, citizens, consumers and groups of citizens, even fragile ones (for example associations that benefit from the redistribution of food in Scenario 2 make up the indirect beneficiaries in the pilot.

During the implementation of the Milan Pilot City Action Plan, important changes to policy have taken place, transforming the city's political and legal environment upon which the pilot operates within. The Municipality of Milan has approved a municipal act in which it formally instructs SoGeMI to manage the Rombon covered municipal market (one of the 23 public covered markets). Among the guidelines for the management project requested by the Municipality, emphasis was placed on the topic of product traceability (for example, concerning the food flows from the Foody Hub to the neighbourhood market) and on circular economy solutions (to prevent waste within the market or along the logistics chain).

Milan Pilot City – Pathway to Change

The Milan pilot's pathway to change weaves through two strings of intersecting Actions and Scenarios towards the production of desired outputs in the pilot. Three interlinking core pilot Actions provide the basis for the development of solutions that support circular and regenerative transitions in Milan upon which three co-created Scenarios develop specific circular solutions.

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Action 1: Co-Creation Phase

The key output of the Action 1, co-creation, was to develop the pilot scenarios across a series of co-creation workshops. The three co-created scenarios provide the foundation upon which the Milan pilot seeks to address its overall challenge and to achieve long-term impact.

In generating the three co-created scenarios through which specific circular solutions are developed, the pilot undertook a series of co-creation activities with a selection of stakeholders. An analysis of the municipal markets in Milan was carried out by the pilot partners at two scales: the city and the neighbourhood. Consequently, this resulted in the identification of 5 areas of interest, marking the start of finalizing the pilot scenarios. Another co-creation activity took place following the identification of the 5 areas of interest to develop specific concepts that would stimulate interactions between stakeholders, material flows, and technological solutions made available by REFLOW. The synthesis of these concepts was carried out within the pilot to produce the three co-created scenarios as the key output of these activities, including the work on defining the solutions that feed into the following Actions 2 and 3.

Action 2: Co-Design Phase

The key output of the co-design phase will generate the desired test phases upon which the subsequent Action 3 will draw upon during a series of prototyping sessions.

To develop this output, the Milan pilot holds a series of co-design workshops with FabLab project partners and external stakeholders. During the first series of co-design activities starting in M20, the three co-created scenario outputs generated in the previous phase (Action 1) were critically analysed and further defined as follows: (1) Food Market 4.0, (2) Foody Zero Waste, and (3) Milan Prima Seconda. These scenarios, activities and their outputs are elaborated in further detail below. Additional co-design activities and workshops (started in M23) will deliver the output of this phase as the particular test phase that will undergo the testing and prototyping in the next Action 3.

Action 3: Prototype Phase

The key output of Action 3 are the circular solution prototypes co-designed and defined within each of the three co-created scenarios.

To develop this, the Milan pilot will gather the engaged stakeholders across the scenarios through a series of implementation activities including tests and prototype development of the circular co-designed solutions. This involves carrying out initial tests with the selected stakeholders based on the output generated test phases produced in Action 2. These engaged stakeholders will additionally undergo an assessment and definition of their needs which will further be developed into a design of the idea drawing upon the stakeholder needs as a starting point. From here, the development of a prototype for each of the scenario's solutions will be carried out and tested by the stakeholders.

The three co-created scenarios generated through Action 1, are presented below. Co-design and prototyping activities are strung through each scenario which in turn lead to the production of the desired outputs expected by the Milan Pilot.

Scenario 1: Food Market 4.0 Dashboard

The first scenario seeks to develop an integrated system of solutions that is part of the digital and circular transformation process of the covered municipal markets of Milan in the form of the Food Market 4.0 Dashboard. The Dashboard acts on the processes of tracking, control, and functionalization of the connections between the procurement, management, and logistics planning of the flows of goods entering and leaving the Markets. This combination favours the meeting between supply and demand for food goods, in order to implement new B2B and B2C procurement models. This scenario involves the targeted stakeholders, SoGeMI, Amsa, Morsenchio Municipal Market, large retailers, a logistic neighbourhood delivery service and the local NGO RECUP.

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The outputs generated from this scenario will be the prototyped phase of the Food Market 4.0 Dashboard which are based on the functions of the Dashboard. These functionalities include: (1) Handling - Handling of goods through an efficient HW system that avoids damage to products, (2) Check-In - Recognition and tracking of incoming and outgoing products through digitized checkpoints and tags applied to an “intelligent” box model, (3) Exposure - Goods display through versatile structures for different configurations designed for market stall, (4) Virtual Organization - Management of exhibited and stored goods through an interactive Dashboard, and (5) Picking & Delivery - Integration of last mile activities via mobile application and smart locker.

Scenario 2: Foody Zero Waste

The objective of this scenario is to recover unsold food within the general Foody Hub market managed by SoGeMI. This is carried out with the support of the NGO RECUP and, through digital tools, to optimize the delivery of the surplus food to the network of Milan associations reducing the potential waste. The scenario undertaken is in collaboration with SoGeMI, Amsa, RECUP, and other local NGOs.

The output of this scenario will include the test of the digital solution developed by REFLOW OS, Weloop, with the players of the RECUP network, applicable both for the collection phase of surplus food (within Foody Hub) and for the redistribution phase (at city level scale). This will further lead to the optimization of the unsold food collection process and the automated distribution of the product to the solidarity network managed by RECUP, minimizing the waste during the entire process.

Scenario 3: Milan Prima Seconda – Interchange System

The objective of this scenario focuses on unsold bread of Milan bakeries supported by Ibrida beer start-up that allows to upcycle the product with local brewery and use the unsold bread instead of malt. Many realities in the Milan area base their projects on secondary raw materials. In addition to the positive impact for avoided disposal, supporting young people, start-ups, and companies to easily access controlled and guaranteed secondary raw materials, the scenario would allow to simplify and accelerate the development of these realities in the area. Milano Prima Seconda, wants to be this place of exchange. The scenario will involve the Ibrida beer which is a local start-up in Milan, Amsa, and actors associated with the Ibrida network including local bakers and the La Ribalta brewery.

The output of this scenario will include the test of the digital solution developed by REFLOW OS, Weloop, with a customised user-interface for the Ibrida beer network. The test checks the optimization of the monthly waste collection (bread) and quantify it more easily. The optimization of the unsold bread collection process and the automated distribution of the product to Ibrida beer network. Indirect output could be the scaling up of other bakers and the potential increase of the collection, supported by a marketing strategy.

Milan Pilot City – Envisioned Impact

Supporting the Milan City’s vision on circular economy as a cross-cutting issue (member of Ellen MacArthur Foundation’s CE100 network on food, fashion and design, urban resilience), the Milan Pilot intends to experiment a new concept of food market to boost the circular transition by engaging diverse stakeholders to co-produce sustainable solutions at the food market/city level.

Considering the evolution of the Milan pilot and applying a short-term view (i.e., with the REFLOW project duration), Milan pilot city will contribute to four overarching goals:

- Local economy goal: to optimize circular practices among different multi-scale stakeholders of the Milan food value chain, activating "circular laboratories" managed by the three FabLabs (Polifactory – OpenDot – WeMake);
- Policy goal: to enhance the municipal covered markets and the general food market of Milan respectively as community hubs for the neighbourhoods and place to avoid food waste;

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- Awareness goal: involve NGOs, active consumers, citizens on circular economy campaigns on fight against food waste;
- Public-Private Partnership goal: involve local businesses to participate in public and private partnership processes to enhance public spaces as drivers for local economy in peripheral areas of Milan.

In a long-term view, the general objective is to develop a circular food pilot developing different circular and tech solutions for sustainable food value chain in logistics and transportation activities, smart food transformation, redistribution of surplus food and conservation processes. Testing this approach connecting different pilot scales (at city level with SoGeMi Foody Hub and at neighbourhood level with municipal markets), the effects of the experimentation could be adopted by different stakeholders in a logic of scalability.

2.2.4.2 Final list of KPIs

Modifications to KPIs established in the REFLOW Grant Agreement

The following table presents and justifies any modifications made to the KPIs stipulated in the REFLOW Grant Agreement. The modifications are a result of the iterative process of KPI co-creation, described in the methodology section.

KPI description in REFLOW GA	New description *(if relevant)*	KPI target in REFLOW GA	New target *(if relevant)*	Justification for changes
P1: Number of agri-food specific city resources identified (materials, infrastructures, etc.)	**Number of agri-food specific city actors and resources identified**	150		The new target is calibrated against concrete project scenarios for measuring context specific resources identified and mapped (stakeholders and material flows)
P2: Number of specific agri-food streams identified	**Number of specific agri-food streams identified at city level**	30		The new definition is calibrated against the MFA based on specific agri-food streams (fruit and veg) tracked at city level (the Milan Fruit and Vegetable Market is the largest wholesale market in the country, moving 10% of the total goods that pass through all the fruit and vegetable markets in Italy).
P3: Number of governance / business models developed	**Number of new technological solutions for better implementation of circular business models and practices developed**	6	3	The new description and target are calibrated against the updated project scenarios for monitoring the concrete contribution and outputs of project activities at stakeholder level.
P4: % food regenerated (current 20% of complete stream)	*Removed from the KPI list.*	25%		This proposal KPI was vague in term of scale, food stream and stakeholders involved. It is replaced by a dedicated list of "environmental KPIs"

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P5: Overall stakeholder satisfaction with new models	**Overall stakeholder satisfaction with new technological solutions for better implementation of circular business models and practices**	75%		The new description is calibrated against P3 for measuring project benefit in terms of stakeholders' satisfaction during and after the project.
P6: Number of new applications for food stream developed	*Removed from the KPI list; this initial KPI is merged with P3.*	6		See P3, where the new description and target are calibrated against the updated project scenarios for monitoring the concrete contribution and outputs of project activities at stakeholder level.
P7: Willingness to pay for regenerated products and materials		75%		
P8: Number of local makers and business reached through showcases	*Removed from the KPI list.*	250		This proposal KPI was designed having as target group other makers or FabLabs not project partners. As the pilot has evolved, the target groups (citizens) pass through the experimentation of the stakeholders and so the KPI is included in P9.
P9: Number of citizens engaged through educational programmes	**Number of citizens reached through events/awareness campaigns**	500	250	The description is calibrated with respect to a wider range of events and activities that could involve citizens, also considering the uncertainties generated by the COVID-19 pandemic. Therefore, the KPI will account for different types of interaction, from in-person and more structured interactions to awareness campaigns based on social media and online platforms, depending on the COVID-19 restrictions in place in the coming months. This calibrated KPI includes also S6 developed in D1.3

Table 8: The Milan pilot's modified KPIs

Final list of KPIs, including additional environmental and socio-economic indicators

The following table presents a consolidated list of KPIs for Milan pilot city, including the modified KPIs from the Grant Agreement (GA), the environmental KPIs based on Deliverable 3.1. (D3.1) and the socio-economic KPIs calibrated in the co-creation process ahead of this deliverable (D1.3).

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Source	KPI	Target	Monitoring approach			
			Scale	Regularity	Stakeholders	Lead organization
GA (P1)	**Number of agri-food specific city actors and resources identified**	150	City Level	End of project	SoGeMI-Foody Hub, based on MFA	Comune di Milano supported by METABOLIC
GA (P2)	**Number of agri-food specific city resources identified with partners (Foody Hub - SoGeMI)**	30	City Level	End of project	SoGeMI-Foody Hub, based on MFA	Comune di Milano supported by METABOLIC
GA (P3)	**Number of business models/applications developed**	3	Scenario level (3 Scenarios)	End of project	SoGeMI Foody Hub/Indoor Municipal Market; Recup NGO, Ibrida	Comune di Milano
GA (P5)	**Overall stakeholder satisfaction with new technological solutions for better implementation of circular business models and practices**	75%	Scenario level (3 Scenarios)	End of project	SoGeMI; Recup; Ibrida	Comune di Milano
GA (P7)	**Willingness to pay for regenerated products and materials**	75%	Scenario level (Scenario 3 - "Milan Secondary Raw Materials")	End of project	Ibrida; others	Comune di Milano
GA (P9)	**Number of citizens reached through events/awareness campaign**	250	City level	End of project	SoGeMI; Amsa; Recup; Ibrida	Comune di Milano
D3.1 (E2)	**Circular material use rate (%)**	+5-10% increase	Scenario level (Scenario n. 3, "Milan Secondary Raw Materials" - Ibrida	At the beginning/end of the project	Ibrida	Milan Pilot team (lead OpenDot)

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			business model)			
D3.1 (E3)	**Food waste index (%)**	~10% increase in agri-food saved and donated	Scenario level (Scenario n. 2, "Foody Zero Waste" - Recup good practice at SoGeMI-Foody Hub)	At the beginning/end of the project	Recup; SoGeMI	Milan Pilot team (lead We Make)
D3.1	**Circular intervention on specific agri-food flows**	~10% increase in agri-food tracked and traced	Scenario level (Scenario n. 1, "Food Market 4.0 Dashboard")	At the beginning/end of the project	SoGeMI; Indoor Municipal Markets; Recup; Ibrida	Milan Pilot team (lead Polifactory)
D1.3 (S10)	**Number of policy makers involved in adapting policies and strategic plans and participating to workshops/dissemination activities**	15	City level	Continuous tracking through a register	Different departments of City of Milan (Urban economy, Urban planning, Food policy)	Comune di Milano

Table 9: The Milan pilot's final list of KPIs

2.2.4.3 Key learnings and challenges

Key Learnings

Changing the scale to better understand which problems to face: COVID-19 forced Milan pilot to turn the focus of the activities from municipal markets point of view to city scale food flows. Focusing on the Milan's wholesale food market (Foody Hub managed by SoGeMI), the specific material flows are better recognizable and the specific food flows to distributed network of 23 municipal markets are a consequence.

Poor digital knowledge of data and skills: The lack of digital data is the main barrier after the scan of the food flows (in/out) both at city level (Foody Hub with wholesalers) and at neighbourhood level (Municipal markets with traders). Before being more circular, the Milan pilot stakeholders need to be more aware of their actual material flow. At the same time, pilot stakeholders have poor digital skills to track and map food flows (i.e., a few specific people of SoGeMI at Foody Hub level) and in some cases they have no tech and no digital skills (i.e., the traders of municipal markets). The consequence is that the shared knowledge of food logistics is highly fragmented.

Great potential for closing material loops: Considering the important amount of food flows and losses at different scales (summarized by the Metabolic Flux Analysis in WP3), the main potential solutions are related to actions for closing material loops due to many diverse innovators on the food value chain involved and interested to invest on circular economy concepts, although the gaps in data flows and the fragmented connections among actors. The immense

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potential is related to surplus food redistribution at city/metropolitan level and the tech applications for integrated logistics processes connecting different actors.

Key Challenges

Inspiring Milan food stakeholders to generate new business models for circular food systems**:** Starting from a multi-stakeholder approach and working on different urban scales, the challenge is to reorganize the key players along a specific food supply chain to avoid food waste, or if this already happens, apply the intelligent reuse of waste in new food uses.

Technology as an opportunity to increase circular actions: Milan pilot tackles the challenge to leverage at pilot level with specific scenarios the tech applications of REFLOW OS (Weloop and Open Data Dashboard developed in WP2) connecting them to the results of the MFA conducted at Foody Hub level (WP3). This intersection between technology and material dimensions will allow a fine-tuning of the project scenarios to concrete testes with involved public and private stakeholders.

Public city agenda on circular food: Based on the attention of the public agenda to surplus food redistribution and waste food reduction due to the COVID-19 pandemic crisis (top down and bottom-up initiatives), Milan pilot optimistically leverages this attention in order to make some experimental circular initiatives potentially stable activities in public spaces (covered municipal markets managed by markets' trustees and the Foody Hub managed by the public company SoGeMI). Effects on public-private governance (WP4) are conceivable as drafting circular and sustainable guidelines for management of the covered markets or for the data management of the food flows at city level.

2.2.5 Paris

2.2.5.1 Narrative of the Action Plan

Paris Pilot City Context

The Paris pilot within REFLOW focuses on the wood waste from the event industry and temporary construction within the city. The lack of common narrative, technological solutions, circular business models among these communities and inadequate regulation currently fails to organise an efficient management of these wastes.

Paris is a global and densely populated city, often hosting many international events and temporary construction projects across the city. According to Forbes (Talty, 2019) and the International Congress and Convention Association (ICCA, 2019), Paris is the second most attractive destination in the world both for tourists and international professional meetings. Consequently, this leads to the production of large amounts of waste, that not only pose a challenge for human health and the natural environment, but also represent an important logistical challenge. Furthermore, as selected hosts of the Olympic Games of 2024, an increase in events and trade fairs, and thus trade fair waste is expected in Paris due the attractiveness of such an event for both tourists and professionals. With this in mind, the city's urban metabolism identified construction material and demolition waste as a crucial element in its circular transition (Athanassiadis et al., 2019).

Paris has developed its strategy towards circular economy, focusing on the production of a "*sustainable, cohesive, responsible and resilient city"* (Paris City Council, 2017, p. 7). The Paris pilot works in close relations to the city-wide strategy, exploring solutions in the management of wood waste produced from events and temporary construction

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taking place in the city. The city and pilot's shared objective for Paris is to be a city with a culture of circular events and circular temporary constructions.

The initiatives already undertaken by the city of Paris include plans for climate and energy, local urban planning, urban agriculture development, local waste prevention, sustainable food, and various circular economy practices (Paris City Council, 2017). The initiatives and actions needed to allow for a circular transition are described in the "Circular Economy Plan" produced by the City of Paris and local authorities of the Paris Region. The plan focuses on cultivating a logic of reuse over replacement in five areas of activity: (1) planning and construction, (2) reduction, reuse, and repair, (3) support for actors, (4) public procurement, and (5) responsible consumption.

