

# CENTRINNO

# URBAN ECOSYSTEM

# MAPPING GUIDEBOOK

A how-to guide to urban resource cartographies



# EXECUTIVE SUMMARY

The CENTRINNO project seeks to test strategies for regenerating industrial heritage sites through inclusive and sustainable production models that put local neighbourhoods at the core. This Urban Ecosystem Mapping Guidebook was created to support pilots in their efforts to include circular and ecologically sustainable approaches into the programming of local innovation hubs.

The Urban Ecosystem Mapping Guidebook synthesises the framework, process and mapping methods which CENTRINNO pilots will implement to (1) understand their local urban ecosystems holistically, and (2) collect data and insights that will feed into the development of the CENTRINNO Cartography. The Cartography is an interactive online map that visualises the multi-layered nature of urban areas surrounding the nine participating pilot cities. It will show the diverse resources, infrastructure and socio-cultural assets that exist in a local context to unveil the opportunities for creating circular and sustainable regeneration pathways.

Beyond the Cartography, urban ecosystem mapping methods will also provide input for the development of the CENTRINNO Living Archive. The Living Archive will become an online repository of diverse stories and narratives highlighting which stories and values are hiding behind the physical location of places, sites, items or buildings. Approaches described in this document will allow pilots to identify where to look further to curate content for the Living Archive.

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## **ACRONYMS AND ABBREVIATIONS**

ACRONYM	DESCRIPTION
CENTRINNO	New CENTRAlities in INdustrial areas as engines for innovation and urban transformation
EN	Emotion networking
GIS	Geographic information system
MFA	Material flow analysis
UM	Urban metabolism
IAAC	IAAC Institute for Advanced Architecture of Catalonia
AHK	Amsterdam University of the Arts



# GLOSSARY



## Urban Ecosystem

In CENTRINNO, urban ecosystems are understood as complex and interconnected systems that embrace people and their communities, ecological systems, as well as industrial systems.



## Urban Resources

Urban resources are all forms of local assets - physical as well as non-physical- that provide the city with value. They include all physical primary and secondary materials, infrastructure or technology that could be an asset for local circular value chains. They further embrace all intangible resources, such as knowledge, cultural heritage, and community services.



## Urban Metabolism

The Urban metabolism (UM) framework is based on the understanding of cities as living organisms. It is used to analyse all flows of energy, water, materials, waste, and air through an urban system.



## Material Flow Analysis

Material flow analysis (MFA) is one of the main methods applied in the study of urban metabolisms. This method quantifies the flows and stocks of materials within a system, such as a city, nation, or organization.



## CENTRINNO Cartography

The CENTRINNO Cartography is an interactive, digital map developed during the CENTRINNO project. It will synthesize the result of urban ecosystem and resource mapping. The Cartography will be made available to the wider public audience through the CENTRINNO Website.



## CENTRINNO Living Archive

The CENTRINNO Living Archive is one of the other central outputs from the CENTRINNO project. Developed alongside the Cartography, the Living Archive will become a multi-media platform that stores and shares stories, reflections and other audiovisual content on local heritage items.



## CENTRINNO Network

The CENTRINNO Network refers to the ecosystem of local and global organizations, businesses, and makers that will be established through the activities within and between the nine participating pilot hubs.



## CENTRINNO School

Each pilot hub will establish the so-called CENTRINNO School where the local workforce is trained in new skills and knowledge required for the 21st century. Training curriculums will include programming for circular economy skills, urban (re)manufacturing, and traditional artisanal trade skills.



## Emotion Networking

Emotion networking (EN) is a method that can be used to map stakeholder positions and complex dynamics between different stakeholders in facilitated interactions around specific items or issues.



## Fab City Hubs

Fab City Hubs are physical spaces that facilitate innovation, experimentation and testing of ideas on productive and circular practices by urban communities. Fab City Hubs are an evolution of Fab Labs and makerspaces developed by the Fab City Global Initiative to improve permeability with local realities, citizens, and communities. Tests on this concept were already carried out in 2019 in London and Barcelona.



## Brownfield

Brownfields are sites or pieces of land formerly used for industrial purposes that have been abandoned. While they are often environmentally polluted and underutilized, they are also attracting investment for redevelopment and remediation.



## Post-industrial sites

Buildings or locations in cities that have once been dominated by industrial functions. They can include abandoned brownfields or derelict infrastructure, as well as areas that have found new functions and uses for industrial heritage buildings.



# INTRODUCTION

## About CENTRINNO

This guidebook was created for the purpose of CENTRINNO - an EU-funded research project testing and developing strategies for inclusive, circular and sustainable urban regeneration in nine historical industrial sites across Europe. One of CENTRINNO's core objectives is to support (post)-industrial districts to once again become thriving centers of creative making, urban manufacturing and productivity. Breaking with the linear and exhaustive nature of Europe's first industrial revolution that led to the overexploitation of people and the planet, the next industrial transformation should be one that is fundamentally circular, regenerative and inclusive. In this guidebook, we introduce a framework and a holistic mapping approach - the CENTRINNO Urban Ecosystems Mapping process - that **provides a starting point for urban initiatives to kick-start a circular industrial transformation.**

## Towards the city of the future

The need for a systemic reformation of the urban economy is high. At both a local and global scale, human activities are putting an increasing pressure on the stable functioning of the world's ecosystems. This expresses itself in a range of negative impacts, such as biodiversity loss, poor air quality, increased extreme weather events, floods and droughts. These impacts mostly affect already vulnerable communities and thereby enhance global inequality. We are faced with the challenge to transition to societies that support the stable

function of the earth's ecosystems, while promoting resilient, equitable, and happy communities.

As hotspots of consumption, transport, and human interaction, cities are a key leverage point to work towards a more sustainable future. While occupying only 3% of the earth's surface, cities consume around 75% of global resources, and cause 60-80% of the global human carbon emissions (United Nations, 2017). The challenge that we are taking on in the CENTRINNO project is extensive: we need to **redesign the way our cities function**, from the spatial layout and systems of governance, to the underlying systems through which we ascribe value to people, nature, resources, and time. We must create cities that value work and craftsmanship over extractive resource use. Cities that provide us with equitable access to the resources we need, while leaving space for wilderness to flourish. Cities that offer space for social gathering, and that stimulate shared ownership and decision-making among its diverse residents.

As remnants of an old, extractive economy, the nine historic industrial sites participating in the CENTRINNO project possess a broad range of resources and opportunities that can set us on track for building towards the city of the future. The sites can serve as productive and dynamic innovation centers that promote new economic models for meeting the local demand of services and goods, while upholding local culture and ecology. By giving space to local makerspaces and sites for developing skills for circular, local and sustainable manufacturing, the (post-)industrial sites can be an example for inclusive and sustainable urban regeneration.

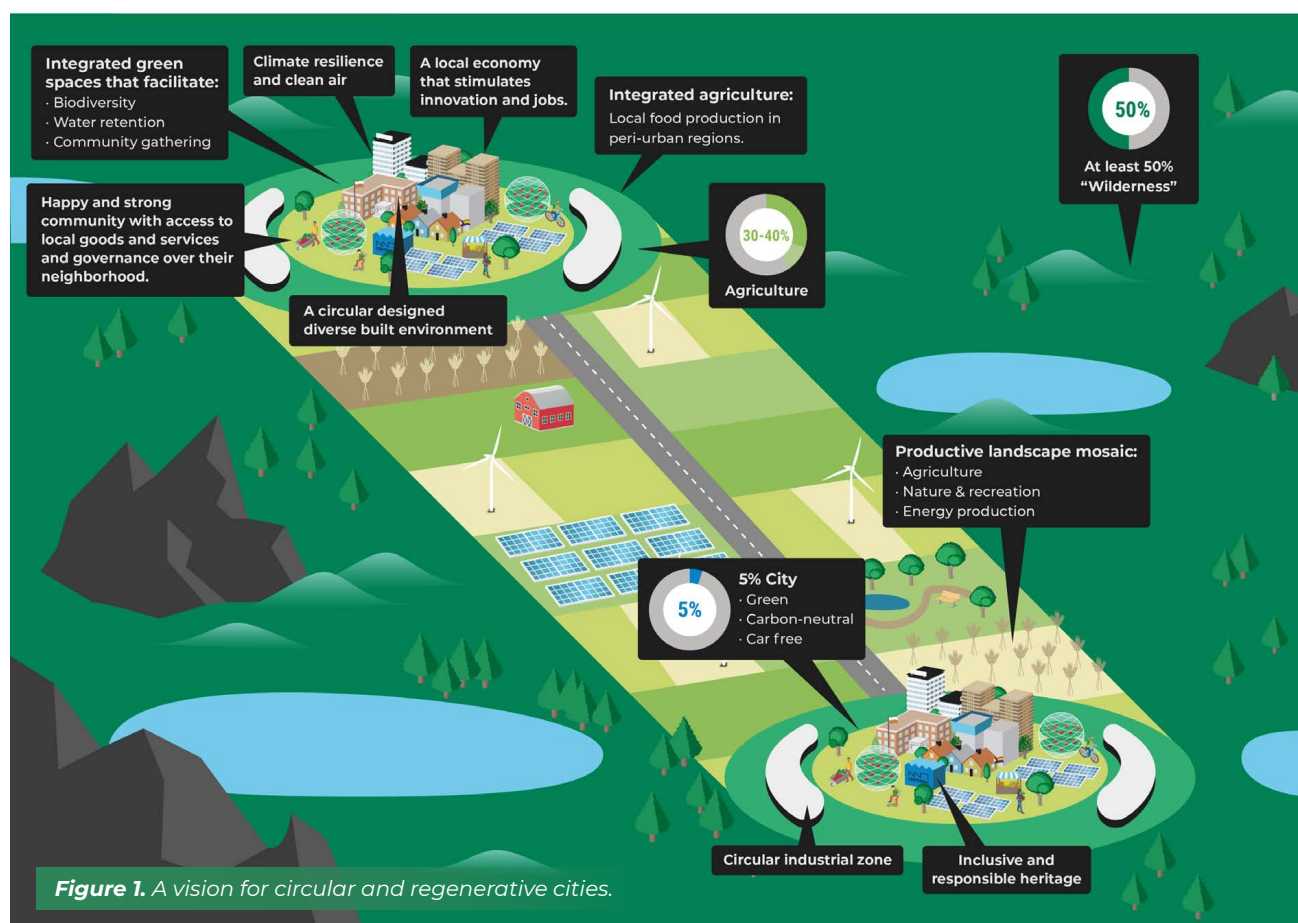


Figure 1. A vision for circular and regenerative cities.

## Why we map cities

The process of mapping urban ecosystems surrounding CENTRINNO pilot sites is a critical part of the CENTRINNO framework and methodology. Through mapping, urban change makers and community planners can develop a more granular understanding of the complexity and interconnectedness of social, ecological and economic challenges related to urban regeneration. Such understanding is important to craft alternative approaches to regeneration while avoiding unintended consequences either within or beyond the city itself. For example, positive intentions such as the clean-up of polluted brownfields may create backlash by increasing property value and subsequently displacing residents in lower-income brackets. Acknowledging possible side effects of urban interventions, the mapping of urban ecosystems around CENTRINNO pilot sites builds the foundation to identify and monitor urban ecological, social and economic conditions across neighbourhood boundaries and across time.

The second major purpose of undertaking mapping exercises is pragmatic: Cities are full of resources, such as skills, technologies, capacities, and materials, that are currently underutilized or wasted. Mapping provides cities the ability to explore and visualize the interconnections between such resources. By generating knowledge on these resources and their location in cities, CENTRINNO pilots and urban changemakers can tap into their hidden potential to spur local economic and industrial development in a circular and inclusive manner.

## Structure of this guidebook

We will present a suite of tools and methods for mapping urban ecosystems that can become an asset for driving this transformation towards circular value chains and responsible heritage management. Since this guidebook is an iteratively updated **'living' document**, it is not meant as an exhaustive methodology but as an inspiration for urban initiatives or community planners seeking to build their knowledge on (post-)industrial sites through the practice of mapping. The remainder of this guidebook is structured as follows:

### Part A

Part A introduces our **CENTRINNO's Urban Ecosystem Framework**. This framework is the backbone of our mapping tools which ensures that we think about cities as connected and complex systems. We structure the framework into three layers that describe the subsystems of cities: (1) urban nature, (2) urban communities, and (3) urban industries.