While implementing the Paris action plan, important changes to the legal landscape have taken place. On the 1st of January 2021, the AGEC ("against waste for a circular economy") law has come into force. This law is formulated to encourage the use of spare parts, as it includes an obligation to offer spare parts for any product from the furnishment industry among others, within 15 days, with an obligation to also offer spare parts from the circular economy. Alongside this measure, the law also provides a plan for widening the Extended Producer Responsibility within the construction sector, which is the biggest wood waste productor in France, with almost 2,2 million tons of wood waste per year (ADEME, 2017). The Extended Producer Responsibility abides to the "polluter = payer" principle where companies producing a product must also fund the end of life of the product. Previously, companies had to fund their waste management through their contribution to an eco-organism that, in turn, are managing the waste in their name. However, none of these were objective-driven as there were no enforcements pertaining to this law. The AGEC law remedies this by setting quantified objectives for each sector and each flow. The eco-organizations now have a quantified target for reuse, repair, and recycling, but also for eco-design. The sector is obliged to declare the quantity and destination of "waste". The qualification of a material as 'waste' will have to be justified: a material will be qualified as waste if it cannot be reused. The law defines 6 waste streams: wood, mineral fractions, metal, glass, plastic, plaster. Since the 1st of January 2021, to encourage more environmentally friendly products, a system of "bonus/malus" is set up: manufacturers based on eco-design principles will receive a bonus. This "bonus/malus" will have to be indicated on their products.

Due to the COVID-19 pandemic, most of the events and temporary construction projects have been cancelled during the second year of the REFLOW project. Considering the challenge encountered by key stakeholders of the industry, the Paris Pilot team further focused its activities on the development of technical solutions supporting the reuse of materials by different stakeholders after the events, and the eco-conception of products used in the events. Solutions have been developed in close relation with event industry partners and tested with reuse industry partners whose activities have been less impacted by the COVID-19 crisis.

In relation to the context presented above, REFLOW and the solutions the Paris pilot will produce are particularly important for the City of Paris and beyond. This is because the circular economy solutions and business models the Paris pilot will design and develop will be put to the test ahead of the Olympic Games in 2024. Eventually, and upon success, these solutions will be ready for scaling up and replication and therefore for much broader environmental and social impact.

The pilot is focused on the generation of data that is quantifying and qualifying material flows, to be shared with reuse actors. Once identified and quantified, the material flows will be used by reuse actors and social innovators who will test the incorporation of that waste into sustainable and circular supply chains. Paris seeks to build a circular economy approach to event waste management by creating a tracking system to coordinate the use and reuse of materials involved in the trade fair sector and temporary structures.

The beneficiaries of the project are very diverse. They can be classified in 3 key categories:

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- Event actors and temporary structures, viewed as waste generators
- Reuse actors, and innovative project developers, viewed as waste users
- Logistical actors and coordinators, viewed as the link between waste generators and waste users

Paris Pilot City – Pathway to Change

The Paris pilot team focuses on three scenarios addressing awareness around circular practices and technological solution, facilitating the use and re-use of wood material, and providing access to a pool of resources and digital tools for reusing wood materials. These scenarios are interconnected and represent ways in which the Paris pilot aim to increase the circularity of wood in Paris' event industry and temporary construction. Key stakeholders range from construction industry professionals, incubated companies, and re-use actors including designers and makers who are incorporated into the Pilot's pathway to change towards a circularity.

The objective for the Paris pilot is twofold. In the short-term, Paris aims to develop technological solutions and new business models to meet the demands and needs of the event industry sector. In the long-term, the Paris pilot seeks to scale up its work by influencing policy making at the EU level, and ultimately upgrading and improving a new regulatory framework focused on waste.

Scenario 1: Equip

The first scenario works towards ensuring that reused wood materials are available in an easy and efficient way for reuse actors and that these specialized and non-specialized actors have access to a fully developed and integrated pool of resources and digital tools. This scenario is targeted towards re-use actors including designers, makers, and hobbyists.

One key activity within this scenario focuses on the technical capabilities of re-use actors through the quantification and qualification of reuse or recycled wood to manufacture objects or facilitate workshops. In order to allow actors to have access to, and to generate a database of reuse materials, the Paris pilot team is developing specific tools and relying on the integration of REFLOW OS in the ecosystem.

Tools developed by the Paris pilot team include the development of smart storage processes and a database. Through these tools, the pilot aims to shift from limited knowledge of the availability of re-use materials known by a few re-use actors to a broader accessible database that can reach a wider audience of re-use actors. In order to decrease the manutention time required to digitalize the number of non-standard materials stored for reuse, the pilot team is developing a low-tech 3D scanner called the Dimension-use. This scanner allows to create a pool of material available online, with dimensions and technical characteristics included while requiring as little extra work as possible.

The development of the Dimension-use hardware and software leads to the creation of an interconnected database of reuse materials available in the region, and furthermore the development of a plugin connecting the database with design software to facilitate the design of projects based on available resources.

In addition, the experimentation of the design process of the smart storage, focused on the specific needs of reuse actors is documented to allow the system to be reapplied easily and foster the development of other storage facilities by external actors.

Finally, key processes, innovative methodologies and actors' specific actions towards reuse and circularity are documented through Re-Label and its scoring variables on wood reuse and shared online via the Re-Label Community. The Re-Label will be automatically generated by answering a self-evaluating questionnaire in the label generator.

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Scenario 2: Design

The second scenario seeks to achieve a change in the use of wood material, enabling its reuse between different events or temporary construction, and/or the use of reused wood material in the event industry (from different companies). This scenario is targeted towards event and temporary construction industry professionals, incubated companies, and reuse actors.

Activities carried out in this scenario include the development of process and awareness of the marketplace, business model analysis and development of incubated projects and pilot-led projects, as well as best practices guide communication. The project incubated in Driven by Volumes incubation program, as part of REFLOW, will experiment on the database. These projects will also be oriented and mentored to develop new business models for circular economy based on digital technologies. This will lead to the creation of innovative services with new business models at three different scopes: products or material focused (incubated companies), Driven incubation program for circular economy and consulting service on circular economy from the pilot members.

Scenario 3: Raise awareness and evaluate

The third scenario focuses on awareness around circular practices and technological solutions for circular economy raised amongst professionals of the event and temporary construction industry. This scenario targets incubated companies and event and temporary construction industry professionals.

Activities encompassed in this scenario are focused on general communication on the solutions developed, actors of circular economy identified, the Driven incubation program and their solutions. In addition, activities include case study analysis and flow analysis for best practices and opportunity identification through the Material Flow Analysis, Re-Label showcase of actors of the community and training of professionals about the possibilities offered by digital technology for circular economy.

In the short-term, technological solutions and new business models for circular economy in the industry intend to incite best practices for future businesses in the pipeline increasing the considered value of circular materials in the industry alongside increased know-how and access to solutions and tools for circularity.

Through the creation of these necessary infrastructures to guide the awareness, the access, and the use and reuse of wood materials in the event and temporary construction industry, Paris aspires for sustained change in the culture of the city's future events and temporary constructions.

Paris Pilot City – Envisioned Impact

Mid-term outcomes:

Thanks to the Paris pilot solutions developed in REFLOW, materials and their characteristics and history are made visible and available for reuse. Indeed, one of the developed solutions allow reuse actors to have access to a database of reuse materials for their projects and business.

The best practices guide informs future business in the pipeline. Professionals know how to use circular solutions and or tools for temporary construction. Thanks to the Re-Label, professionals can access product related information to manufacture new products.

In addition, resources, reuse professionals and reuse customers are well connected through the REFLOW community, REFLOW OS and incubated projects held in Driven. Driven is an autonomous incubator supporting the development of new companies working with circular economy solutions.

Long-term outcomes:

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A shift has been operated from craftmanship based to industrialized and digitalized reuse processes for elements in temporary construction. Therefore, the capacity to process large volume of reuse materials has grown for the distributed network of stakeholders. There is an increased number of tech company for circular construction.

Companies create products with more recycled materials in use, and people consider more value in structures built with circular principles/ materials. There is a shift in the mindset of construction and design stakeholders: available materials become a mandatory input/constraint/entry point for any design choice.

Finally, REFLOW actions have an influence on both temporary events regulation and waste regulations, that leads to proposals for changes in waste regulation and temporary events regulation developed in line with CE principles

Impact:

Paris as a city with a culture of circular events and circular temporary construction.

Ultimately, the Paris pilot consortium wants to achieve continuous support for the event industry sector's economic development through sustainable and circular business models. The economic aspect of circular economy practices is crucial in waste management – if the projects are not economically viable, many stakeholders refrain from getting involved. However, with new, relevant business models being implemented, more actors can be engaged and the overall circularity and reuse of wood in Paris could be increased. Setting a good example, paired with uncovering the inefficiencies in existing regulation, could unleash national and global political reforms regarding waste management, especially in the event industry.

2.2.5.2 Final list of KPIs

Modifications to KPIs established in the REFLOW Grant Agreement

The following table presents and justifies any modifications made to the KPIs stipulated in the REFLOW Grant Agreement. The modifications are a result of the iterative process of KPI co-creation, described in the methodology section.

KPI description in REFLOW GA	New description *(if relevant)*	KPI target in REFLOW GA	New target *(if relevant)*	Justification for changes
P1: Number of wood and packaging specific city resources identified (materials, infrastructures, etc.)	**Number of wood specific city actors and resources identified (organization, materials, infrastructure)**	150	-	The description was changed as the pilot is not focused on packaging. A more specific and detailed description was updated by adding the mention of city actors identified.
P2: Number of specific wood and packaging streams identified	Number of scoring variables on wood reuse	5	-	The initial P2 KPI is already encompassed in the P1. The updated description is more precise and related to validation of reuse protocols
P3: Number of governance / business models developed		5	-	
P4: % wood and packaging regenerated	DELETED	30%	DELETED	This KPI was deleted, as it was not clear or precise enough. It is replaced by the KPI "Circular re-use of MDF waste"

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				focused on the FIAC event. (see the final list of KPIs)
P5: Overall stakeholder satisfaction with new models		90%	80%	After evaluation with different stakeholders, the new target of 80% appears to be a more realistic target
P6: Number of new applications for wood and packaging developed	**Number of new applications to minimize wood waste**	15	10	After evaluation with different stakeholders, 10 new applications appear to be a more realistic target. In addition, the pilot is not focused on packaging but on wood waste minimization.
P7: Willingness to pay for regenerated products and materials		75%	-	
P8: Number of local makers and business reached through showcases		1,000	200	The target was decreased from 1,000 to 200 due to the COVID-19 impact on participation of live events and difficulty to meet with makers
P9: Number of citizens engaged through educational programs	**Number of people remote from employment engaged through formation**	600	17	Review the KPI: the target was decreased from 600 to 17 aligned with the new KPI description from citizens to formation to a specific public unemployed

Table 10: The Paris pilot's modified KPIs

Final list of KPIs, including additional environmental and socio-economic indicators

The following table presents a consolidated list of KPIs for Paris pilot city, including the modified KPIs from the Grant Agreement (GA), the environmental KPIs based on Deliverable 3.1. (D3.1) and the socio-economic KPIs calibrated in the co-creation process ahead of this Deliverable (D1.3).

Source	KPI	Target	Monitoring approach			
			Scale	Regularity	Stakeholders	Lead organization
GA	**Number of wood specific city actors and resources identified (organization, materials, infrastructure)**	150	City	End of project	Individuals, companies, or associations involved in the wood flow or temporary structure industry	FCGP
GA	**Number of scoring variables on wood reuse**	5	City	End of project	Wood workshop users	ARS LONGA
GA	**Number of governance / business models developed**	5	City	End of year	Business Model	FCGP

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GA	**Overall stakeholder satisfaction with new models**	80%	Project	End of project	Incubated companies, pilot partners, users of developed solutions	FCGP
GA	**Number of new applications to minimize wood waste**	10	Project	End of year	Driven incubated companies, REFLOW internal solutions + partnership with events / companies	Volumes
GA	**Willingness to pay for regenerated products and materials**	75%	City	End of project	Key REFLOW partners and solutions users	FCGP
GA	**Number of local makers and business reached through showcases**	200	Project	End of year	Local makers and businesses	Volumes
GA	**Number of people remote from employment engaged through formation**	17	Project	End of year	People remote from employment	FCGP
D3.1	**DELETED Circular timber use rate**		Events	Beginning and end of project period	Manufacturers, industry, entrepreneurs.	ARS LONGA
D3.1	**DELETED End-of-life reuse/recycled input rates**		Events	Data collected per event schedule, according to their occurrences	Manufacturers, industry, entrepreneurs.	City of Paris (Municipality)
D3.1	**DELETED Life-time extension – number of event cycles**		Events	Data collected per event schedule, according to their occurrences	Educational institutions, entrepreneurs, manufacturers, SMEs (driving the incubators and innovations).	TBD
D1.3	**Circular reuse of MDF waste**	2 tons (15% of the 2019 baseline)	Event	End of year	FIAC	FCGP
D1.3	**Number of stakeholders involved in counselling activities to orient the project direction**	7	Project	End of year	Organizations or individuals involved in project meeting and data collection sessions.	FCGP
D1.3	**Number of workshops and makers in the target group that has been reached and/or activated by the project**	Training: 5 Tracking label: 4 Data base user: 5	Project	End of year	Participants in trainings; users that receive the outputs of the project.	ARS LONGA

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		Handbook user: 50				
D1.3	**Number of projects that receive financial and non-financial support in form of assets, counselling, facility access, etc.**	5	Project	End of year	Project owners supported in financial and non-financial form.	Volumes
D1.3	**The extent to which the project has contributed to, or inspired, changes in municipal rules and regulations to support implementation and "mainstreaming"**	Qualitative ; unitless	City	End of year	Parisian policy makers, city council of Paris	City of Paris
D1.3	**Numbers of solutions related to waste management and recycling: applicable and replicable**	1	Project	End of year	Incubated companies and innovative project owners	Volumes

Table 11: The Paris pilot's final list of KPIs

The environmental KPIs defined in D3.1 were focused on the FIAC evolution. However, the material flow analysis of the FIAC 2019 event, led by METABOLIC, revealed the extent to which the FIAC event is already mostly circular regarding timber, with the exception of the MDF wood flow. In addition, the COVID-19 crisis led to the cancellation of most events in 2020 and 2021, which made it impossible to focus on another event for the Paris pilot, as there was no data available for 2 editions (one past edition, and one future edition) within the REFLOW timeframe, considering the COVID-19 pandemic restrictions and situation. It was thus decided by the Paris pilot team and METABOLIC to change the proposed KPIs from D3.1 (greyed in Table 11) to a single KPI (highlighted Table 11) focused on the one problematic wood flow identified during the MFA analysis: the MDF flow.

2.2.5.3 Key learnings and challenges

The key learnings and challenges faced by the Paris pilot team over the second year of REFLOW can be classified in five categories.

The COVID-19 pandemic

The COVID-19 pandemic impacted the Paris pilot team at different levels. The crisis came with different challenges for the pilot, leading to the redefinition of the operation processes and a slight change in the methodological approach to the event industry and temporary construction.

Firstly, as for many project members, the lockdowns and switch to full online work required a quick adaptation of the operational processes of the Paris pilot team.

The incubation program Driven by Volumes was designed to be a blended experience with onsite experience and online learning. The Paris pilot's response to the pandemic was to have a 100% online platform, which made things more

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difficult but also opened new perspectives on the possibilities to scale up the incubator to the international scale (in connection to REFLOW Legacy).

In addition, the target of the Paris pilot team being the event industry and temporary construction projects, which have been mostly cancelled during the past year, required the adaptation of activities in the Paris pilot team. Due to the restrictions of the COVID-19 pandemic, the pilot team could not experiment solutions at event sites. With the key stakeholders in the Paris pilot in crisis mode, the pilot team switched their focus over to providing solutions developed with the event actors of the targeted chain that are involved before the event, and after at the deconstruction to develop reuse projects.

Storage and logistics

The pilot team realised that storage and logistics are fundamental to the challenges arising for important stakeholders that prevent the development of the circular economy.

Storage is a key challenge limiting reuse in the event industry in the Ile de France region. Due to the lack of storage place and the high cost of the square meter in the area, storage of reuse material, of medium to low value, has to be very efficient and automatized to be cost worthy. Advanced digital technologies appear to open unexpected potential in logistics of circular economy, more than design and construction. Focus on incubated projects in the field of logistic has been encouraged by the incubation program Driven.

The Paris pilot team focused on experimenting on storage solutions at Re-Store and developing the Dimension-use machinery made to automatize the digitalization of the materials stored. By developing this process focused on reuse material storage, decreasing the manutention time and increasing the access to data, and thus materials, the Paris pilot team aims to develop efficient storage solutions. In addition, storage has been included in the D5.2 map of the material transformation process, as it is key to the lifecycle of materials, even though it is not a transformation of the material per se.

Community building

There are many involved players of different size and specialties that do not work together effectively, therefore the pilot team has encountered difficulties in connecting these stakeholders together. There are many actors involved, of various size and specialities, that did not tend to collaborate efficiently. We support the development of a network of actors involved in a circular economy in the event industry and temporary structures.

The Paris pilot team organized a cycle of events, in the Pecha Kucha format, focusing on the event industry and circular economy, with a refined emphasis on wood reuse at those events. The events allowed actors to come together around the topic, to be aware of the different initiatives in place, and to promote and give visibility to key stakeholders. In all of the projects led by the pilot team, actors were involved during interviews, design phases or testing to keep them engaged with the project, and ensure the pilot develop tailored solutions.