### Part B

Part B will give a step-by-step description of CENTRINNO's Urban Ecosystem Mapping process and the respective methods applied throughout the project. CENTRINNO pilots will use these methods throughout the project to build out a locally relevant and context-sensitive mapping strategy which speaks to each of the pilots' objectives, needs, and challenges. This section will further introduce how the pilots will integrate mapping results into a local, interactive cartography that will be embedded into the CENTRINNO website for knowledge sharing and networking purposes. Outside of the CENTRINNO project, each of these methods can be either individually mixed and matched by urban changemakers, or fully implemented to inform circular strategies, roadmaps, or regeneration projects.

### Part C

Part C will showcase how mapping outcomes can be harnessed to implement circular and regenerative activities across the other four elements of the CENTRINNO Framework: (1) CENTRINNO Network, (2) CENTRINNO School, (3) CENTRINNO Living Archive, and (4) CENTRINNO Fab City Hubs. The purpose of this section is to highlight exemplary visions and use cases to move from mapping as a process to tangible actions for circular, inclusive, and sustainable urban regeneration.



PART

A

# THE CENTRINNO URBAN ECOSYSTEM FRAMEWORK

## THE CENTRINNO URBAN ECOSYSTEM FRAMEWORK



Cities require a holistic and interdisciplinary approach to urban regeneration that helps to overcome social, ecological and economic challenges in a systemic manner. Mapping urban ecosystems through the lens of systems thinking is a good starting point to comprehend the complexity of cities while simultaneously providing actionable insights into resources and opportunities for sustainable, regenerative and circular transformation.

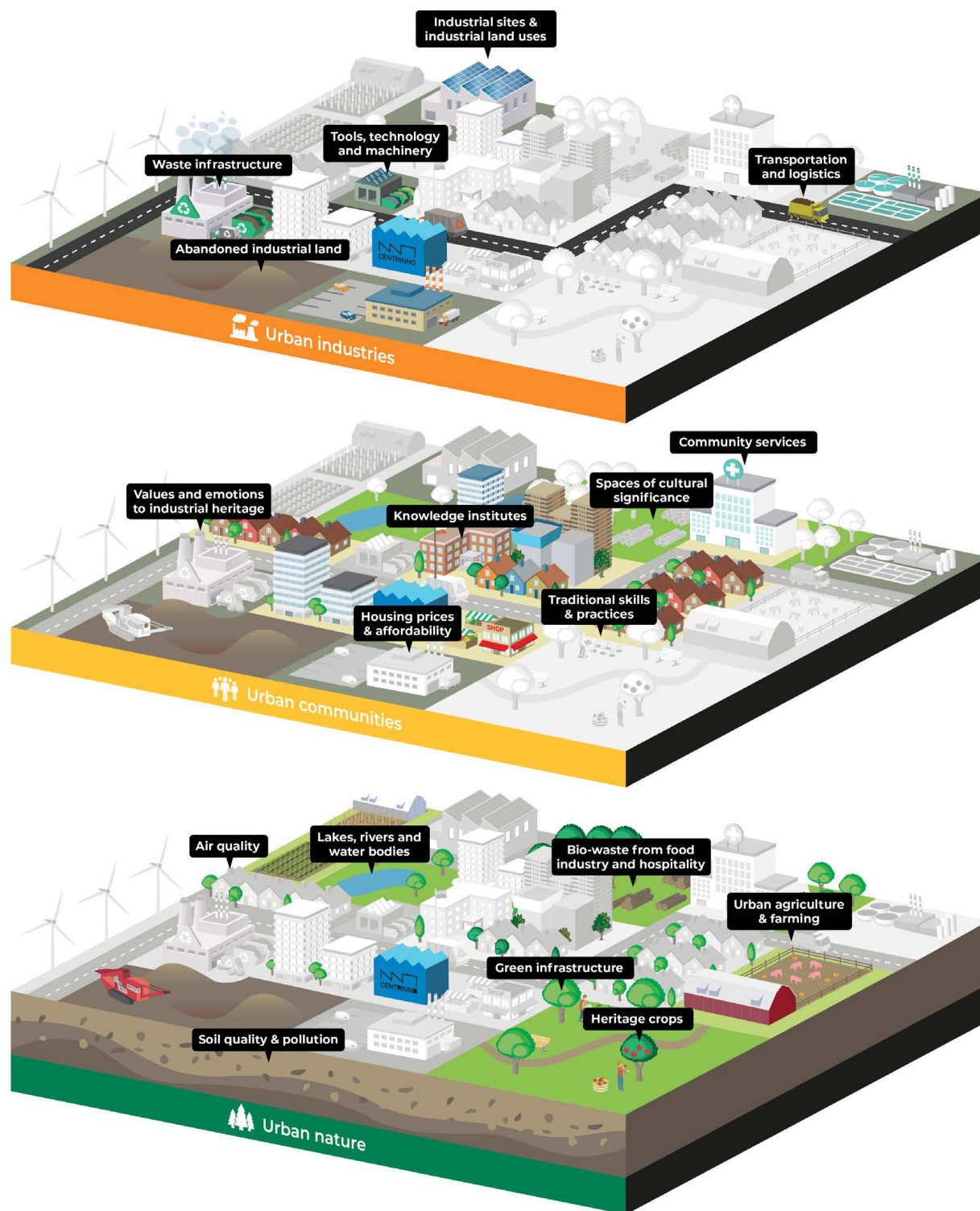
To identify and map resources across social, cultural, ecological, and industrial dimensions, we developed the CENTRINNO Urban Ecosystem Framework. Rooted in the fields of urban ecology and urban metabolism studies, CENTRINNO's Urban Ecosystem Framework approaches cities as multi-layered ecosystems, embracing three key layers: urban nature, urban communities, and urban industries.

First, **urban nature** refers to the underlying natural ecology of cities, including urban green infrastructure, ecosystem services, water, land, and air. Urban agriculture and gardens are also part of the urban nature dimension.

Second, **urban communities** will zoom in on the socio-cultural dimension of cities. Elements mapped in this layer may include community services and public resources, formal and informal knowledge held within the community, as well as heritage and cultural artefacts. Local consumption patterns are also part of this layer since a city's demand for goods and services is closely linked to socio-cultural behaviour, values, and wealth.

Third, **urban industries** cover a city's industrial and waste infrastructure as well as related resources that flow through local industrial facilities. Within this layer, CENTRINNO pilots will map the local industrial productive capacity and waste streams available for creating new circular value chains.

While these "layers" are a useful conceptual framework to support the understanding of cities as complex systems, it is important to keep in mind that each layer is interconnected and dependent on the others. The following section will further elaborate on each layer.



**Figure 2.** CENTRINNO's Urban Ecosystem Framework as multi-layered ecosystems.

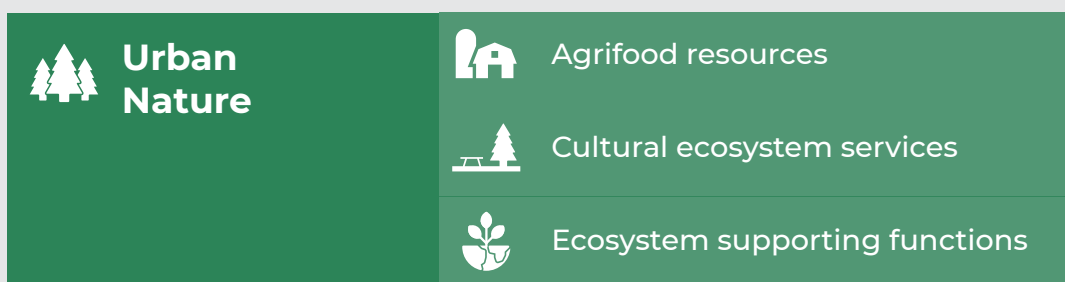


## URBAN NATURE

### What resources are available in urban nature?

Urban nature provides cities with indispensable ecosystem services, biophysical and cultural resources: Peri-urban woodlands and agricultural land provide food and feedstock for local consumption and production, or biomass for energy generation. Sometimes, recognizing the value of urban biomass for local production requires creativity and inspiration. For instance, polluted water bodies have been proven a fruitful growing substrate for duckweed - an aquatic plant with a significant feedstock potential for biogas, biofuel, and biochar production (Verma & Suthar, 2015), while underutilized tree maintenance waste has been successfully used by local woodworkers and craftsmen in Baltimore to create high-value products, such as furniture (Galvin et al., 2020).

Other resources, such as the provision of ecosystem services, are more intangible and harder to quantify. Green spaces, for example, serve as a resource for local recreation, and at the same time serve as protection against flooding and regulating urban heat. Urban nature is also rich in resources for plants and animals if natural spaces within cities are safeguarded from human disturbances. In particular abandoned sites and environmentally degraded brownfields that cities often seek to redevelop are critical habitats for the local flora and fauna which, in turn, provide human communities with pollination services and biodiversity (Gallagher et al., 2018; Wratten et al., 2012).



**Figure 3.** Key resource categories in urban nature.

### What insights can we get from mapping urban nature?

Mapping urban nature and its resources can generate important insights into the quality, distribution and function of local ecosystems within cities. Parks, urban forests, trees and water bodies have measurable benefits for urban climate regulation (Brown et al., 2016; Kardan et al., 2015; Wheeler, 2015) and community well-being (Nutsford et al., 2013; Vanaken & Danckaerts 2018). Studying publicly available spatial datasets allows us to identify where natural ecosystems are lacking, degraded or polluted, and to highlight areas where urban regeneration projects should focus on ecosystem regeneration.

CENTRINNO's focus on post-industrial sites demands particular attention to urban nature. It is often in and around these sites that the legacy of industrial activity continues to burden local water bodies, soils and habitats (Panagos, van Liedekerke, Yigini, & Montanarella, 2013). Heavy metals, petroleum hydrocarbons, solvents, pesticides, and polynuclear aromatic hydrocarbons are some of the most commonly found pollutants in the proximity of ports,

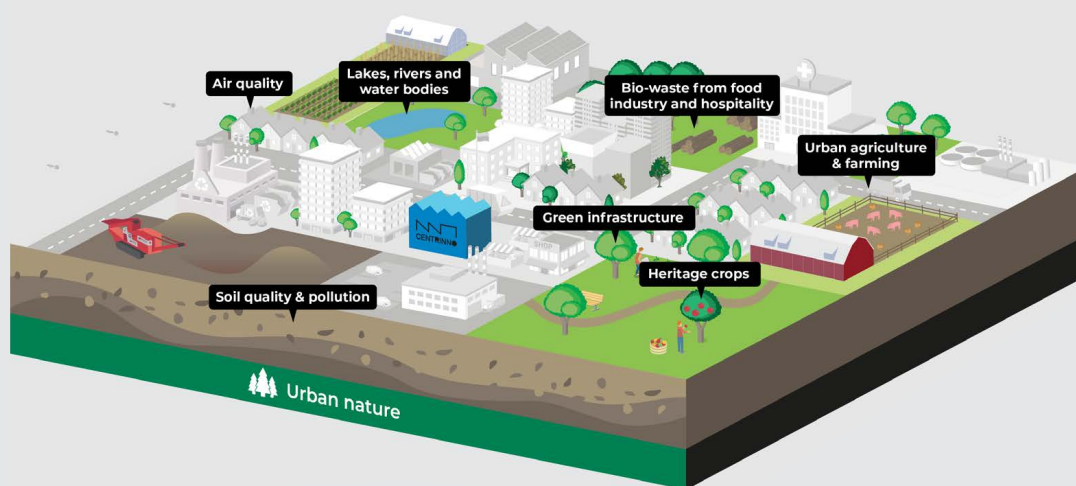
industrial areas, pipelines, and former waste disposal sites. Through mapping these environmental challenges, it is easier to identify which neighbourhoods are disproportionately exposed to pollution and heavily degraded ecosystems.

Luckily, greening and de-polluting both brownfields and (post-)industrial sites has become a key action item on many regeneration projects. But despite the various benefits for people and the environment that greening has, expanding parks and recreational green spaces can bring along unintended consequences for local communities. Housing prices and property values may rise as a result of the new services and benefits that parks, forests, urban gardens and trees provide (Immergluck & Balan, 2017). In the most extreme cases, greening contributes to the gradual displacement of low-income residents - a process known as environmental gentrification (Curran & Hamilton, 2017). Mapping the development of urban natural areas paired with socio-demographic patterns over time is a valuable place to start monitoring and identifying these negative rebound effects.