Connecting work package activities to operational pilot level activities

Over the full span of the project, work package activities were well defined in the GA, and overall a crucial support to the progress made by the pilot team. However, as the pilot activities have been further defined in the first part of the project, after the GA was signed, alignment between work package activities, timeline of executions of the tasks and operational needs for the pilot activities have been a key challenge. The different coordination meetings, at pilot level, work package level and project level have proven very useful and insightful in aligning all the priorities.

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Replicability and scalability

Overall, the Paris pilot team focused on replicability and scalability of the solutions developed. The tools created are designed to answer specific needs of the event industry and temporary construction actors in the Paris area, but are also designed to be replicable in different context. Whether it is with different materials, different sectors, or different geographical regions, the solutions and processes developed are made so that they can be scaled. The Driven incubator is an example of a project led by the Paris pilot team that is designed to be scalable at the European level. Key learnings about the incubation program first round of project incubation are leading to a redefinition of the program format. Mixing educational format and incubation is difficult and challenging. The Paris pilot is now studying opportunities of having a two-step platform: one year training, one year incubation.

2.2.6 Vejle

2.2.6.1 Narrative of the Action Plan

Vejle Pilot City Context

The Vejle pilot within REFLOW aims to raise awareness among citizens and organisations and to engage public, private, and civil society stakeholders in the design and development of new circular economy solutions and tools that will allow the reuse, reduction, and recycling of plastics. Vejle aims to reduce and recycle plastic in order to improve the circular economy on the local level, with the future goal to upscale these solutions to national scale. The Western part of Vejle provides the testing ground for circular plastic strategies where the pilot works with citizens, companies, public institutions, culture innovation institutions, entrepreneurs, and a range of experts within circular economy, waste management and politicians.

The setting under which the pilot operates in coincides with the ongoing momentum for circular economy and plastics at the regional, national, and international scales. With the creation of the EU Climate Action Plan to support the cities in developing climate actions plans that are aligned with the objectives of the Paris Agreement, the EU Plastic Directive was established. This Directive aims at reducing the volume and impact of certain plastic products on the environment, underpinning the National Plastic Plan in Denmark published in 2019. The Plan continues to attract attention on plastic recycling and circular economy in Denmark – and therefore in Vejle. The vision of the National Plastic Plan is to let Danish companies be known for taking the lead in the development of sustainable plastic solutions in design, recycling, reuse, circular business models and recycling technology. In 2020, the government published the National Waste Plan, which sets the goal to improve circular economy and reduce 70% of the greenhouse gases by 2030. Along with the Waste Plan came a goal to improve household waste and get citizens to sort their waste into 10 different fractions at home. By October 2021, new waste plans for Danish municipalities will also take effect. At the municipal level, in late 2020, the Municipality of Vejle published a new waste plan, and in collaboration with RessourceCenter Vejle, the Vejle pilot will contribute with guidance and knowledge of plastics and circular economy.

The pilot is working with five scenarios that test circular solutions on the micro level. This test sites located in West Vejle include: Rema1000 (supermarket), Sofiegården (nursing home), Den Gamle Gård (apartment block), Spinderihallerne/FabLab (culture and innovation centre), and REFLOW OS (technological solution). The pilot is working with established working groups and are pursuing partnerships within these groups. The pilot has conducted a waste and stakeholder analysis, innovative ideation and prototyping with stakeholders and created a local movement towards a more sustainable future.

The pilot aims towards providing realistic best practices through a people-centred approach by:

- Mapping waste and plastics sorted in five micro test sites;

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- Involving and connecting a wide range of local stakeholders;
- Developing new prototypes and consequently enable scaling and replication in other cities and
- Executing citizens' engagement and capacity building activities.

During the first year of RELOW, the Vejle pilot created a plastic analysis including a value chain-analysis. The results from this analysis showed that a large amount of plastic from the chosen test sites was ending up incinerated due to improper discarding, ending up in regular or paper waste bins. This presented a great potential for better sorting at the test sites and for increasing the recycling of plastic. It also showed a demand for a more sustainable procurement policy – and thereby decreasing the amount of plastic in the city.

The outputs received from research and stakeholder mapping concluded that there was a lack of knowledge among citizens on plastic recycling and CE. Furthermore, there was a lack of structure, collaboration (tech solutions) and partnerships in order to make plastic flows circular and the city (and especially in the Western part) had a very heterogeneous citizen-group, complicating communication.

Vejle Pilot City – Pathway to Change

The pilot has set goals in order to achieve an impact on the recycling and reduction of plastic waste in Vejle. The pilot aims to:

- Facilitate connections/exchange knowledge between civic, business and policy level.
- Create arguments and show potential for a more circular procurement policy.
- Identify potential barriers among stakeholder for a sustainable transformation (and present them at a policy level).
- Identify the potentials for the implementation of REFLOW OS in a local context to track the plastic streams and visualize the potential for behaviour change.
- To develop and launch a list of digital communications tools/channels that can help the pilot spread knowledge generated by REFLOW (i.e., social media, newsletter, homepage)
- To engage with citizens to incite behavioural change via information-meetings, events, and workshops throughout the project period both on a local and national level with designers/businesses/citizens/educational system

The activities chosen for all five scenarios will be developed in a way where the Vejle pilot defines the possibilities for scaling solutions to a national and international level. To achieve these goals, the Vejle pilot is working with five scenarios:

Scenario 1: Sofiegården

Scenario 1 aims to change the plastic streams within healthcare at the nursing home test site, Sofiegården. The focus area will prototype new solutions that will decrease the use of plastic in the healthcare sector and eventually scale these solutions to a regional and national level.

The Vejle pilot has completed activities surrounding the mapping of plastic streams through qualitative and quantitative methods, conducting value chain and stakeholder analysis, establishing partnerships, interviews, visits to Sofiegården, creating and hosting working group meetings and organising prototyping workshops. From the second year of REFLOW until M36, the Vejle pilot will finalise the prototypes and road mapping, testing, and implementing the solutions, creating awareness initiatives to display solutions related to exhibition, as well as working with WP4 and WP3 to scope further scaling potentials.

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The outputs for Sofiegården are to create new partnerships between the purchasing department, suppliers and Sofiegården, to influence the political ambitions, and create awareness through exhibitions in Spinderihallerne. The pilot is also seeking to exchange knowledge through the prototype workshops and to develop these prototypes based on the needs and challenges identified. On the local scale, the Vejle pilot has established environmental ambassadors who investigate how a decrease in the use of plastic can be done.

Scenario 2: Rema1000

In collaboration with the supermarket, Rema1000, the pilot is creating circular streams of specific plastic types in this second scenario. The focus area will prototype the creation of new circular loops for specific plastic containers and scaling this to other SMEs.

Since the beginning of REFLOW, the Vejle pilot has completed the following activities: mapping plastic streams through qualitative and quantitative methods, creating partnerships to create circular loops and engage in dialogue with Rema1000 to identify products. From the second year of REFLOW until to M36, Vejle will be exploring the specific products and the method to create circular loops for them. The pilot will also initiate common dissemination activities through awareness campaigns and displaying the solutions at the final exhibition.

The outputs that the pilot is seeking to generate will lead to the creation of new partnerships, increase dialogue, increase awareness, and develop prototypes based on the needs and challenges identified.

Scenario 3: Den Gamle Gård

The third scenario aims to create better and more intuitive sorting systems and information in apartment buildings. The focus area of this scenario concentrates on citizen engagement, empowering the local community and generating knowledge. On a practical level, the scenario aims to help the inhabitants at Den Gamle Gård to sort better and to develop new prototypes to consequently enable scaling and replication in other cities.

Over the second year of REFLOW, the pilot has completed activities related to the mapping plastic streams through qualitative and quantitative methods, conducting communication activities, interviews, and visits to Den Gamle Gård, creating and hosting working group meetings, and organising prototyping workshops. From the second year of REFLOW until M36, the Vejle pilot will finalise prototypes and road mapping, testing, and implementing, awareness initiatives to display solutions related to the exhibition.

The outputs that the pilot seeks to fulfil is to increase awareness and develop prototypes based on the needs and challenges identified at the test site.

Scenario 4: Spinderihallerne/FabLab

In the fourth scenario, the Vejle pilot aims to empower and build the knowledge capacity of the local community trough citizen engagement in creative events and initiatives. The focus area is executing citizen, maker and entrepreneur engagement and capacity building activities.

Over the second year of REFLOW, the pilot has undertaken activities related to the organising of exhibitions, open workshops at the FabLab, creation of partnerships for meeting at an organizational/governance/policy level, hosting meetings from scenarios 1, 2, and 3, and carry out a broad range of communication activities online.

The outputs within this scenario are the hosted exhibitions at Spinderihallerne, the creation of citizen involvement in workshops (e.g., in FabLab) and capacity building, and thereby activating increased awareness.

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Scenario 5: REFLOW OS

Scenario 5 seeks to test the online platform for material exchange, REFLOW OS, which focuses on material exchange between the waste-plant, SMEs, and makers. To do so, the pilot uses the circular loops identified at the different test sites with the potential for an addition test site at the new RessourceCentre in Vejle.

The pilot's planned activities for this scenario, REFLOW OS, involves creating an overview of plastic material available at the pilot test sites (and other options in Vejle), the development of the process with WP2 and Task 5.4 for the testing period, knowledge, and capacity building within the Municipality of Vejle and FabLab and testing with working groups for feedback for future development and implementation.

Insights on how the pilot can implement and benefit from the REFLOW OS system in Vejle for more circular material exchange are expected outputs within this scenario. Furthermore, as mentioned the possibility of collaboration between the new RessourceCenter in Vejle is an additional output.

Vejle Pilot City – Envisioned Impact

The envisioned impact of Vejle is the reduction of plastic waste and increase in plastic recycling. The Vejle pilot is researching and testing at the micro-level with the goal to scale this to the national and international level following the tests and implementations of the solutions at the West Vejle test sites. In this sense, the pilot develops and works on a micro level supplemented by design methods from DDC and help from WP3 and WP4. As a result, Vejle gathers information on how these micro-level solutions and prototypes could be used more generic and across different scales and contexts.

The long-term outcomes for all five scenarios are as follows:

1. Activating citizens with an empowered local community of active and informed citizens.
2. New prototypes/solutions that foster methods and tools to reuse plastic/replace plastic in products in the healthcare sector and in grocery stores.
3. A line of scalable principles from the pilot to enable scaling of the tested solutions, models, and methods.
4. Enabling scalability of the pilots' solutions, models and methods across other contexts and scales (local, regional, national, supranational and to benefit across private and public sectors.

The pilot has created short- and long-term outcomes for each test site:

Sofiegården: The outcomes the pilot is seeking to achieve in Sofiegården is better sorting at the site and use of more sustainable products. Furthermore, the pilot seeks to achieve impact from implementing solutions that point to the potentials of changes procurement policy in the Municipality.

The long-term outcome aims to change the plastic streams in healthcare on regional and national level.

Rema1000: The short-term outcomes for Rema1000 are to create new circular loops for specific plastic packaging to showcase the potential and possibility for other retail stores and SMEs as well as increasing their sorting – for the goal of more recycled plastic.

The long-term outcomes aim to create circular streams of specific plastic types (packaging) on a national level.

Den Gamle Gård: The short-term outcomes are better sorting at Den Gamle Gård, awareness creation among citizens and testing prototypes on waste management/sorting as well as identify scaling potential in other housing associations.

The long-term outcomes aim to achieve better sorting in apartment households on a national level.

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Spinderihallerne/FabLab: At Spinderihallerne the short-term outcomes are awareness creation and thereby to enhancing better sorting among citizens, encouraged experimentation of plastic alternatives. Through these outcomes, the pilot expects to create behavioural change among citizens through the practical initiatives/prototypes that revalue plastic waste. Concretely, Spinderihallerne will host two exhibitions to display the solutions and share knowledge about plastic and circular economy.

The long-term outcome aims to change citizens' view on plastic and get them to see different perspectives on plastic waste and how to use plastic after it has been categorized as waste.

REFLOW OS: The short-term outcomes for REFLOW OS are to unlock possibilities to improve reducing, reusing, and recycling of plastics in a local context. The Vejle pilot will identify the potentials and scalability for REFLOW OS through iterative testing.

2.2.6.2 Final list of KPIs

Modifications to KPIs established in the REFLOW Grant Agreement

The following table presents and justifies any modifications made to the KPIs stipulated in the REFLOW Grant Agreement. The modifications are a result of the iterative process of KPI co-creation, described in the methodology section.

KPI description in REFLOW GA	New description *(if relevant)*	KPI target in REFLOW GA	New target *(if relevant)*	Justification for changes *(if relevant)*
P1: Number of plastic specific city resources identified (materials, infrastructures, etc.)		50		
P2: Number of specific plastic streams identified		5		
P3: Number of governance / business models developed		10		
P4: % plastic regenerated		25%		
P5: Overall stakeholder satisfaction with new models		75%		
P6: Number of new applications for plastic developed		12		
P7: Willingness to pay for regenerated products and materials	Willingness to test or implement the new models and tools	70%		
P8: Number of local makers and business reached through showcases		50		

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P9: Number of citizens engaged through educational programmes		250		

Table 12: The Vejle pilot's modified KPIs

Final list of KPIs, including additional environmental and socio-economic indicators

The following table presents a consolidated list of KPIs for Vejle pilot city, including the modified KPIs from the Grant Agreement (GA), the environmental KPIs based on Deliverable 3.1. (D3.1) and the socio-economic KPIs calibrated in the co-creation process ahead of this Deliverable (D1.3).

Source	KPI	Target	Monitoring approach			
			Scale	Regularity	Stakeholders	Lead organization
GA	**Participation of minimum 50 households distributed on different types of housing and public and private buildings**	50	West Vejle (test area)	Beginning and end of project	Test sites	Vejle/DDC
GA	**Plastic streams identified at the different test sites**	5	West Vejle (test area)	Beginning and end of project	Test sites	Vejle/DDC
GA	**Number of governance / business models developed**	10	Project	End of project	REFLOW Vejle stakeholders	Vejle/DDC
GA	**Reduction in the amount of plastics sent to incineration from the test sites**	25% reduction	Selected test sites: Den Gamle Gård; Sofiegården; REMA 1000	End of project	Waste management within the Municipality and selected test sites (Den Gamle Gård: Sofiegården, REMA 1000	Vejle/DDC
GA	**Overall stakeholder satisfaction with new models**	75%	Primarily test sites	End of project	REFLOW Vejle stakeholders	Vejle/DDC
GA	**Number of new applications for plastic developed**	12	Project	End of project	Vejle Pilot	Vejle/DDC
GA	**Willingness to test or implement the new models and tools**	70%	National	End of project	REFLOW Vejle stakeholders	Vejle/DDC
GA	**Number of local makers and business reached through showcases**	50	National	Track regularly, report end of project	Vejle Pilot	Vejle/DDC

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GA	**Number of citizens engaged through educational programmes**	250	City	Track regularly, report end of project	REFLOW Vejle stakeholders	Vejle/DDC
D3.1	**Number of plastic streams going into circular use within REMA 1000**	5	REMA1000, Vejle	Beginning and end of project activity.	Municipality, industries, manufacturers.	Vejle/DDC
D1.3	**Increase in the awareness about circularity of plastics among the citizens**	75%	City	Before and after events	Spinderihallerne visitors	Vejle/DDC
D1.3	**Active community involvement through meetings in shaping the implementation**	Local steering group: 3/year Working groups: 3/year NMU: 2/year AB: 2/year	Project	Yearly	Working groups, local steering groups, Advisory Board, NMU	Vejle/DDC

Table 13: The Vejle pilot's final list of KPIs

2.2.6.3 Key learnings and challenges

Key Challenge

The challenges the pilot has faced during the second year of REFLOW has for a large part been affected by COVID-19. Due to the restrictions associated with the COVID-19 pandemic, the Vejle pilot cancelled all physical events, workshops, and meetings, and transformed these to an online platform, leading to a lack of physical citizen involvement. The uncertainty of the pandemic has been a challenge for the Vejle pilot team due to the ongoing changes and extensions of the restrictions. Moreover, the concern of hosting online workshops as opposed to physical workshops has also garnered some challenges in the Vejle pilot. This was noticed in some of the target group participants who had more difficulties in engaging and interacting on an online platform due to lower technical skills.

Key Learnings

Overall: Vejle has learned that circular plastics is a complex matter – both concerning plastic as material, within circular economy and in the community – what and where exactly the problem is, and how to solve this problem. The pilot can only measure the plastic that is sorted and not what is actually recycled, as this depends on the quality of the plastic. Currently, only 30% (approximately) of household plastic waste is being recycled in Denmark. This underlines the importance of the pilot's collaboration with the supermarket, Rema1000. The pilot's Material Flow Analysis points Vejle in the direction of the most pollutant plastic – and this will help inform the pilot's decision on which concrete activities and areas they will focus on at their test sites.

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Furthermore, the pilot has learned that it is also important to incorporate different perspectives into plastics. For example, the involvement of art, products, industrial production, and waste management, has allowed the pilot to discover this key learning. The pilot has not only received positive feedback to their activities involving these different perspectives on plastics, but also from a wider range of target groups as these activities have had a broader reach.

To keep up with the momentum of positive streams regarding plastic in the city and beyond, waste, and circular economy has been a crucial topic for the pilot. Furthermore, leveraging off and acknowledging the ongoing changes at the international and national levels has helped to guide this momentum in the Vejle pilot. The pilot has further learned to exploit the ability to be part of the local climate plans and the new RessourceCenter in Vejle to further guide and bring REFLOW down to a more practical and local level and to be used as a communication point to reach the pilot's target audience.

Technology: The pilot has discovered how challenging it is to translate a digital IT system (REFLOW OS) into a local context. This has included challenges in understanding and defining the goal and purpose for the platform. In addition, the actual implementation at the community level has also arisen as a challenge that the pilot faces. To tackle this challenge, the pilot has acknowledged and learned the cruciality of exchanging information with the project's WPs and pilots as part of Task 5.4.

Alignment between WPs and pilots: The Vejle pilot has learned that it is important that WPs and the pilot city teams are closely connected and communicate with each other if the potential pilot solutions are to be fully exploited. The different coordination and alignment meetings facilitated by CBS between pilot city teams and WPs have proven very useful and insightful in aligning all the priorities, as well as the one-on-one meetings between the WPs and Vejle.

2.3 Concluding Remarks

As a continuation of Deliverable 1.2 - Cities' Circular Action Plans, Chapter 2 of this deliverable presented the updated Pilot Action Plans, supplemented with the final list of KPIs identified and calibrated for each pilot city. In the upcoming final year of the project, the pilot cities will increasingly focus on the monitoring of progress towards each of their KPI targets; as such, the KPI lists included in this deliverable will also inform the overall project impact assessment, which will be reported through Deliverable 1.5 in M36 of the project.

Beyond their use within the project, the KPIs and the calibration methodology applied to develop them are presented here to demonstrate how generic KPIs sourced from international institutions and well-recognized databases can be calibrated to reflect the intricate and contextual situation of each city. A key learning that emerged in REFLOW related to performance measurement for circular economy was the need for indicators to reflect the context specificity of each city that was expected to measure and report progress based on the given KPIs. The action plans presented here highlight the differences between the pilot cities in REFLOW, shining light also on the distinct challenges that each pilot city is facing in their own journey to become a more circular and regenerative city. Ultimately, these contextual differences are also reflected in the KPIs that the cities have calibrated.

On the other hand, all pilot city action plans make evident the common issues related to the complexity of circular transition and emphasise the shared need to operate on multiple levels and together with a diverse set of stakeholders. In this regard, the REFLOW Framework has been developed as a model for organizing a circular transition in cities, with the objective to be generic enough to accommodate for the context-specific contingencies of the pilots (as reflected in the action plans by the final list of KPIs), but at the same time to be detailed enough to frame the core elements characterizing urban transitions to circular economy. The REFLOW Framework is further introduced in Chapter 3, where its definition, objectives and elements are described in detail.

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3 The REFLOW Framework

The previous chapter presented the REFLOW Pilots' Action Plans, outlining the key actors, activities and pathways of the six cities' transitions undertaken throughout the REFLOW project. Moreover, it presented the key performance indicators informing the six cities in the implementation and monitoring of their circular transitions. In so doing, the six action plans provide the context in which the REFLOW Framework has been developed. This chapter will describe the REFLOW Framework as a supportive model to organize and guide cities' circular transitions. The first section will present the objectives and definition of the REFLOW Framework. The second section will position the REFLOW framework vis-a-vis other existing initiatives and frameworks aimed at supporting the transition towards circular economy in Europe. The third section will describe the methodological approach that informed the development of the REFLOW Framework throughout the second year of the project. The fourth section will describe the REFLOW Framework in detail, by outlining its core components and terminology. The fifth section will introduce the envisioned next steps related to the use of the REFLOW Framework during the third and last year of the project and beyond.

3.1 Objectives and Definition of the REFLOW Framework

The objective of the REFLOW Framework has been defined in the REFLOW project Grant Agreement as:

"a publication to enable agency and participation of municipalities, SMEs, and citizens' associations in the development of CE practices and governance. It will include the environmental, social and economic indicators identified" (REFLOW Grant Agreement Annex 1, 2021, p. 13)."

Such a definition motivates the choice of developing **a general model for the pilot cities to better describe, understand and implement CE practices and governance, as well as for future cities to embark in CE transitions.** This definition inherently represents the human-centred and bottom-up approach to CE, reflected by the key stakeholders, previously outlined in Table 1. Moreover, it reflects the relevance of social and environmental performance measurement as a central aspect of the REFLOW Project. All of these elements have been taken into consideration in the development of the REFLOW Framework.

3.2 Positioning the REFLOW Framework: CE initiatives and Frameworks of Circular Transitions

The ambition of "making circularity work for people, regions and cities" brought forward by the European Commission highlights the need for supporting key actors and decision-makers in understanding and enabling the conditions for CE implementation. This is evident from the OECD report on "The Circular Economy in Cities and Regions" (OECD, 2020). The report highlights the multifaceted nature of CE transitions within cities, by showing the interplay of actors and actions that need to be leveraged throughout this process. Moving towards a circular system is an opportunity for rethinking production and consumption patterns; improving environmental quality and resource efficiency; creating new business models; promoting citizens and business acceptance and awareness on the circular economy through awareness change; and boosting innovation, as identified by surveyed cities and regions (OECD, 2020). The REFLOW Framework aims to provide the necessary support for these opportunities to be leveraged.

It is well documented how the implementation of circular economy in cities can create social, economic, and environmental benefits by increasing liveability, resilience, and economic productivity (EMF, 2020). In this regard, the European Commission's Circular Economic Action Plan 2020, (CEAP 2020) published as part of the Communication on a European Green Deal, has presented the Commission's commitments to enable the transition toward CE through a series of new initiatives. These refer to multi-stakeholder projects, action plans and policy initiatives involving European cities, regions and member states. On the other hand, a multitude of frameworks aimed at facilitating the understanding and implementation of circular economy have been proposed. By building upon and extending existing frameworks, and

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targeting circular economy, The REFLOW Framework aims at contributing to these efforts by offering an integrative framework to support CE transition in cities. This section outlines the main European initiatives the REFLOW might contribute, as well as the existing frameworks that the model proposed can complement.

3.2.1 Existing initiatives

The initiatives introduced in this section are part of the ambition outlined in European Green Deal for Europe to be climate neutral by 2050. In this regard, they represent spaces where circular economy and cities' circular transition play a central role. All the initiatives here briefly outlined highlight the relevance of a supportive model to enable agency and participation in cities' transition towards a CE.

European Urban Initiative (EUI): "This initiative aims to strengthen integrated and participatory approaches to sustainable urban development and provide a stronger link to relevant EU policies, and in particular, cohesion policy investments. It will do so by facilitating and supporting cooperation and capacity building of urban actors, innovative actions, knowledge, policy development and communication in the area of sustainable urban development" (EUI, 2019).

The Intelligent Cities Challenge (ICC): This initiative supports 136 cities in applying latest technologies, which support them in their intelligent, social and green recovery. The cities will be provided with strategic advice of experts in the regarding fields, comprising green deals, citizen engagement, transition in tourism, data management and other innovative solutions. The aim is to recover the local economy, by the transition to a sustainable local ecosystem. The initiative "looks to move towards a more digital, service-oriented and low-carbon economy, supported by a knowledge-based society, that enables circular economy systems through 'local value loops', evidence-based reskilling, and sustainable investments" (ICC, 2021).

Circular City and Regions initiative (CCRI): This is part of the new circular economy action plan. The objective of the initiative is to implement circular solutions at local and regional scale and help deliver on the European Green Deal and the EU bioeconomy strategy. (CCRI, 2020). The contract is aiming to support and advice cities and regions in their transitions towards circular, inclusive, sustainable and innovative solutions. Herby the focus is not only on the traditional resource recovery of water and waste but on all sectors connected to the city or region.

Green City Accord (GCA): In order to change towards circularity and sustainable approaches in their cities, European mayors created the movement of Green City Accord. By signing the Accord, cities commit to the overall goal of accelerating of EU environmental laws and thereby changing the quality of life of all Europeans. The Accord addresses five aspects of environmental management of air, water, nature and biodiversity, circular economy and waste, and noise. In specific, mayors within the Green City Accord set ambitious goals that go beyond the EU-regulations and should achieve these circular transitions by 2030 (GCA, 2019)

European Circular Economy Stakeholder Platform (ECESP): The ECESP is a joint platform of the European Commission and the European Social and Economic Committee which connects stakeholder within the field of circular economy. The platform is designed as a 'network of networks' that highlights the interconnectedness of stakeholder and creates the opportunity to connect and implement circular solutions across sectors as well as societal levels. By encouraging communication between stakeholder, the platform offers a space to share experience as well as difficulties in the process of circular transition (ECESP, 2019).

The European Green Deal Investment Plan (EGDIP): The EFDIP is also referred to as Sustainable European Investment Plan (SEIP). "To achieve the goals set by the European Green Deal, the Plan will mobilise at least €1 trillion in sustainable investments over the next decade. Part of the plan, the Just Transition Mechanism, will be targeted to a fair and just green transition. It will mobilise at least €100 billion in investments over the period 2021-2027 to support workers and citizens of the regions most impacted by the transition" (EGDIP, 2020).

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Such diversity of initiatives and actors, involving, among others, policy makers, local governments, businesses, citizens, and the scientific community, makes evident the need for thinking and designing processes that can support a multidisciplinary understanding and implementation of CE practices.

The effort undertaken in the development of the REFLOW Framework departs from the acknowledgment of the importance of taking such change actors into account, by emphasising their strategic role in the innovation and transition processes. In particular, attention is placed on the role of design and designers in this process. In fact, it recognizes the key role that design plays in enhancing global sustainability and environmental protection, involving individual and collecting efforts and supporting cultural and professional diversity (ICSID, 2010). In this regard, it reflects the increasingly broadening area of action of design and designers, moving from the development of objects towards a supporting role as facilitators in societal change (Joore and Brezet, 2015). Through this understanding, the role of the designer is not understood as tailored to one single specific skillset. Rather, the REFLOW Framework is based on the recognition of a diversity of expertise related to different kinds of design, including the design of products, services, business models and systems (ibid). With regards to CE implementation, as made evident by the European Commission itself, such combination of specialisations is a cornerstone for fostering CE transition. It is on this premise that a need for a supportive model, able to provide insights into the change process characterising CE transition has been deemed necessary.

3.2.2 Existing Frameworks of Circular transitions

As much as a multitude of initiatives is pushing forward the implementation of CE in Europe, a variety of models and frameworks were developed in the recent years to support this process. However, no model has been developed to specifically support cities in the transition towards CE.

The REFLOW Framework positions itself within a series of models and frameworks relevant to understand and enhance development and implementation of CE transition within cities. Some relevant complementary models which have informed the development of the REFLOW Framework are summarized here:

The European Circular Cities Declaration (CCD), funded by the EU Horizon 2020 program: The European Circular Cities Declaration is a document aimed at (when signed by local or regional governments) supporting its signatories in enhancing the transition from a linear to a circular economy. It provides governments across Europe with the opportunity to openly communicate actions towards a circular economy. The declaration offers a shared assumption of a “circular city” and outlines the responsibility that local and regional governments have in the implementation of circularity. It also functions as a platform to share experiences throughout the committed organisations. The European Circular Cities Declaration provides committed governments with levers such as vision, engagement, urban management, economic incentives, and regulation, based on the urban policy levers for circular economy transitions by the Ellen MacArthur Foundation (2019b). The CCD provides a common vision, shared by its members, to ensure circular transition in European cities (ICLEI, 2020).

The EMF Butterfly model: Following the approach of the butterfly model (Figure 10), developed by the Ellen MacArthur Foundation (EMF), circular cities aim at rebuilding a wide variety of resources. The model illustrates the circular flows of renewable (left loop) and infinite material (right loop) through the value circle of an urban system. Technical materials or finite resources cannot re-enter the environment. These materials, such as metals, plastics, and synthetic chemicals, must continuously cycle through the system so that their value can be captured and recaptured.

Biological materials such as renewable resources are those materials that can safely re-enter the natural world once they have gone through one or more use cycles. The renewable resources will biodegrade over time, returning the embedded nutrients to the environment. Biological materials are wood, paper, cork, and cotton, among other materials. In a circular economy, biological materials are the only materials that can be thought of as consumable, while technical materials are used and therefore remain in the loop (EMF, 2019a).

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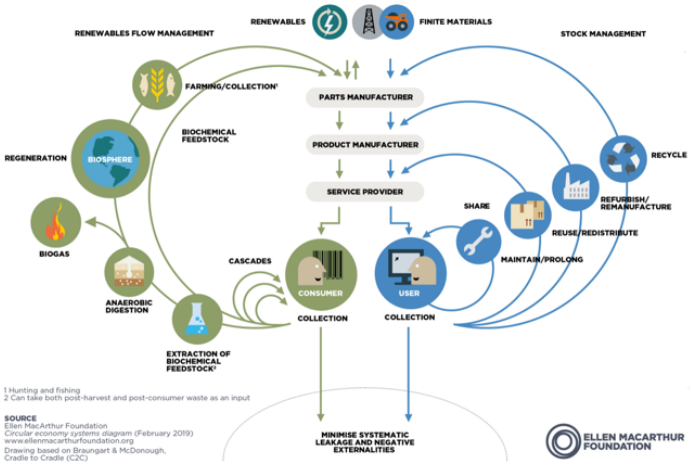

Figure 10: Circular economy system diagram. Source: Ellen MacArthur Foundation, 2019a

EMF Circular Economy in Cities: The Circular Economy in Cities project is a collection of resources launched by EMF in March 2019. The suite provides easy access to relevant resources designed to function as an international reference in circular transition. The framework focuses on the rethinking of material use in cities and how this can lead to circular actions related to housing, mobility, and economics.

The vision focuses on planning, designing, making, accessing, operating, and maintaining circular approaches in urban surroundings. To achieve this, the module names ten policy levers that municipalities can leverage to integrate circular economy principles (Figure 11). The levers are based on the principle of creating thriving, liveable and resilient cities (EMF, 2019b).

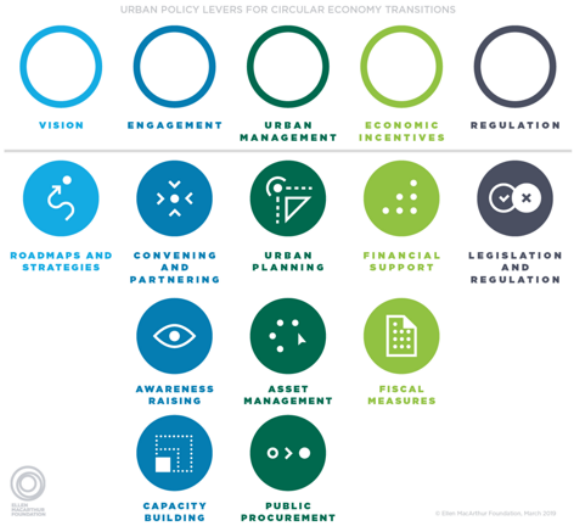

Figure 11: Urban Policy Levers. Source: Ellen MacArthur Foundation, 2019b

The Circular Economy in Cities and Regions, OECD Urban Studies: The OECD report, *The Circular Economy in Cities and Regions,* represented by five different cities around Europe, summarizes and reports the challenges cities currently do and will face in the future (by 2050) and how municipalities and its actors can adapt CE in response to these upcoming challenges. The survey identified environmental factors as well as institutional and socio-economic factors as the key

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drivers of circular transition. In terms of gaps towards circular economy, the OECD survey on the Circular Economy in Cities and Regions highlights five categories: financial gaps, regulatory gaps, policy gaps, awareness gaps and capacity gaps. The report encourages cities to promote circular approaches and communication as well as enable policies simultaneously to close the reported gaps. The survey provides policies, tools, a check list for action and scoreboard, major drivers of circular economy and puts forward the 3Ps framework. The framework is based on the three dimensions: People, Policies and Places and emphasizes the key stakeholder relevant for circular economic transition.

In line with the prescriptions of the European Green Deal and the Commission's Circular Economy Action Plan 2020, the REFLOW Framework complements these frameworks and tools as a supportive model to enable agency and participation among municipalities, SMEs, and citizen´s associations in the development of circular economy practices and governance in cities. The experience of the REFLOW work packages and pilot cities, integrated with both the theoretical and practical insights presented in this section, have informed the development of the REFLOW Framework. In the remaining 12 months of the REFLOW project, particular attention will be placed on enhancing the complementary dynamics between the REFLOW Framework and the frameworks here presented, as well as supporting the use of the REFLOW Framework as a supportive tool for other CE initiatives in Europe.

3.3 The REFLOW Framework Methodological Approach

3.3.1 The need to move from a linear to a multilevel design model

In light of the existing initiatives and frameworks aimed at supporting CE transitions, the REFLOW Framework responds to the need of generalising the key learnings from theory and practice concerning Cities' circular transition. In this regard, the REFLOW Framework is informed by the concrete experiences of the REFLOW Pilot cities, and by the research activities and implementation actions undertaken to develop the REFLOW Process. The first iteration of the REFLOW Process was presented in D1.2 - Cities' Circular Action Plan, describing the coordination mechanisms introduced to facilitate alignment and coordination between the actor involved, and to address the challenges characterising the overall planning of circular transitions within REFLOW. Prior to the first iteration, the REFLOW Process informing the circular transitions of the REFLOW pilots cities was represented as a Double Diamond, reflecting a linear and iterative process for the development of pilot solutions (Figure 12). The first iteration has been developed in response to the alignment and coordination challenges emerged throughout the first year of the project and the need of better leveraging on the synergies between WPs and the pilot cities. This was based on the integration of the Double Diamond with the EMF Circular Design Thinking model (Figure 13). Here, the Theory of Change as a co-creation and monitoring tool has been used to inform the development of the REFLOW Process. Despite the actions implemented as result of the first iteration substantially improved alignment and coordination, the need of better representing and tackling the complexity of CCAPs implementation remained evident. In fact, the way in which the REFLOW Process was understood and represented could not fully embrace the societal complexity and networked problems emerging in the implementation of the Cities' Circular Action Plans.