Lastly, mapping urban nature over time can also generate insights into the global impacts and unintended consequences that cities can have. A good example of how local urban development interconnects with environmental challenges across the world is found in the effects that growing cities have on global food production. When cities expand into their hinterland, prime farmland is often converted into urban land uses (van Vliet et al., 2020). Globally, however, the lost fertile cropland is replaced through the deforestation of less fertile woodland (van Vliet et al., 2019). Thus, focusing on reusing and regenerating post-industrial land, or underutilized, abandoned infrastructure is an important strategy to minimize the pressures on both local greenfields as well as faraway ecosystems (European Commission, 2019).

#### Which methods work best to map urban nature?

- **Geospatial context analysis** - a method to analyse the neighborhood profile by collecting suitable spatial data on the relevant geospatial context within the pilot sites, which will be further explained on [page 31](#).
- **Material flow analysis** - a method to identify the physical resources that are circulating in the pilot cities in order to create insight on how it is being used. This method will be elaborated on [page 36](#).



**Figure 4.** Zooming into urban nature.



## URBAN COMMUNITIES

### What resources are available in urban communities?

Resources in urban communities can be present in any form of cultural or social asset. Some of these assets can be physical, while others are intangible in nature. Artisanry and craftsmanship, historic cultural places, natural monuments, or local festivals are all aspects of urban culture which may provide local communities with a sense of belonging and meaning that is unable to be represented by monetary value. We also count social and public infrastructure, such as schools, libraries, stores, and other day-to-day community services as resources worth mapping to understand the current assets in the target urban community.

Intangible cultural assets, such as everyday practices, rituals, stories, memories, personal experiences and attitudes, and values, are harder to identify but no less important to ensure place-based and participatory urban regeneration. It is widely recognized that the mapping of social and cultural resources is an important method for sustainable urban development by safeguarding cultural diversity and enabling communities, individuals, and networks in order to recognize their value for social, cultural, and economic development (Avrami, 2019; Lu, Pintossi, Dane, & Roders, 2019).



**Figure 5.** Key resource categories in urban communities.

### What insights can we get from mapping urban communities?

Mapping community and culture can generate a deeper understanding of the social challenges, strengths and opportunities present around (post-)industrial sites and beyond. The most pragmatic insights that a map of community resources can generate is that it clearly lays out the local social and cultural resources already present within a neighbourhood that can be harnessed in regeneration initiatives. Comparing locally existent community resources to other surrounding districts can further uncover some of the shortcomings of an area: Are public services, schools, or healthcare facilities lacking? Is there a thriving scene of socially engaged initiatives? Being accessible and visual, a map of community resources provides a first overview of local networks of knowledge, support systems, and social cohesion.

Mapping can also be used as a more sophisticated tool to gain insights about the negative effects of urban revitalization. Displacement and gentrification count as the most feared side-effects of urban regeneration, yet, they are often challenging to identify and measure. Often, these

processes are gradual, unfolding over several years and across several neighbourhoods (Easton, Lees, Hubbard, & Tate, 2020). Mapping housing prices, changes in building ownership, or the movement of people in and out of the district can become a tool for the long-term monitoring of gentrification and displacement.

A last reason for mapping the local socio-cultural landscape of a neighbourhood relates to what it tells us about the past. While cities are undergoing constant processes of renewal, redevelopment, and demographic changes, the meaning embedded in the historic landscape through memories, beliefs, and practices continues to shape social and cultural life today and into the future. The cartography of legacies allows us to see how humans initially arrived at a place of living; which roads were constructed; which goods were traded and how these goods were used in production, influencing and being influenced by social and cultural communal life. The industrial revolution, as a shorter time frame, can be of particular interest as it binds together mass transformations at a local scale, of globalised trade, new energy consumption regimens, technological change and mass cultural

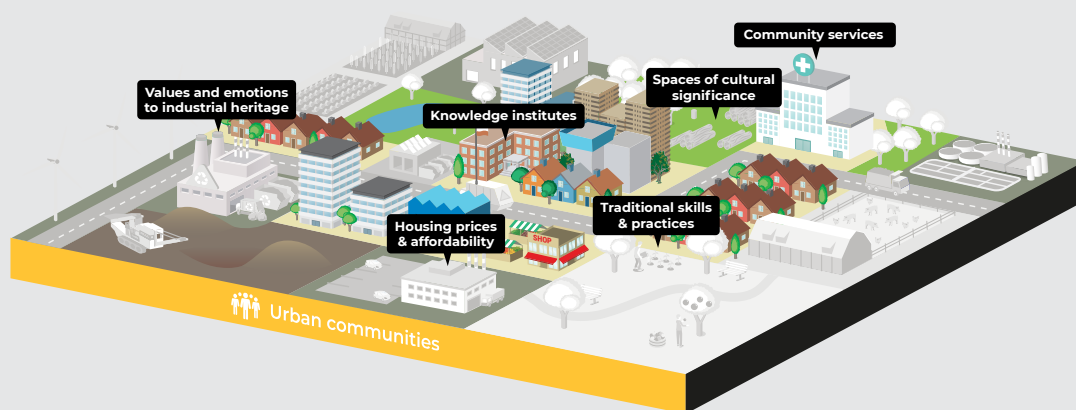
shifts, population growth and shocking events as wars, floods and pandemics. A road, a building and people's recollection and/or attribution of meaning to it, offers a way to peek into history.

#### Which methods work best to map urban communities?

- **Geospatial context analysis** - (page 31)
- **Stakeholder surveying** - a technique to collect

bottom-up information on both tangible and intangible resources and also the urban actors involved in the pilot cities. This practice will be elaborated on [page 41](#).

- **Ethnographic mapping** - a practice to identify local attitudes towards heritage items and to engage with the cultural dynamics that existed in the pilot cities. This process will be described in [page 47](#).



**Figure 6.** Zooming into urban communities.

## URBAN INDUSTRIES

### What resources are available in urban industries?

CENTRINNO places a strong emphasis on urban manufacturing and local making to induce inclusive urban regeneration of post-industrial sites. This is why the third layer of CENTRINNO's Urban Ecosystem Framework focuses on the industrial dimension of cities. We can think about this layer as the aggregation of all industrial activity, including production infrastructure, logistics, and transport of materials. Waste management and treatment facilities are also an important element of urban industries that are critical to transform urban industrial material flows into circular value chains (Furlan, Wandl, Geldermans, & Sileryte, 2020).

Scrapped materials, waste streams and underutilized by-products from local economic activities are key resources that offer many opportunities for a new circular industrial transformation. But without the required tools and infrastructure, it is difficult for local makers to tap into these material resources. This is why we also count industrial and non-industrial equipment and logistics infrastructure of local industries, SMEs or citizen-driven workshops as critical resources worth mapping.



**Figure 7.** Key resource categories in urban industries.

### What insights can we get from mapping urban industries?

Mapping urban industries and waste-related infrastructure aid CENTRINNO's pilots to build knowledge on the urban metabolism and emerging opportunities to create more circular value chains. A city's metabolism describes the flows of materials, energy, water, and waste that is used to drive economic, industrial, and social activities (Decker, Elliott, Smith, Blake, & Rowland, 2000). Through mapping the waste management sites and industrial clusters, we can start to locate where in the city secondary resources could be "mined" to feed local production and manufacturing processes. A cartography of local industrial sites and zones is also a good place to start getting an overview of the productive capacity within an area, as well as the spatial layout and distribution of industrial land uses.

Beyond providing an inventory of resources present within current-day urban industries, we can also use mapping as a tool to uncover the legacies of past industrial activities. Deindustrialization and technological innovation have left behind many contaminated sites, derelict infrastructure, waste dumps, and abandoned

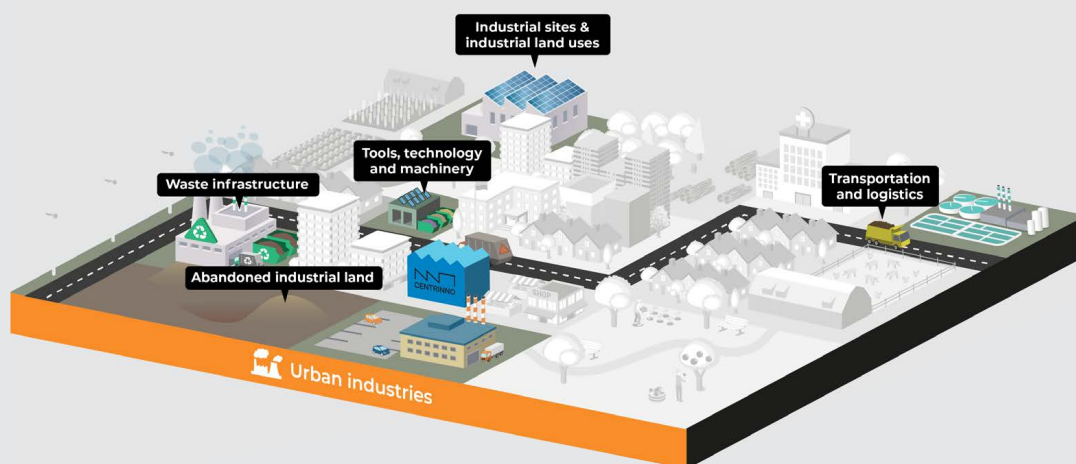
buildings that impact the health and wellbeing of local communities and urban nature (Clark, 2009). Inherited contamination and pollution can be a threat for people and nature - for example when organic and inorganic pollutants are ingested via food grown in peri-urban or urban soils (Li et al., 2018; Eiser, Stafford, Henneberry, & Catney, 2011). Apart from real human health effects of contaminated sites, both wasted lands and waste land in cities can also induce perceived risks and feelings of fear amongst citizens, especially if local authorities fail to build trust about the safety of these places (Eiser et al., 2011). The connections between industrial pollution, environmental degradation and community wellbeing is a prime example to showcase how the three layers - urban industries, urban nature, and urban communities - are all linked to one another.

But these interconnections between urban industries, nature, and communities are not necessarily negative. Often, it is on abandoned brownfields and industrial land where plants and animals find a habitat undisturbed from construction and socio-economic activities (Hall, 2013). Local communities may also use these spaces for recreation, urban gardening, or

other informal social gatherings that significantly contribute to their wellbeing. Mapping urban industries from this multifaceted perspective will allow us to understand the diverse opportunities and challenges that urban industrial land can bring along.

#### Which methods work best to map Urban Industries?

- **Geospatial context analysis** ([page 31](#))
- **Material flow analysis** ([page 36](#))
- **Stakeholder surveying** ([page 41](#))



**Figure 8.** Zooming into urban industries.



## MANY LAYERS, ONE SYSTEM

The three layers of CENTRINNO's Urban Ecosystem Framework: urban nature, urban communities, and urban industries can help us understand urban ecosystems from a holistic perspective. But instead of thinking about these layers as isolated parts of cities, it is important to understand their interdependencies and interconnectedness. When ecosystems in cities disappear or degrade, urban communities feel the impacts physically and emotionally. They might be exposed to hotter temperatures as the results of the urban heat island effect, without the cooling effect of urban forests, parks and lakes, or suffer from mental health problems without access to nature (Brown et al., 2016). Past industrial activities may leave behind soil and water pollution, but also a diverse historical heritage that continues to shape urban culture and communities.

In order to fully comprehend the urban ecosystem with its challenges, strengths, and opportunities, we must look at all dimensions - urban nature, communities, and industries - as an integrated system. Where are the obvious and hidden feedback loops between these layers? What consequences does an intervention in one layer trigger in another? Which resources and assets only emerge from the interaction of each of these layers? Waste, a resource emerging within urban industries, may only be seen as such if local communities recognize its hidden value. An abandoned (post-)industrial replete with biodiversity can only be perceived as a local asset if any persistent feelings of threat within the community are broken down. Mapping the conditions and resources within the three layers of urban ecosystems may help to find some answers to these questions. At the very least, it will enable us to find hotspots that are worth exploring further - through detailed mapping of one layer, one area, or one industry.