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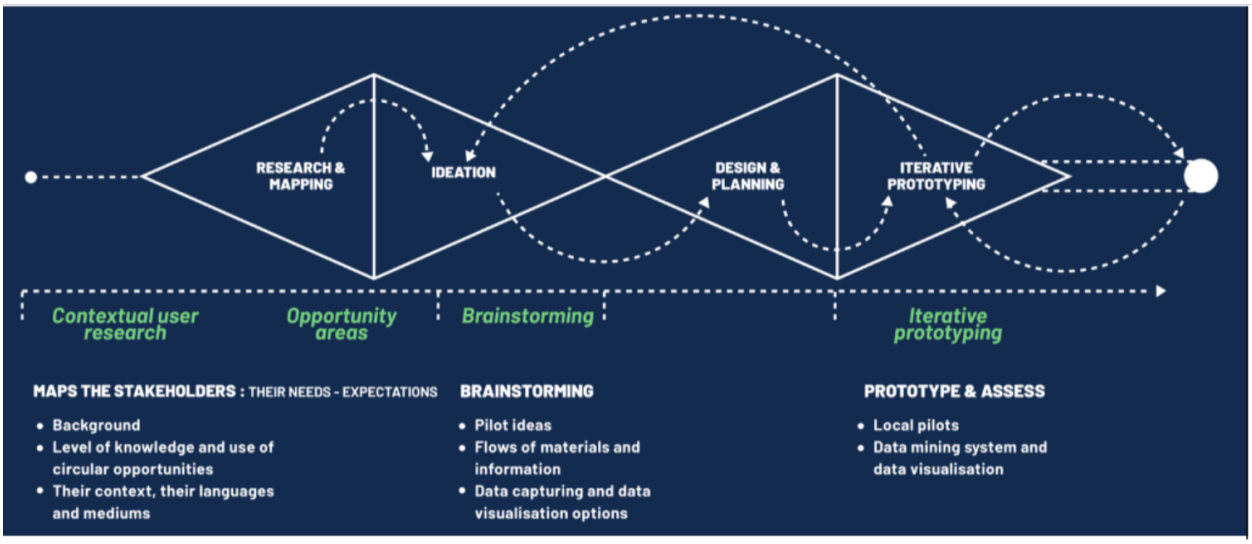

Figure 12: The REFLOW Process represented as a "Double Diamond". Source: Copenhagen Business School

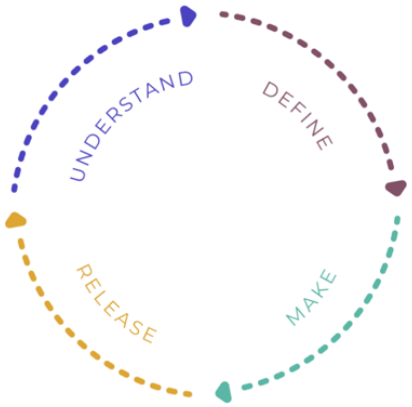

Figure 13: Circular Design Framework. Source: Ellen MacArthur Foundation and IDEO, 2020

To address this complexity, the design thinking approach informing the REFLOW Process has been broadened with the incorporation of a systems thinking which informed the development of the REFLOW Framework.

3.3.2 Development of the REFLOW Framework

The development of the REFLOW Framework was based on a process of desk research and discussions among WPs in the form of meetings and workshops taking place throughout the second year of the project. In this process, attention was placed on the need of developing a model that could be generic enough to be applied in different urban contexts, while maintaining its relevance regarding the specific contingencies of locally based urban transitions. To do so, several versions of the REFLOW Framework have been debated and evaluated against relevant research and ongoing pilot and WPs experience within the project. First, following a review of existing research on design and innovation models for sustainability, the Multilevel Design Model (MDM) proposed by Joore and Brezet (2015) has been selected as a baseline to rethink, adapt and generalize the REFLOW Process. In fact, the MDM gave the conceptual flexibility to better represent the complexity and multilevel challenges inherent to the project, and more broadly, characteristic of the organization and governance of circular transitions towards circular economy. In this sense, the MDM represents an

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upgrade of the Double Diamond, thereby allowing actors involved in the implementation of CE practices to be able to unpack the complexity of circular economy transitions. To adapt the model to the specific challenges and characteristics of pilot cities' circular transitions, a second round of desk research took place to identify CE levers. As a result, 17 CE levers have been identified and one more level (material innovation) was added to the original model. This work has been complemented with ongoing desk research activities of WP4, concerning collaborative governance strategies and approaches. As a result, the three infrastructuring dimensions (Strategic, Operational, Relational) have been introduced to cluster the CE Levers. The three infrastructuring dimensions are described in detail in "D4.3 The Governance Cities Toolkit v.1.0". Finally, the model was presented to the consortium during the second co-design workshop held in M23. The version of the REFLOW Framework presented in this deliverable will be further discussed and used to provide pilot-specific representations of their circular action plans.

3.3.3 Definition of CE levers

The notion of circular economy levers has been particularly central in the development of the REFLOW Framework. This is due to the recognition that CE transition can be enabled through the identification of specific leverage points and the activation of related levers that can foster the implementation towards Circular Economy. In fact, while the circular design thinking framework (Figure 14) can support the conceptual understanding and framing of the transition towards CE, the notion of levers allows to place the attention on specific actions that can be undertaken in this process, thereby better describing and framing the implementation process towards CE within cities.

In this regard, a ***leverage point*** is understood as a point at which a minor shift can cause a major change in its surrounding (Meadows, 1999). Senge (2006, p. 64) state that leverage points are the "right places in a system where small, well-focused actions can sometimes produce significant, enduring improvements". Leverage points are determined in every system (Nguyen & Bosch,2013). Referring this back to circular transition and sustainability, Chan et al. (2020) understand leverage points as the point of intervention to change socio-ecological systems. These points of intervention must be identified and related to the actual intervention, which has at this point a disproportionally large positive impact on the ecological system. In relation to sustainable transformation, Chan et al. (2020) defined the following primary eight leverage points for sustainable transition: (1) Vision and good life, (2) Total material consumption and waste, (3) Latent values of responsibility, (4) Inequalities, (5) Justice and inclusion in conversation, (6) Externalities and telecouplings, (7) Technology, innovation and investment and (8) Education and knowledge generation and sharing. Abson et al. (2016) aggregated leverage points into four broad types of system characteristics that levers can target: *parameters, feedbacks, design* and *intent* (n.p.). "The four system characteristics represent a nested hierarchy of, tightly interacting, realms of leverage within which interventions in a given system of interest may be made. Deeper system characteristics constrain the types of interventions possible at shallower realms of leverage" (Abson et al., 2016, n.p.). Given these leverage points for transformative change, specific levers are applied to enable significant change. In this sense, levers are understood as approaches, tools or instruments to enable the needed change in the identified leverage points.

Chan et al. (2020), define **levers** as "actions and interventions promoting transformative change" (p. 703). Nevertheless, levers should not be understood as simple mechanistic relation between the aimed social change and the intervention itself. Results from a lever can be highly complex and unintended or even unexpected (Abson et al., 2016). Therefore, Abson et al. (2016) emphasise the interconnectedness of leverage points and applied levers. Chan et al. (2020) defined five levers, promoting socio-ecological change: (1) Incentives and Capacity building, (2) Coordination across sectors and jurisdiction, (3) Pre-emptive action, (4) Adaptive decision-making in the context of resilience and uncertainty and (5) Environmental law and implementation. The Ellen MacArthur Foundation (2019) developed urban policy levers to improve material flow and value, regenerate natural systems around and within cities and to design waste and pollution out of products and urban systems. These circular economy levers are an open source and include: (1) Roadmaps and Strategies, (2) Convening and Partnering, (3) Awareness Rising, (4) Capacity Building, (5) Urban Planning, (6) Asset

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Management, (7) Public Procurement, (8) Financial Support, (9) Fiscal Measures and (10) Legislation and Regulation. In this case, policy levers are the tools that governments and its agencies have at their disposal to direct, manage, and shape changes in public services. This includes laws and regulations, government goals, strategic plans, by-laws, and frameworks.

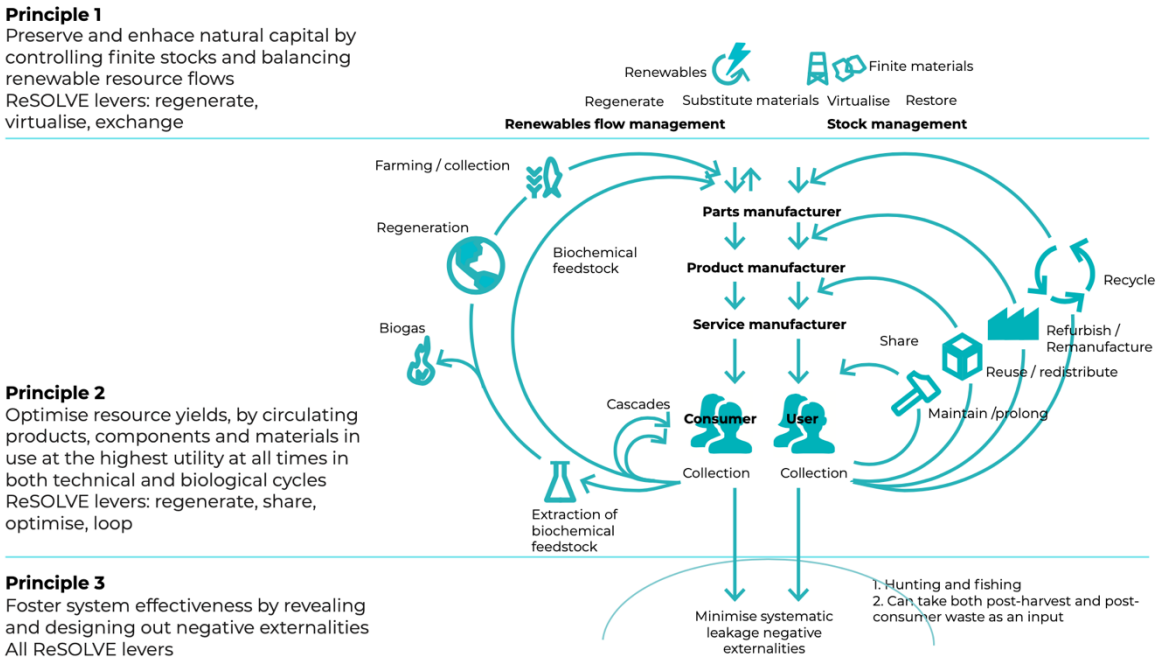

Figure 14: Circular Economy System Diagram. Source: Ellen MacArthur Foundation, SUN and McKinsey Centre for Business and Environment

Referring back to the EMF Butterfly model (Figure 10), the following illustration (**Error! Reference source not found.**) further includes circular economy levers. Circular economy is based on the three principles of preserving and enhancing natural capital (1), Optimising resource yields (2) and fostering system effectiveness (3). Each principle is related to specific circular economy levers: Regenerate, Share, Optimise, Loop, Virtualise and Explore (Joore et al., 2019).

The notion of CE lever has been a central element in the development of the REFLOW Framework, by providing evidence of concrete actions that can support cities' transition towards circular economy. The next section will build upon the notion of CE levers, as well as on Joore and Brezet's Multilevel Design Model and baseline concepts from collaborative governance, to finally describe the core components, logic and terminology of the REFLOW Framework.

3.4 Components, logic, and terminology of the REFLOW Framework

The RELOW Framework is a Multilevel Design Model (MDM) that relies on the iterative design approach to describe the REFLOW Vision of a circular and regenerative city. The model shows the relationship between products, services, systems, and societal changes. On the one hand, the model is generic enough to describe both the design process of new circular products and product-service systems. On the other hand, it describes in a simplified manner how complex societal change can be enabled to foster transitions towards circular and regenerative cities.

As a supportive model, the REFLOW Framework is the result of the combination of three main elements, namely (1) Joore and Brezet's Multilevel Design Model, (2) literature review on CE levers, and (3) the baseline concepts of

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collaborative governance informing the three infrastructuring dimensions. The following section describes each component of the REFLOW Framework. First, the phases (Section 3.4.1) and the hierarchical levels (Section 3.4.2) describe the backbone of the REFLOW Framework reflecting the cyclic design approach and the hierarchical system levels representing a circular and regenerative city according to the REFLOW Vision. Second, the CE Levers (Section 3.4.4) describe the set of tools and methods that can be leveraged to enable circular transitions towards CE. Third, the three infrastructuring dimensions (Section 3.4.3) describe set of actions to enable collaborative governance and support the implementation of CE transition according to the REFLOW Framework. The following paragraphs provide initial descriptions of circular practices in cities by drawing on examples based on the Pilot Action Plan presented in Chapter 2.

3.4.1 Phases

The REFLOW Framework is based upon an iterative cyclic process for the design of physical artifacts, business models as well as socio-technical and broader societal change processes. The REFLOW Framework consists of four phases involving Understanding, Defining, Making and Releasing. As such, the four phases are based on the EMF Circular Design guide and are consistent with the first iteration of the REFLOW Process presented in D1.2 (Figure 13). In the development of the REFLOW Framework, the four phases resemble the MDM phases proposed by Joore and Brezet (Figure 15).

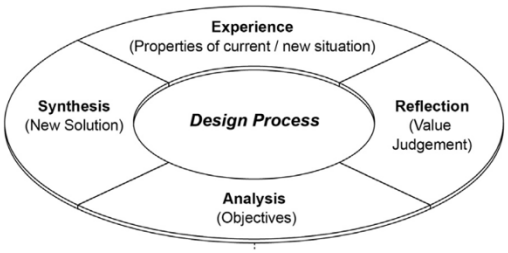

Figure 15: Phases in Multilevel Design Model. Source: Joore and Brezet, 2015

In the REFLOW Framework these phases are understood as follows:

Phase (1) Understand – This resembles the **Reflection** phase of the original MDM. It represents the starting point of the design or problem-solving process regarding the initial situation. In this phase, the actors involved in the design of a circular transition focus their attention on the identification of issues and opportunities characterising their local context. This reflects a moment of discovery in which a detailed understanding of the current situation is pursued. If an issue or negative situation is identified, the design process can continue.

Phase (2) Define – This phase is consistent with the **Analysis** phase of the MDM. At this stage the actors responsible for the design and implementation of the circular action plan have to interpret the problem at stake and define a new desired situation. In this phase, the new situation is described through initial requirements, it is still abstract, and no concrete action plan is developed yet.

Phase (3) Make – This phase resembles the **Synthesis** phase of the MDM. It includes the ideation and development of the initial idea and its design. At this stage, the actors involved explore creative directions to develop the new situation. It is at this stage that the actors involved actually create, describe, and visualise the new solution.

Phase (4) Release – This last phase reflects the **Experience** phase of the MDM. It is at this stage that a model, a prototype, or a simulation of the final solution is released. This phase implies an evaluation on which the judgement regarding the value of the solution can be made. If the evaluation is positive, the design process is completed. If the evaluation is unsatisfactory or if opportunities for further improvements are identified a new Understanding phase can start.

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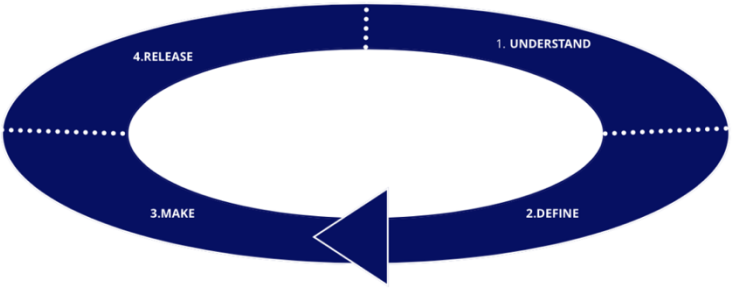

Figure 16: The REFLOW Framework Phases. Source: Copenhagen Business School

As highlighted in the first iteration of the REFLOW Process (Parisi et al., 2020), this iterative model is consistent with several methodologies in design and performance management. In the specific case of the REFLOW Framework, and in line with the MDM, this is generic enough to both apply to physical artifacts, business models, as well as broader complex societal systems. In this way, it allows to take into consideration the broad spectrum of actors and spaces of actions to comprehensively tackle an urban transition towards CE.

3.4.2 Levels

The second element applied in the design of the REFLOW Framework refers to the multilevel approach described by Joore and Brezet's MDM. This allows differentiation of the different system levels characterising circular transition. With regards to the four phases, the multilevel approach distinguishes how the cyclic design approach can occur at different levels through which a circular transition can be understood. The levels described below are based on the MDM, where four hierarchical levels are proposed (Product-technology system, Product-service system, Socio-Technical System, and Societal System), on the basis of the V-Model for System Engineering (KBST, 2004; Cadle and Yeates, 2008) and the Dynamic Multilevel Model (Geels, 2005). In light of the specific contingencies characterising circular transitions in cities (OECD, 2020), also emerging from the REFLOW pilots' action plans development and implementation (Section 2.2), the REFLOW Framework extends the four hierarchical levels proposed by Joore and Brezet's MDM, and defines the following five levels:

Material Innovation (1) - Materials form the basic level of the REFLOW Framework. These can be defined as physical material inputs and outputs of manufacturing (Millette, 2019). As exemplified by the Butterfly Model (Figure 10) these refer to both biological and technical materials composing the value circle of an urban system. On the one hand, biological materials are those substances "that can safely re-enter the natural world, once they have gone through one or more use cycles, where they will biodegrade over time, returning the embedded nutrients to the environment" (Ellen MacArthur Foundation, 2017). On the other hand, technical materials are those materials that "cannot re-enter the environment. These materials, such as metals, plastics, and synthetic chemicals, must continuously cycle through the system so that their value can be captured and recaptured" (ibid). In this regard, materials determine the format of the urban system. Therefore, material innovation refers to the design of new materials or re-design of existing ones to support the development of closed loop systems and the improvement of resource efficiency.

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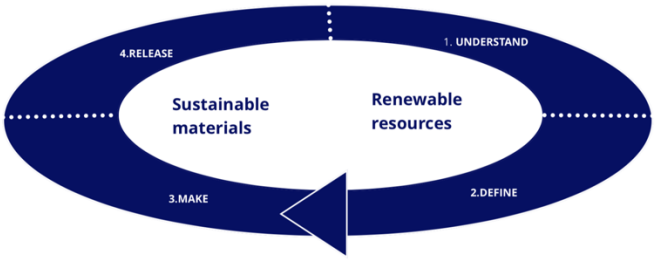

Figure 17: Material Innovation Level The REFLOW Framework. Source: Copenhagen Business School

Product and Tech Innovation (2) - This second level resembles the Product-technology system described in the MDM. It refers to physical products made of different material components. In this sense, it describes the "inextricably linked technical systems, physically present in place and time" (Joore and Brezet, 2015, p. 96), which fulfil one or more specific functions. Product and tech innovation refers to the design of physical products based on circular production and consumption practices.

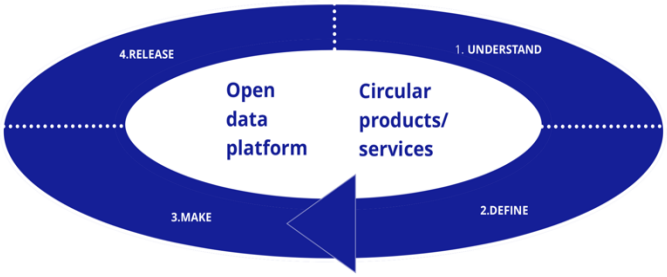

Figure 18: Product and Tech Innovation Level The REFLOW Framework. Source: Copenhagen Business School

Circular Business Models Innovation (3) - This level encompasses the "physical as well as organizational components, which form a united and cohesive whole that together fulfils a specific function, usually definable in time and place" (Joore & Brezet, 2015, p. 96). As such, it refers to circular business models defined as "the rationale of how an organisation creates, delivers, and captures value to close and slow material loops" (Bocken et al., 2018, p. 81). Therefore, circular business model innovation refers to the design of networked innovative practices of collaboration, communication, and coordination within networks of interdepended but independent actors and stakeholders (Antikainen & Valkokari, 2016). Circular business model innovation occurs within a specific policy, legal and cultural elements but these remain distinct from the business model innovation at stake (Joore & Brezet, 2015). In other words, while certain business model innovations might be context-specific others might apply to different urban contexts.

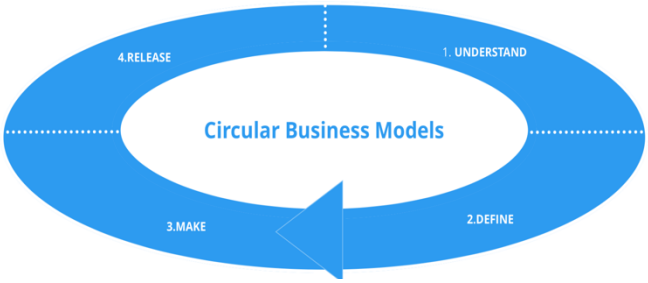

Figure 19: Circular Business Level The REFLOW Framework. Source: Copenhagen Business School

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Socio-Technical Innovation (4) - This level describes "a cluster of aligned elements, including artefacts, technology, knowledge, user practices and markets, regulation, cultural meaning, infrastructure, maintenance networks and supply networks, that together fulfil a specific societal function" (Geels, 2005, p.446 – as cited in Joore & Brezet, 2015 p.95). Socio-technical innovation refers to large-scale transformation of the way in which societal function are fulfilled. This for example refers to the redesign of a foody system, and the related business models, products, and materials in use to sustain the system function.

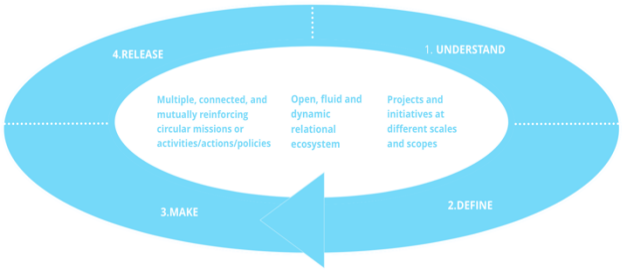

Figure 20: Socio-Technical Innovation Level The REFLOW Framework. Source: Copenhagen Business School

Societal Innovation (5) - This represents the highest level of the REFLOW Framework, defined as the interpretative framework, believes and shared behaviour of cities and its shareholders and/or actors. This level builds on the interconnectedness of elements of the other levels. Processes at this level can be understood as structural transitions and are most likely gradual and continuous. At this level, single components are hard to determine and the societal system spans over several influence spheres and domain, without fulfilling a specific function. As such Societal innovation in the design of process of structural societal change towards circular economy which the REFLOW Framework can support to frame and understand.

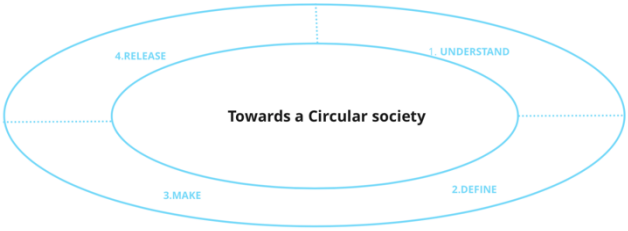

Figure 21: Societal Innovation Level The REFLOW Framework. Source: Copenhagen Business School

All the 5 levels here described together give shape to the REFLOW Framework to understand and organise the process towards the REFLOW Vision of a circular and regenerative city. As such, the REFLOW Framework is consistent with principles informing the REFLOW Vision, ensuring the following 4 requirements:

a) providing meaning to the concepts of circular and regenerative city
b) ensuring interpretational flexibility to provide opportunities for discussion.
c) embracing a vision of circular economy that is rooted in plurality and dialogue.
d) enabling freedom to explore the idea of circular and regenerative city in ways that make contextual sense.

Being hierarchically organized, the REFLOW Framework aims at simplifying the means-end relationship informing complex innovation processes for the circular economy within urban environments. As such, it can be understood

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moving upwards from the characteristics and the design of materials, products, business models, socio-technical systems and whole societies. Alternatively, and complementarily in can be read top-down to understand societal values, socio-technical needs, product-service functions, and form of materials.

Together, the 4 cyclic phases and the 5 system levels give shape to the basic form of the REFLOW Framework (Figure 1). As a supportive model, the REFLOW Framework does not aim at providing a real-life picture of the urban system, but rather at providing a simplification to understand at which phase of development and at which level this might occur. In this sense, on the basis of the MDM, the REFLOW Framework can be visualised as in *Figure 22*.

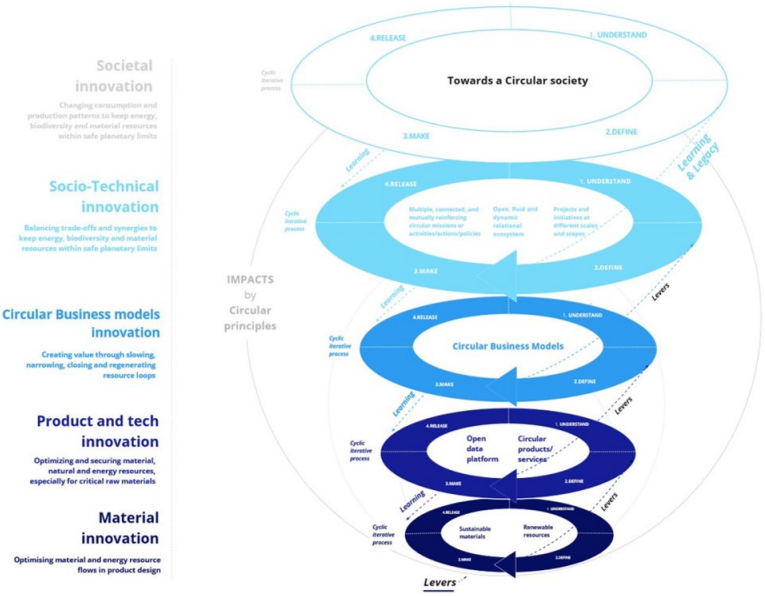

Figure 22 The REFLOW Framework. Source: Copenhagen Business School

3.4.3 Strategic, Operational and Relational Dimensions

The first component of the REFLOW Framework, represented by the integration of the four iterative cyclic phases and five hierarchical system levels reflects the transitional nature of circular economy, on the basis of the REFLOW Vision. As such, the REFLOW Framework builds on the definition of collaborative presented in D4.3 - REFLOW Collaborative Governance Toolkit.

‘‘We understand collaborative governance as a long term, systemic process of steering and coordination of all the different levers in cities - policy, regulation, funding, knowledge, collective intelligence, and many others - in a way that allows distributed capacity, legitimacy and agency for (circular) change across public and private sectors. More in detail (building on Thorpe & Manzini 2018; Manzini 2015), we define Collaborative Governance as an ***open-ended infrastructuring process***: **a continuous work of providing the means for action, discovering and learning within a loose steering and coordination framework that supports both present and future collaborations**.”

Such definition understands collaborative governance as an enabler of circular transitions with a long-term view reflected by the societal system level of the REFLOW Framework. Second, it acknowledges that circular transition requires multiple loops of mutually reinforcing portfolios of innovations across material, product & tech, business models which in turn can trigger socio-technical and societal innovation. This is represented by the interlinked nature of the model, reflected in the 4 cyclic phases, and by the inherent relationships spanning across the 5 levels of the REFLOW Framework. In this regard, it recognizes that such innovations can be fostered through the activation of multiple circular

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economy levers, described in the following section. In this sense, collaborative governance in REFLOW is framed as a “meta concept”, entangled within system dynamics and complex strategic, operational and relational networks.

Such understanding of collaborative governance frames the way in which the REFLOW Framework can inform circular practices in cities, by enabling different collaborative governance actions that recognize multiple possibilities of design, planning and undertaking. The infrastructuring process mentioned in the REFLOW definition of collaborative governance, can be understood to operate at different scales and scopes. These inform three infrastructuring dimensions, providing a loose frame of actions for the actors involved in the implementation of the REFLOW Framework. These include:

Strategic Dimension

This infrastructuring dimension covers (mostly intangible) aspects related to visions, objectives, agendas, motivations and interests. Aspects considered mostly respond to the ''***why***'' a circular transition is taking place. Knowledge about resources and material flows is also a strategic dimension to the extent that it helps identify leverage points for action and make better decisions. The strategic dimension creates synergies and alignment across different actors and related agendas.

Strategic Dimension
focused on creating synergies and alignment across different actors and agendas so that their resources can be made widely accessible and pooled towards collective impact.

Operational Dimension

This infrastructuring dimension articulates the strategic one into activities and operations, therefore responding to the ''***what***'' cities concretely do to initiate and advance in the transition. Being a systemic transition, operational infrastructuring includes all activities and experiments across a full system stack - including regulations, Business Models, technology, funding, etc. This dimension can be understood as building operational capacities and tools to support interconnected circular experiments and activities.

Operational Dimension
focused on building operational capacities and tools in a way that allows different circular experiments and activities to exist as a highly connected, systemic process

Relational Dimension

This infrastructuring dimension relates to the ''***how***'' a circular transition is embraced and delivered, therefore considering fundamental aspects of quality and value. Relational infrastructuring can be understood as the intentional action of connecting people and assets around the identified vision and objectives, through the activities & operations envisaged. It is where organisational & governance aspects mostly come into play to ensure that capacity-building, learning and awareness flow effectively across all edges of the system, enabling in turn an open-ended transition that expands in scope and scale over time.

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Relational Dimension
focused on building trust, distributed agency and legitimacy, developing shared value

Each emphasis can be fostered through a process that is iterative - thus facilitating the emergence of innovations at micro, meso and macro levels (from material to societal innovation) and over time. This is done through a combination and activation of different circular economy levers, representing the last component of the REFLOW Framework.

3.4.4 Circular Economy Levers

As a supportive model, the REFLOW Framework highlights how transitioning towards circular economy requires change to occur at multiple levels. To do so, the necessary conditions need to be created for the aforementioned design processes to be supported. In this regard, the shift required to develop integrated and systemic circular solutions from the material to the societal level makes the identification of levers that can support and accelerate this change process of importance. As such, organising circular transition requires the intervention onto different elements encompassing artefacts, technology, knowledge, user practices and markets, regulation, cultural meaning, infrastructure, maintenance networks and supply networks.

For this reason, the REFLOW Framework provides further guidance through the definition of circular economy levers. These are defined as practices that create the leverage to change towards circularity in cities. The CE levers are based on the general assumption that a small force can lead to major changes (Meadows, Leverage points: Places to intervene in a system, 1999). In this line of thought, a literature review of existing research and reports led to the identification of 17 CE levers that should, when activated, drive change towards economic circularity. The pilot cities, and other non-REFLOW cities can leverage these elements to develop their circular action plans.

With regards to the two main components previously introduced, the CE levers are considered as cutting across the cyclic iterative transition process to support change across all the 5 levels represented in the REFLOW Framework. In this sense, several levers can be used in conjunction, according to the context-specific needs and objectives of each city. Table 14 lists the circular economy levers developed and validated by REFLOW.

Levers	Definition	Infrastructuring dimension
Baseline assessment	Define the system and assess its current state; map existing initiatives and stakeholders; identify drivers and barriers to change	STRATEGIC
Visioning	Craft an integrated vision and associated goals.	
Roadmaps, strategies and action plans	Identify and prioritise areas for intervention, plan activities, set actions	

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Social, environmental, economic impact assessment, and learning	Predicting and assessing the potential environmental, social, and economic impacts of interventions; design appropriate evaluation, management and monitoring measures; learn from results observed.	
Urban management of assets and material flows	Assess and sustainably manage city-owned physical assets (land, buildings, roads and bridges, water and sewage systems; energy grids…) and related material flows. Assess and manage urban plans and area development in ways that optimize spatial design for environmental and social well-being.	OPERATIONAL
Prototyping and experimentation	Conduct pilots, experimentations, new products, services and business models. Open source blueprints and share best practice/ lessons learned.	
Data and tech	Collect quality data across public and private supply chains in energy-efficient ways. Facilitate secure data exchange through digital tools. Ensure datasets are interoperable through common protocols and channels.	
Public procurement	Create new markets and seed demand for circular materials, products, services and businesses.	
Economic and financial incentives	Support initiatives through funding, subsidies, grants, bonds, and innovation competition. Facilitate public/private financing and leverage impact-driven equity funds.	
Fiscal measures	Discourage or incentivize certain behaviours or market developments (including taxes, charges, fees, fines). Actively facilitate divestments in the linear economy.	
Legislation and regulation	Shaping bylaws that stimulate circular economy practices.	
Engaging and convening	Enable stakeholders' participation and co-creation.	RELATIONAL
Innovative partnerships	Involve multiple stakeholders in public policy creation and delivery though multi-stakeholder collaborative forums and innovation hubs.	
Capacity building	Provide training, coaching and advisory support programs to help mainstream circular economy understanding and practices within society.	

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Awareness raising	Activate citizens by challenging linear inertia, highlighting and sharing benefits of urban transition.	
Communication	Disseminate learnings, activities, and impacts.	

Table 14: Circular Economy Levers. Source: REFLOW, based on EMF (2019), Circular City Funding Guide (2019), EIB (2018), Metabolic (a), Metabolic (b), Circle Economy (2020), ICLEI (2020)

Within REFLOW, the following CE Levers have proved to be particularly effective to different extent within each pilot. The diversity emerging from the most recent version of the pilot action plans well reflect how different levers have been activated by each Pilot. In this process the technical expertise and resources provided by the WPs often played a key role to support the activation of CE Levers. The following section will provide some examples of how the activation of CE Levers has been supported by WPs, and how the REFLOW Framework might support in the understanding of Pilots' Circular Transition process.

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Figure 23 provides a comprehensive representation of the different components of the REFLOW Framework. The vertical axis represents the different hierarchical level along which circular transitions can occur. The horizontal axis represents the time horizon across which the circular transition is implemented. The three main circles describe the interrelations between the three infrastructuring dimensions, and the related CE lever that can be activated across the project.