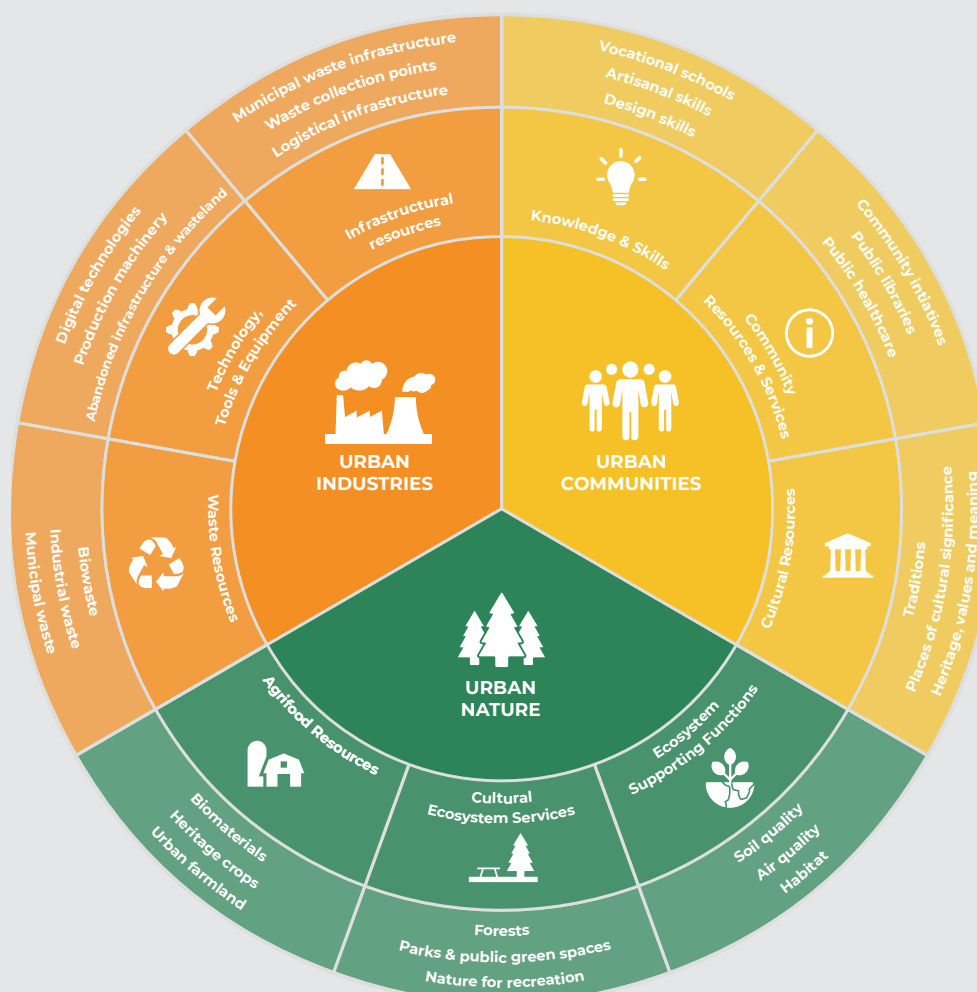


Figure 9. Urban ecosystems and their resources.



PART

B

# MAPPING TOOLS & METHODS

## MAPPING TOOLS & METHODS

### Urban ecosystem mapping put into practice

The following section will present a suite of mapping tools and methods, describe their main steps, and their specific applicability in collecting information on urban ecosystems and their resources. In the CENTRINNO project, these mapping methods and tools will help pilot cities to develop a **local cartography** that identifies various types of resources across the three layers as described in Part A of this guidebook: urban nature, urban communities, and urban industries.

Against the backdrop of CENTRINNO's industrial transformation approach, a strong focus is placed on physical secondary materials that can be "mined" from urban waste streams for local production systems. Utilizing waste materials to feed the manufacturing and making activities organized by CENTRINNO's prospective hubs is one of the most critical levers to spur circularity in pilot cities.

Despite the importance of mapping waste resources in cities, they are but one form of resources necessary to transform (post-)industrial sites into socially and culturally inclusive hubs. Equally critical to map are those knowledge systems, practices, and infrastructures that enable local makers to thrive in a new circular urban economy: knowledge on designing products/services with regenerative and circular principles in mind; tools and technologies to produce these products/services; and infrastructure for the delivery and distribution of circular goods/services.

All these resources should be leveraged in a manner that is culturally and socially sensitive. Instead of replacing traditional crafts and manufacturing practices, industrial transformation can build on and learn from the resources of traditions and heritage. Taking stock of these intangible assets that exist in local organizations, research institutions and communities will require the integration of different mapping methods in addition to those used to map physical materials in a city. Which method is best suited to identify local resources highly depends on the context, interests, and objectives of each pilot.

### Mapping across space and time

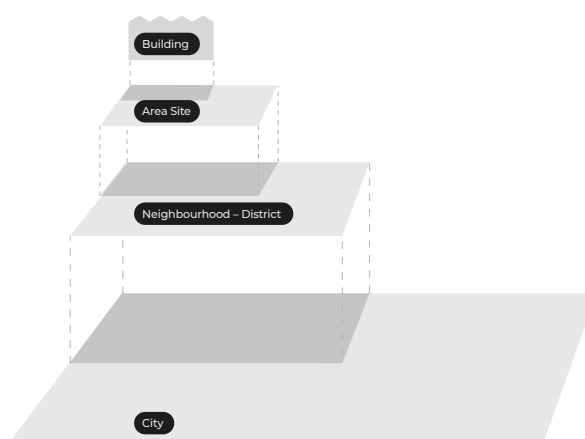
Space and time are two essential elements that delineate any mapping process, and determine the types of insights it generates. It is therefore worth defining at which spatial and temporal scales the CENTRINNO Urban Ecosystem Mapping process will take place.

#### Mapping across time

Maps often only provide a snapshot of a moment in time. But in order to generate meaningful insights about longer-term ecological and socio-economic processes present in a city, it is necessary to map urban ecosystems and development patterns throughout time. For CENTRINNO's pilot sites, this could signify mapping the change in land use from industrial to residential functions, or the change in housing occupancy to identify demographic processes throughout the city. CENTRINNO's mapping process will encourage urban change makers and pilots to identify those parameters that are critical to monitor across time.

#### Mapping across spatial scales

Apart from time, CENTRINNO's approach to urban ecosystems mapping will also recognize that mapping can and should occur at different spatial scales, ranging from individual buildings to the entire city. Some geospatial parameters are critical to map across the whole urban landscape and even beyond, while others are more conducive to be mapped only in the immediate proximity of a building, site or street. As an example, CENTRINNO pilots or other urban change makers may map local soil or water pollution surrounding a (post-) industrial area to understand the environmental burden of their location in more detail. Mapping soil pollution across the entire city, however, is too resource and time-intensive to be realized. For certain parameters, such as green space distribution, city-wide employment rates, or industrial land use distribution, a broader spatial scale is critical to compare between neighbourhoods. CENTRINNO's mapping process allows pilots to specify at which spatial scales mapping should occur.