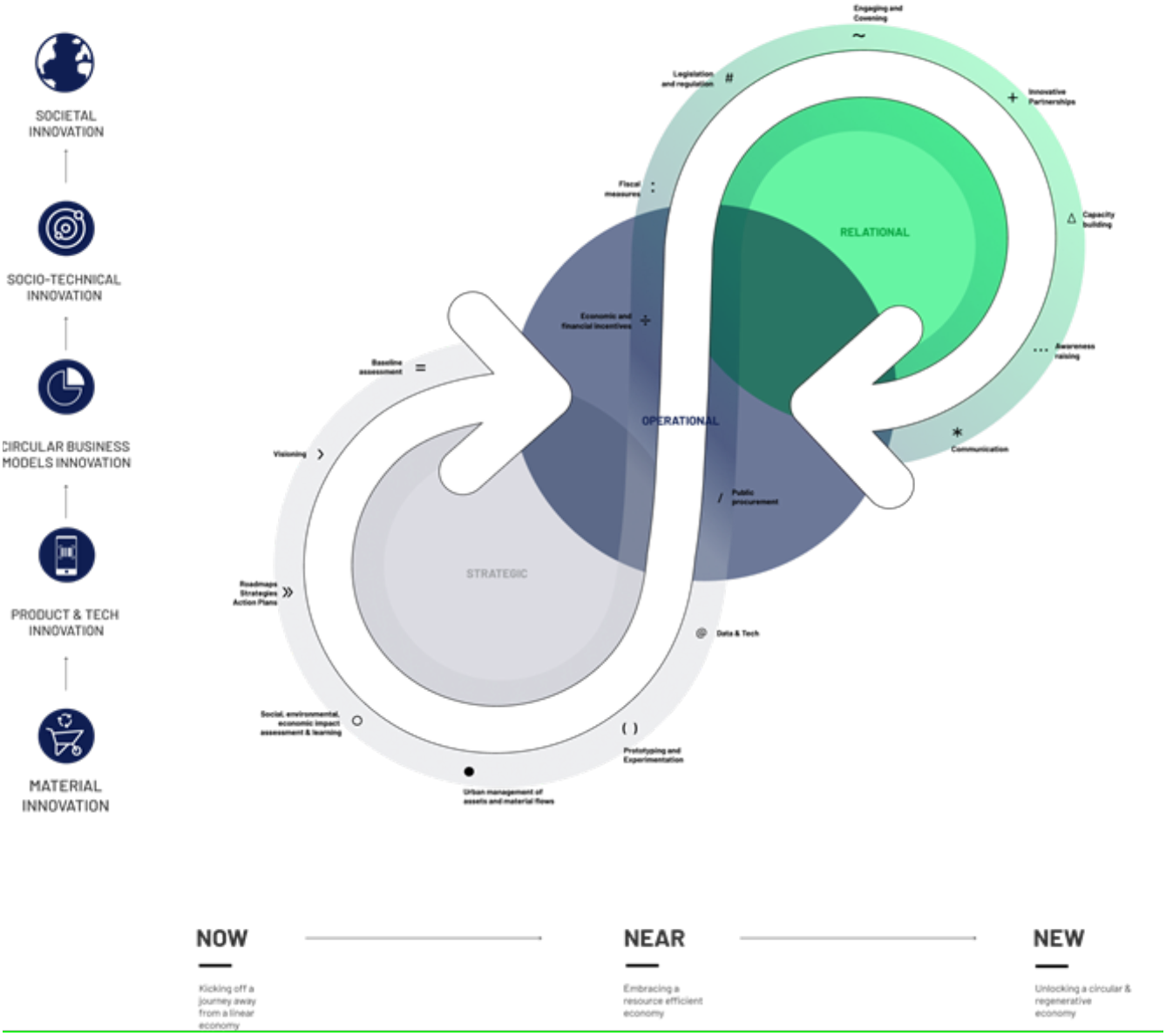

Figure 23 The REFLOW Framework. Source: D4.3 Collaborative Governance Toolkit

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3.5 Implementation of the REFLOW Framework

3.5.1 Pilots' Action Plans and the REFLOW Framework

As made evident in Chapter 2, the Pilots' Action Plans represent the roadmap for the transition toward circular and regenerative cities of the REFLOW Pilots. On the one hand, the development and implementation of Pilot's Action Plans requires an ongoing engagement with local stakeholders. On the other hand, it is characterized by an active collaboration with WPs to make use of the REFLOW Resources developed on a project-level. Altogether, such activities are reflected by the activities, outcomes and outputs traced and recorded in each pilot's Theory of Change. Moreover, they are linked to the Key Performance Indicators presented in the previous sectors. Therefore, the Pilot Action Plans show how both local activities and activities undertaken in collaboration between pilots and WPs result in the implementation of CE practices and development of solutions for transitioning towards a circular economy.

Observing the Action Plans presented in Chapter 2 through the lens of the REFLOW Framework (Figure 1 and Figure 23) allows to make evident how REFLOW Pilots are operating at multiple levels within their local context. The REFLOW Framework allows to frame at which level pilot cities are operating with their activities, and which CE Levers they are activating. Indeed, as a supportive model, the REFLOW Framework can support the pilot cities in linking planned actions to expected outcomes by (1) providing insights on the CE Levers activated (or to activate) through the development of new products and product-service systems for a circular economy; (2) providing insights on the links between functional problems identified and broader societal issues relevant in the creation of circular and regenerative cities; and (3) supporting the description of the design process, change process and transition process to describe and understand future design-based initiatives for CE Transition. This work will be undertaken and presented in the next steps of the project by supporting the pilot in the City Ecosystem Analysis that pilot will complete before the end of the project, addressing stakeholder, logistics, governance and business models.

3.5.2 Map of WP Resources to Activate CE Levers

WP activities refer to the work of the REFLOW work packages in supporting the implementation of the pilot cities' action plans. In so doing, WPs are involved in the development of WP resources which refer to instruments, tools or methods developed to enable the development and implementation of Cities' Circular Action Plans. This section summarizes WP Activities and related Project-level solutions to highlight how the work packages contribute to the implementation of Pilots' Action plans. More broadly, this section can provide future cities with an overview of tools and practices aimed at supporting the activation of multiple CE Levers across the five levels represented in the REFLOW Framework. In fact, the WP resources developed by the WPs are available to all pilot cities in REFLOW, and they completement CE practices implemented on a local level. In an analogous manner, with respect to future cities interested in replicating the REFLOW process in their local context, Project-level resources developed in REFLOW can provide the opportunity to replicate the CE practices implemented in the REFLOW Pilots within their local context.

The possibility of providing access to both WP resources and Pilot Solutions is part of the work on the REFLOW Legacy (section 3.5.3). This represents the REFLOW project contribution aiming at creating the conditions for other cities to leverage on the knowledge and experience created by pilots and work packages throughout the project. Therefore, this section provides an initial overview of some concrete practices relevant to activate CE Levers according to the logic of the REFLOW Framework. Each table provides info about the main circular economy lever the specific resource can contribute to activate. Moreover, it provides information about where to find more detailed descriptions of each resource. Most of the resources here summarized in the Deliverables of the WPs that led the process for the resource's design and development. In some cases, specific descriptions will be provided in upcoming deliverables. All the public

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deliverables containing specific information about each resource can be accessed through the Knowledge Hub within the REFLOW Website: [https://reflowproject.eu/knowledge-hub/.](https://reflowproject.eu/knowledge-hub/)

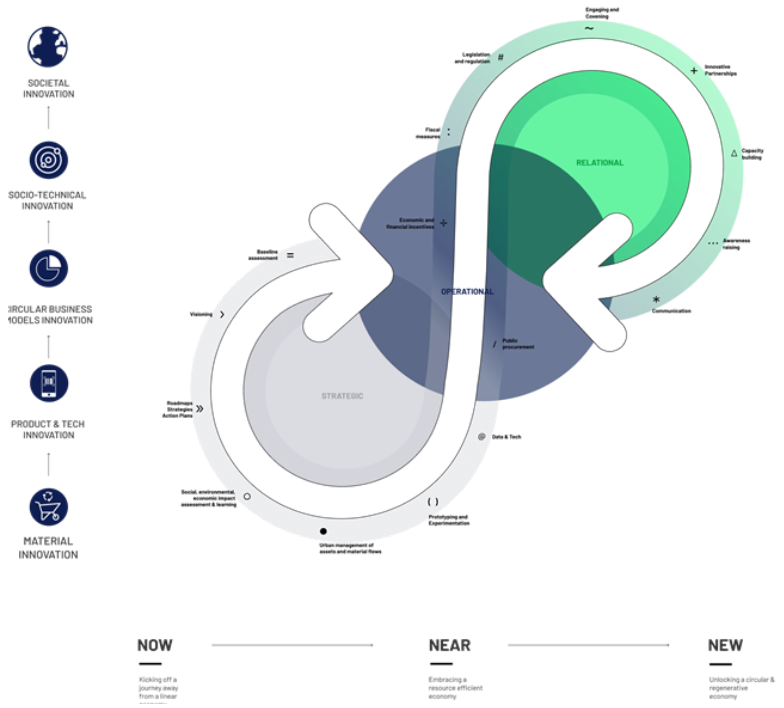
REFLOW Framework	
A supportive model to enable agency and participation of municipalities, SMEs, and citizens' associations in the development of CE practices and governance. Applying the REFLOW Framework should enable cities to implement and transform towards circularity on all levels of (1) Material Innovation, (2) Product & Tech Innovation, (3) Circular Business Model Innovation, (4) Socio-Technical Innovation and (5) Societal Innovation.	
	
Related Circular Economy levers	**All levers -** The model describes the overall process and logic informing organising a circular transition
Where to find more info	The model is introduced in this deliverable and further elaborated in the upcoming deliverable D5.3 (M30).

Figure 24 The REFLOW Framework. Source: D4.3 Collaborative Governance Toolkit

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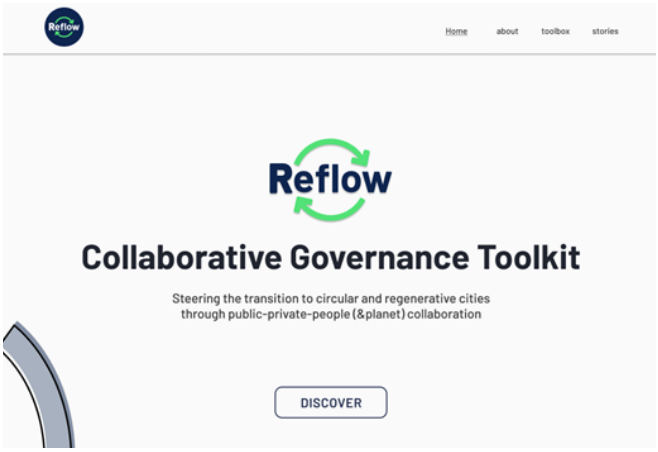
The REFLOW Collaborative Governance Toolkit	
The REFLOW Collaborative Governance Toolkit (RCGT) is a resource conceived to support the design and development of collaborative governance arrangements for the transition to circular and regenerative cities. This consists in a how-to practical guide for cities based on the REFLOW Framework to enable new forms of infrastructuring collaboration in ways that can unleash distributed agency and capacity for innovation. The toolkit is conceived as an evolving process based on a timeline, ranging from local to national, in which the peer-to-peer and bottom-up dynamics of stakeholders in the short term meet the top-down dynamics of more advanced public agencies and government in the long term.	
 *Figure 25 Collaborative Governance Toolkit. Source: https://governance.reflowproject.eu/*	
Related Circular Economy levers	**All levers -** The RCGT provides and overview of the ''levers'' considered in the REFLOW framework. Moreover, it provides access to specific tools that cities can use in the design and implementation of their Circular Action Plans. All tools are tagged and can be filtered according to two core categories, namely (1) Infrastructuring dimension (i.e. strategic, operational, relational) and (2) REFLOW levers.
Where to find more info	The Toolkit is designed as a website hosted in the REFLOW web domain (www.reflowproject.eu) and featured as a sub-page within the REFLOW website (https://governance.reflowproject.eu/). More information can be found in D4.3.

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The REFLOW Vision of a Circular and Regenerative City	
Describes the "aspirational state" guiding the pathway of change of the pilot cities towards their circular and regenerative transitions. In doing so, it provides a baseline for a common understanding of the whole consortium of how different partners at different levels of the projects understand the transition. This is represented by the REFLOW Vision statement and reflected by the REFLOW Framework. The REFLOW Vision has been developed to ensure the following 4 requirements of (a) providing meaning to the concepts of circular and regenerative city, (b) ensuring interpretational flexibility to provide opportunities for discussion, (c) embracing a vision of circular economy that is rooted in plurality and dialogue and (d) enabling freedom to explore the idea of circular and regenerative city in ways that make contextual sense.	
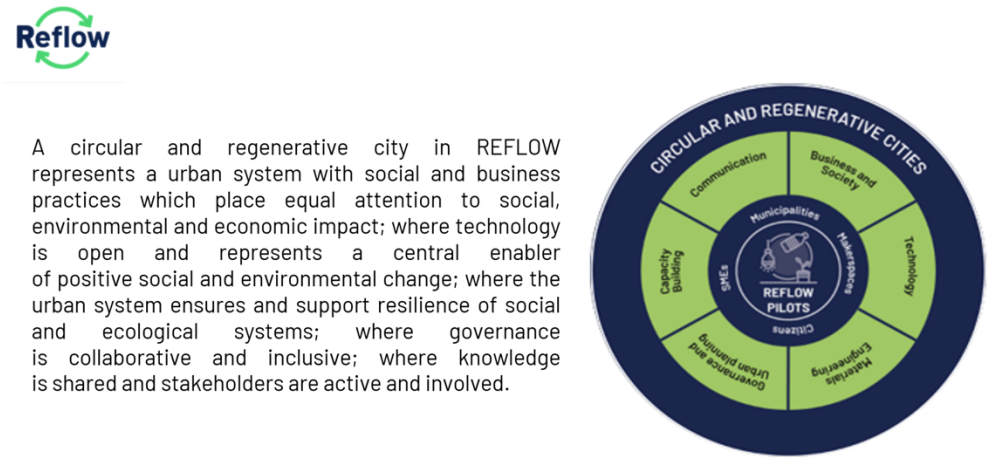	
Figure 26 REFLOW Vision. Source: D1.2 Cities' Circular Action Plan, 2020	
Related Circular Economy levers	**Visioning -** The REFLOW Vision provides a general vision of a Circular and Regenerative Cities based on key pillars such as Business and Society, Technology, Materials Engineering, Governance and Urban planning, Capacity Building and Communication. This can be used by future cities as a reference to develop a city-specific vision of CE.
Where to find more info	Deliverable D1.2 Cities' Circular Action Plans

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Circular Principles
The 10 Circular Principles help guide pilot cities in their transition to more regenerative circular economies. They distil the aims of a regenerative circular economy and provide guidance and support for place-based circular economy initiatives to take root in the pilot cities. To illustrate the use of the principles and provide a point of reference, each of them is accompanied by a case study. The 10 principles are: (1) Design for biological or technical loops, (2) Pursue efficient use of materials and energy, (3) Build with abundant accessible materials and harness freely available energy , (4) Use life-friendly chemistry, (5) Foster diversity and redundancy, (6) Manage connectivity, (7) Incorporate system feedback, (8) Encourage learning and experimentation, (9) Enable broad participation and (10) Promote polycentric governance.


Figure 27 Circular Principles. Source: D.3.1 Circular Principles and Indicators

Related Circular Economy levers	**Visioning, Roadmaps, strategies and action plans -** The Circular Principles provide access to an overview of the principles useful for a circular transition, thereby providing a source of inspiration for future cities willing to replicate the REFLOW Process.
Where to find more info	Activities connecting to the resource, Circular Principles, have been completed and presented within D3.1. The Circular Principles have been defined together with Case Studies developed by MATERIOM and METABOLIC. Activities to further iterate these Principles will continue to be carried out throughout the project.

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The Cities' Circular Action Plans	
A Cities' Circular Action Plan (CCAP) is the roadmap for the transition toward circular and regenerative cities. Therefore, the CCAP are the specific pilot action plans utilized for the management and implementation of the local pilot activities towards the pilot-specific objectives. In line with the overall structure of the project, The REFLOW Cities' Circular Action Plan operates on two levels: Project Level and Pilot Level. On a Project Level, the CCAP is described as the overall Roadmap that determines the general direction and modes of organising of the whole consortium. On a Pilot Level, the CCAP refers to the specific action plans created by the REFLOW cities, within the broader Roadmap of the project. The action plans are mainly concerned with the management and implementation of local activities aimed at achieving the pilot- specific objectives. The CCAP gathers the resources created and implemented by the project consortium to overcome the challenges encountered or expected by the pilot cities.	
Related Circular Economy levers	**Baseline assessment; Visioning; Roadmaps, strategies and action plans -** The CCAPs provide access to an overview of the REFLOW Pilots' Action Plans, thereby providing a source of inspiration for future cities willing to replicate the REFLOW Process.
Where to find more info	The Pilot Cities action plans are described in this deliverable. Pilot specific representations through the lens of the REFLOW Framework will be provided in Deliverable 5.3 – City Ecosystem Design.

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Urban Metabolism Scans
Urban Metabolism Scans are the result of urban metabolism analysis, which help build a deep understanding of the state of circularity. The scans show how key materials flow throughout the city or chosen site and helps provide an understanding how they might be recalibrated and re-circled back into use for productive purposes. The analysis is based on a quantitative mapping of material flows through a material flow analysis (MFA) to understand and visualize material flows in each pilot city. It helps understand at a granular level how they might be recalibrated and re-circled back into use for productive purposes. This can help pilot cities to: (1) Understand closely the challenges and pain points stakeholders have with some of the inflows and outflows related to their activities, (2) Facilitate the quantification and understanding of these recurrent issues from a material and metabolism perspectives and (3) Enhance the ability to create practical interventions catered to the stakeholder to implement in their day-to-day operations.

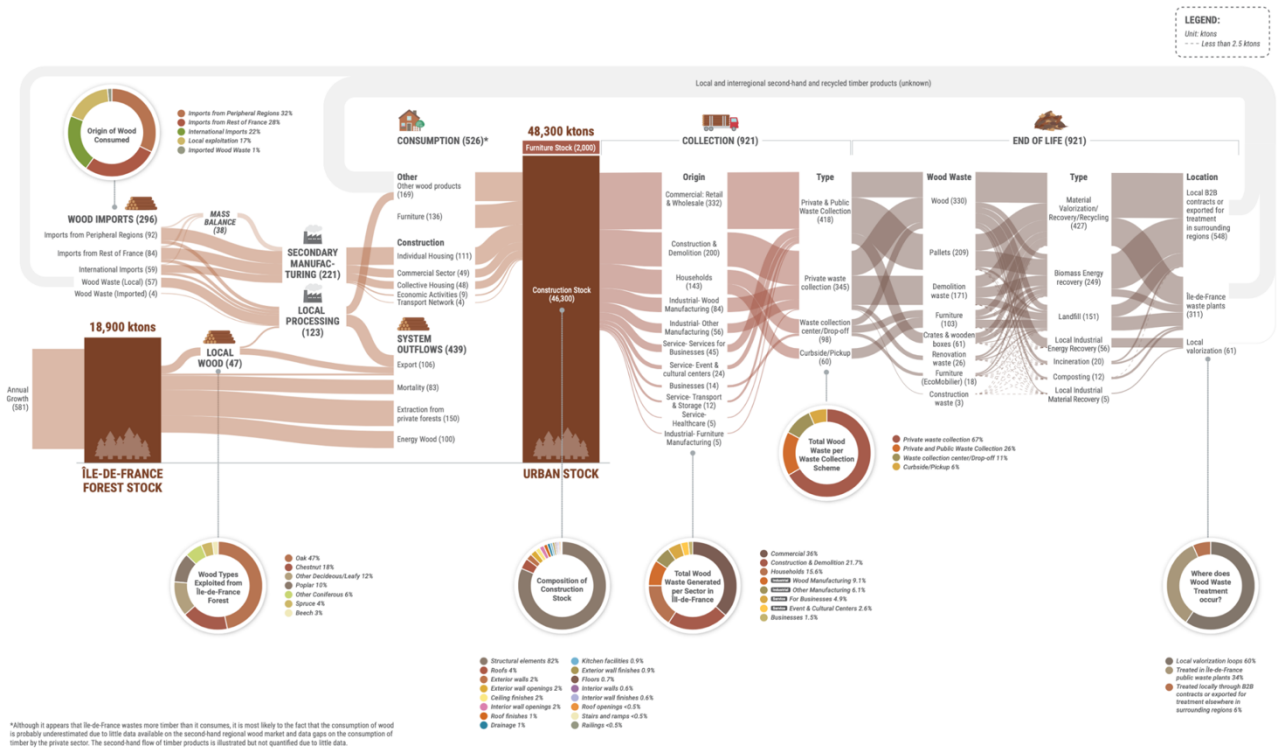

Figure 28 MFA Paris. Source: D3.2 Urban Metabolism Analyses: Initial Assessments, 2021

Related Circular Economy levers	**Urban management of assets and material flow -** By the incorporating the concept of Urban Metabolism and Material Flow analysis, the Building Block Circular Engineering activated this lever. The analysis of resources flow and strategies that enable systems change towards circularity are leveraged by using this CE Lever.
Where to find more info	Activities connecting to the Urban Metabolism Scan have been completed and presented within D1.2 Cities Circular Action Plan.

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Social, Economic, Environmental KPIs	
Social, Economic and Environmental KPIs are designed to monitor the social, economic and environmental performance of cities' circular transitions. This resource consists of two main elements. First, the final list of REFLOW Pilot Cities' KPIs, including both progress and outcome-based KPIs. Second, the calibration methodology outlining the process to calibrate KPIs according to the specific local circumstances of each city's circular transition on the basis of international standards for performance measurement of circular transitions. The KPIs originate from twelve impact areas identified through a co-creation exercise with the pilot teams. Under each impact area, a list of scientific KPIs were assembled through an extensive literature review. Through a 4-step process, each pilot city arrived at their list of final KPIs calibrated to best assess their activities and progress towards a circular economy.	
Related Circular Economy levers	**Social, environmental, economic impact assessment, and learning -** On the one hand the final list provides a resource for future cities to learn from the experience of the REFLOW pilot cities and understand how their performance can be assessed, measured and monitored. On the other hand, the KPI development methodology provides guidance to calibrate KPIs to specific local contexts.
Where to find more info	The final list of KPIs is presented in this deliverable. The KPI development methodology has been described throughout both WP1 and WP3 deliverables. It will be summarized in detail in D1.5 – Validation and Performance Evaluation, which will also provide access to intermediate evaluation results. D1.6 – Project Impact Assessment will provide a comprehensive assessment of the social, economic and environmental CE practices implemented in the project.

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Pilot Framework
The Pilot Framework is a digital content management system for guiding and aligning actors involved in the Circular Transition. The Pilot Cities Framework was created as a system for guiding and aligning, fostering iterative project development, monitoring the progress and boosting knowledge exchange between the cities and partners. I t sets in place a strategy that aims to guide a city in further becoming aware of the opportunities that arise along with the interactions. Its form and structure translate these concepts and aims into a vision for long term use to facilitate support in the replicability of the outcomes, possibly even after the project's lifetime. In REFLOW this has been developed for coordinating communication between Pilot Cities and work packages.

Figure 29 Overview of the city specific pilot framework page. Source: D5.1 Detailed Pilot Planning Evolution Framework

Related Circular Economy levers	**Roadmaps, strategies and action plans; Social, environmental, economic impact assessment, and learning** - provides access to key information about the Cities' Circular Action Plans and functions as a space for KPI reporting, monitoring and learning.
Where to find more info	The first version of the Pilot Framework has been presented in Deliverable 5.1 – Detailed Pilot Planning & Evaluation Framework

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REFLOW OS
The REFLOW OS is an Operating System based on GNU/Linux distribution technologies that helps incentivising the circular practices in local ecosystems by monitoring and optimising urban metabolic processes. It presents a secure, peer- to-peer network that allows to conduct economic activities like monitoring, track and tracing, and coordination among participants online and without central control. Specifically, the REFLOW OS will allow to: Track and trace materials, observe real time economic activities and create a Material Marketplace. The REFLOW OS will enable stakeholders to insert manually or automatically data about the material flows they want to track at custom level of detail. It will allow interested stakeholder to trace back the whole material flow at any time and observe changes and updates of data in real time. Users will be able to customize data visualizations charts according to the metrics they want to highlight and monitor. The development of a ledger will allow for the safe storage and update of data on available materials exchanged (for free, with tokens, or with other material) between stakeholders.

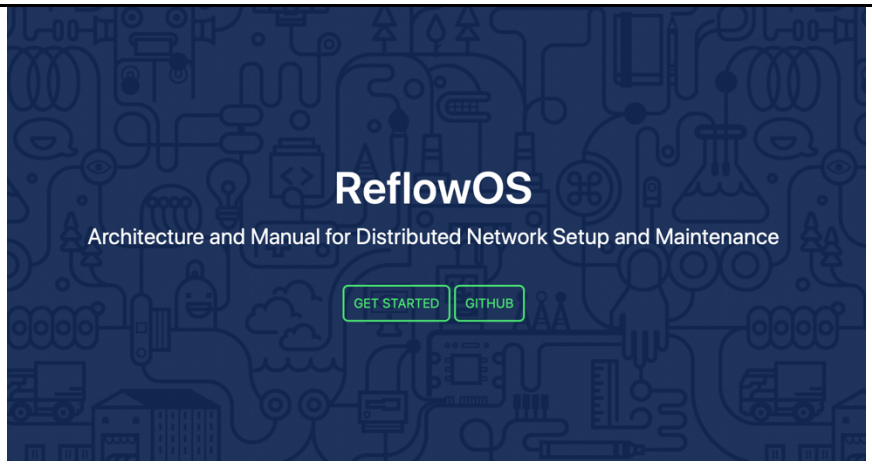

Figure 30 REFLOW OS. Source: https://reflowos.dyne.org/

Related Circular Economy levers	**Data and tech** - The data collection, software development and creation of online platforms as technological solutions for the pilots are leveraged by using this CE Lever.
Where to find more info	https://reflowos.dyne.org/

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REFLOW Community
The REFLOW Community is part of the REFLOW Capacity Building Framework strategic implementation. This refers to the REFLOW strategy to enable capacity building among different target groups along three dimensions of the individual, organisational and system level. The REFLOW Community consists of a group of professionals and practitioners sharing insights on the skills, competences, knowledge and tools necessary to facilitate the transition to circular cities. This involves academics, innovators, dreamers, entrepreneurs, and policy makers who are creating tangible solutions to cities' most pressing issues. This resource is based on a dedicated 24/7 online space for collaboration, discussion, archiving meetings and webinars, and sharing resources hosted the REFLOW website.

Figure 31 The REFLOW Community. Source: ttps://reflowproject.eu/community/

Related Circular Economy levers	**Engaging and Convening; Capacity Building:** The knowledge dissemination as well as enabling various stakeholder to engage in the transition towards circular economy are levered by these CE Levers.
Where to find more info	https://reflowproject.eu/community/

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Knowledge Hub
The knowledge Hub is a dissemination tool hosted on the REFLOW website. It provides public access to basic information about the public reports of the project with the purpose of disseminating the project outputs and findings. Its purpose is to disseminate project outputs and findings both internally in a clear and concise manner, as well as externally (i.e. beyond the project partnership) in order to increase the exploitation of project outputs and results.

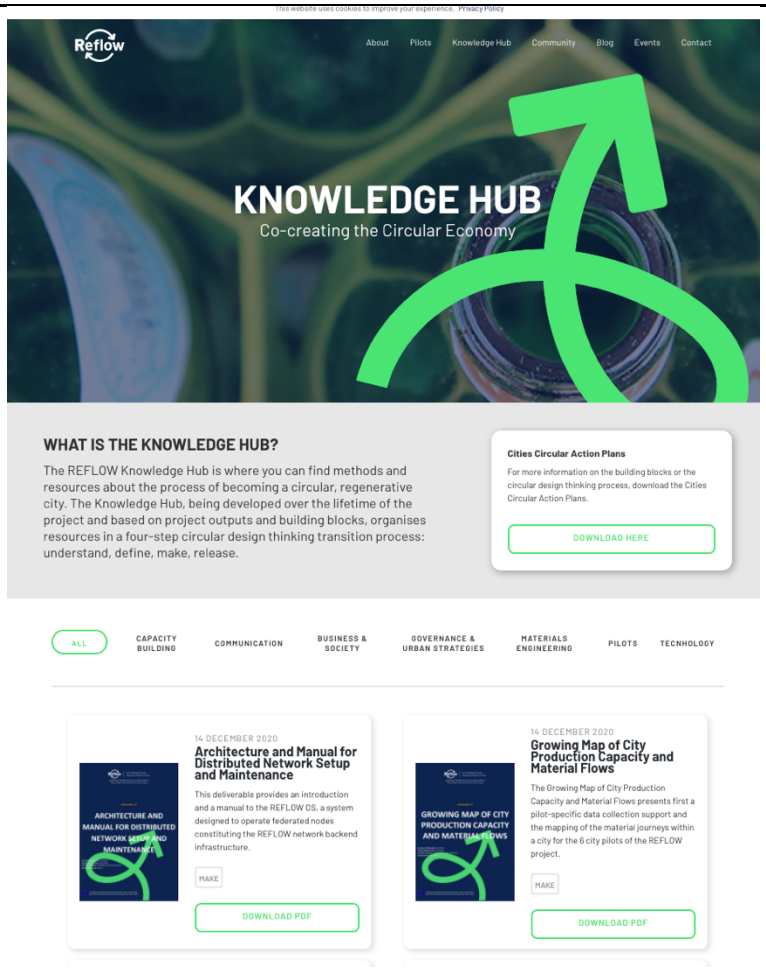

Figure 32 REFLOW Knowledge Hub. Source: https://reflowproject.eu/knowledge-hub/

Related Circular Economy levers	**Awareness rising**: By creating, highlighting and sharing benefits of urban transition this CE Lever was activated. **Communication**: This CE Lever is activated in the ongoing integrated communication process along all project partners.
Where to find more info	https://reflowproject.eu/knowledge-hub/

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3.5.3 REFLOW Legacy and REFLOW Framework

The REFLOW Framework, describes and gives shape the REFLOW Vision of a Circular and Regenerative cities. Together with the WP resources and Pilot Solutions developed throughout the project, the REFLOW Framework constitutes one of the core components of the REFLOW Legacy, which refers to the collective effort of enabling the exploitation of the solutions developed in REFLOW to support the transition towards a circular economy.

3.5.3.1 What are we doing to create the REFLOW Legacy?

The approach to the REFLOW Legacy has been collaborative. The inclusion of a range of partners in the consortium secures relevance among different kinds of actors working with circular transition. Coordination calls between CBS, DDC, IAAC, and ECOVALA were undertaken to define the purpose, requirements, needs, users, and format of the REFLOW Legacy and to refine the roles and responsibilities of partners involved based on ongoing activities within their respective WPs. DDC is leading the conceptual development of the REFLOW Legacy while CBS is responsible for the development of REFLOW Framework and collection of the content required for its development. Several co-creation sessions have been organized to create awareness across the consortium to discuss the objectives and purpose of the REFLOW legacy, as well as how to secure its relevance and ownership among the right actors after the project ends. In this regard, the first co-design (M17) workshop facilitated discussion on the importance of the project's replicability. By the second co-design workshop (M23), the process and development of our common project legacy was intensified. The consortium partners started pointing to the most important output of the project and this can be operational.

Themes emerged from the co- creation workshops

The themes that emerged from the co-creation workshops are providing input for the next steps of developing the REFLOW Legacy and should help the consortium to qualify the content being produced and the platform(s) being set up to promote and make the project available and approachable. Relevant actors will be involved in working further on elaborating the REFLOW Legacy and making it operational and relevant to the project's target users. Throughout the project period consortium meetings will be used to align this work and further co-create the frame and content for the REFLOW Legacy to ensure the accessibility of the learnings to potential takers. The following main themes have been identified:

- **The approach to the Legacy work should be** a validated methodology to solve a fundamental CE problem and later be translated for replication. The REFLOW Legacy should be a holistic approach to apply to circular transition in cities. It should be Mission-, Partnership- and Co-investment driven, thereby the focus should be on environmental, economic and social efforts. It should function as a tool and overview of experts (skills), which should help to identify and understand how unique city characteristics can be incorporated into the circular economy.
- **The tools and methods used in the Legacy should embrace** tangible resources (e.g. tools on websites), best practice and guidelines as well as events and communication. Regarding the organization, the Legacy could be organized within **REFLOW Packages** (Set of solutions tackling specific challenges); **REFLOW Academy** (Set of educational resources for the understanding of circular best practices and methods); **REFLOW Forum** (Virtual space for enabling and joining discussion about CE-related topics and challenges) and the **REFLOW Knowledge Hub** (A collection of informative resources developed during the REFLOW Projects such as Public Deliverables and other dissemination materials based on deliverables. It as functions to share meta-level learnings - how the knowledge is created and shared in such a diverse multi-stakeholder project with many different views/goals/frames of action).

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- **The Legacy should be made available through** online platforms, events and workshops and the consortium network.
- **The Legacy should engage by** creating a movement or a REFLOW network and by external dialogues and synergies with other projects.
- **Potential formats to disseminate the Legacy could be** Events (conferences, roadshows, festivals); Communication initiatives (magazine articles, cartoons); Digital initiatives (Forum, Wiki, website, podcast); REFLOW certification; REFLOW facilitator programme; Training sessions on how to use e.g. tools; Lessons learned (sharing experiences) or Application workshops to engage with user.

REFLOW Legacy and REFLOW Framework

What emerged at the co-creation workshop was the wish to be able to showcase a process from vision to implementation involving different city stakeholders. It was also underlined that REFLOW offers an approach to the circular transition that involves both a bottom-up and a top-down approach, which is of popular demand in many contexts where the potentials and future of CE cities are being discussed. Regarding the format of the REFLOW Legacy, the partners are in the process of considering a simple tool such as an interactive PDF with simple guidelines on how to exploit REFLOW resources. In this regard, the inputs are requirements collected by the consortium further corroborate the usefulness of the supportive model represented by the REFLOW framework and set a promising ground for this to be used as a general framework to develop the REFLOW Legacy.

4 Conclusions and Next Steps

The deliverable introduced the REFLOW Framework as a supportive model to enable agency and participation of cities willing to embark in the transition towards Circular Economy. To do so, the deliverable first presented the REFLOW Pilot Action Plans and their respective final list of key performance indicators (KPIs). This contributed to show the current state of the art of the six circular transitions undertaken in REFLOW, as well as the inherent implementation challenges and complexities of the cities' pathways towards circular change. In so doing, the pilot action plans represent a useful resource for other cities willing to embark in the journey towards a more circular economy. Moreover, the pilot action plans contributed to describe the context in which the REFLOW Framework can and should be applied, to provide a stable reference to understand and implement circular urban transitions. This document made evident the need of a supportive model for cities in transition towards CE vis-a-vis existing circular economy frameworks and initiatives.
The REFLOW Framework here described can support cities to unpack the inherent complexity of circular transitions, thereby supporting the design and implementation of circular action plans. In this sense the REFLOW Framework will support the description of the pilot action plans in the final City Ecosystem Design (D5.3) thereby providing specific examples of the REFLOW Framework application to the REFLOW Pilot Cities. Moreover, the REFLOW Framework will inform the development of the REFLOW Legacy, in order to enable future exploitation and replication by cities willing to benefit from and make use of the solutions developed throughout the REFLOW project.

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