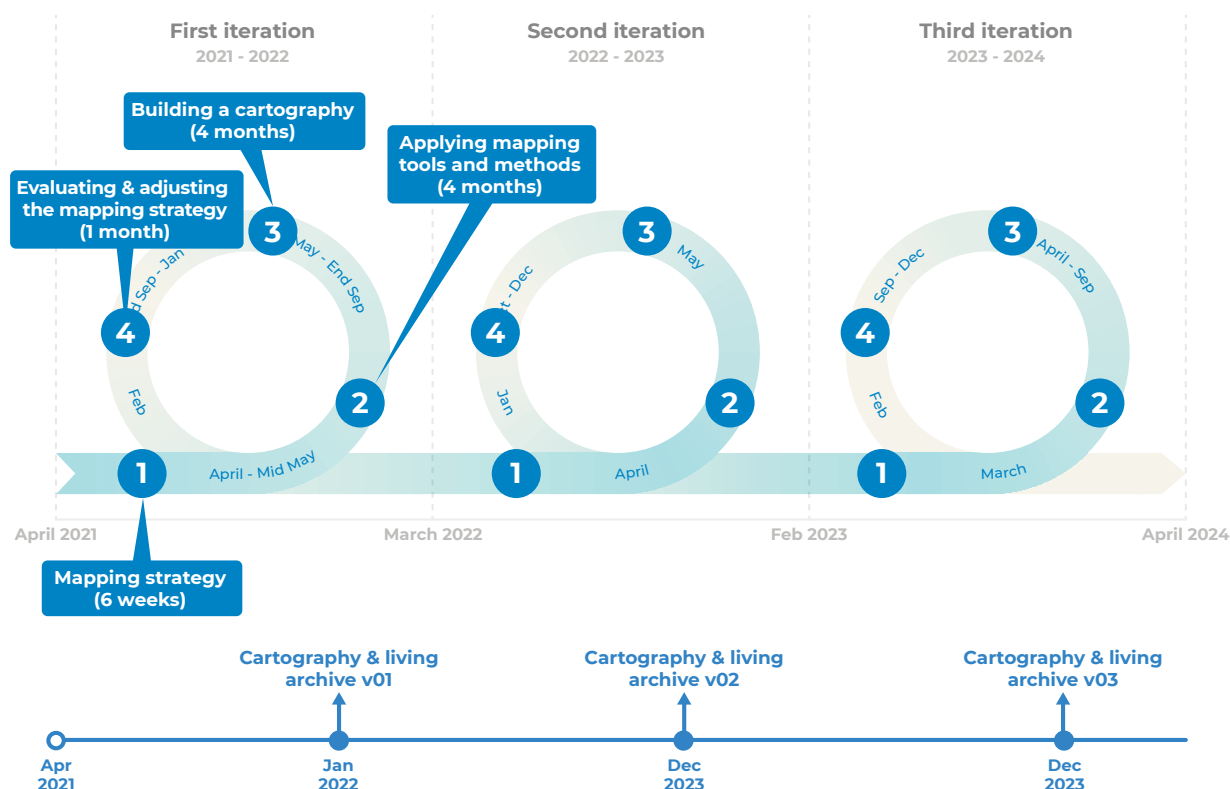


**Figure 10.** Spatial scales for CENTRINNO's mapping process. Source: CENTRINNO, 2020.

## The process in a nutshell

The process for mapping urban ecosystems we present here is structured in four phases: (1) Building a mapping strategy, (2) Applying mapping tools and methods, (3) Building a cartography, (4) Evaluating and adjusting the mapping strategy, as shown in Figure 11 below. While this guidebook presents these phases in a logical sequence

that, together, are meant to provide a systemic analysis of cities and their resources, each phase can also be applied as a stand-alone method. Cities, communities, and other urban initiatives outside the CENTRINNO project can follow the CENTRINNO Urban Ecosystem Mapping process without the specific end-goal of a physical cartography, rather as a means to better understand the system in which they are operating.



**Figure 11.** Urban Ecosystem Mapping process: In CENTRINNO, the mapping process will be repeated and refined over the project's three pilot sprints. After each mapping iteration, CENTRINNO pilots will reevaluate how the mapping process and the resulting cartography can be improved, built out, or adjusted to become more insightful.

# MAPPING OVERVIEW SHEET

PHASE

## 1 Building a Mapping Strategy

Any mapping project starts with the formulation of a mapping strategy that defines the purpose and objectives for creating a map, cartography or other visualisation of urban ecosystems and their resources.

Level of required expertise   

PHASE

## 2 Applying the Mapping Tools & Methods

### Geospatial Context Analysis

A geospatial context analysis provides the basis for building intelligence on how regeneration sites relate to their surroundings. It is a highly-recommended first step to scope out baseline parameters to map in the three layers of urban nature, urban communities and urban industries.

Level of required expertise   

Geographic scope 

### Material Flow Analysis

Material Flow Analyses are a good starting point to map high-level waste streams through urban ecosystems and identify waste generation hotspots.

Level of required expertise   

Geographic scope  

### Stakeholder Surveying

The Stakeholder Survey is a tool to identify resources at the level of organizations, individual stakeholders and selected industries. In comparison to the MFA, it is better suited as a bottom-up data collection.

Level of required expertise   

Geographic scope 

### Engaging with local heritage & culture

Socio-cultural mapping of prospective items of tangible and intangible heritage, everyday practices, rituals, values, emotions and stories identified through site fieldwork and facilitated interactions in Emotion Networking workshops.

Level of required expertise   

Geographic scope 

PHASE

## 3 Building a Cartography

Outcomes of the methods and tools applied in Phase 2 will be visualized in form of a digital and interactive map. In CENTRINNO, this cartography is developed in three iterations. In each cycle, new data collected from the mapping process above will feed into a gradually growing refined version. Resulting insights from the Cartography are

Level of required expertise   

PHASE

## 4 Evaluating and adjusting the mapping strategy

Each mapping cycle will end with an evaluation and synthesis of the outcomes. Insights will be used to (1) adjust the strategy for the next cycle and (2) develop action plans for harnessing resources and information about urban ecosystems in CENTRINNO's programming

Level of required expertise   

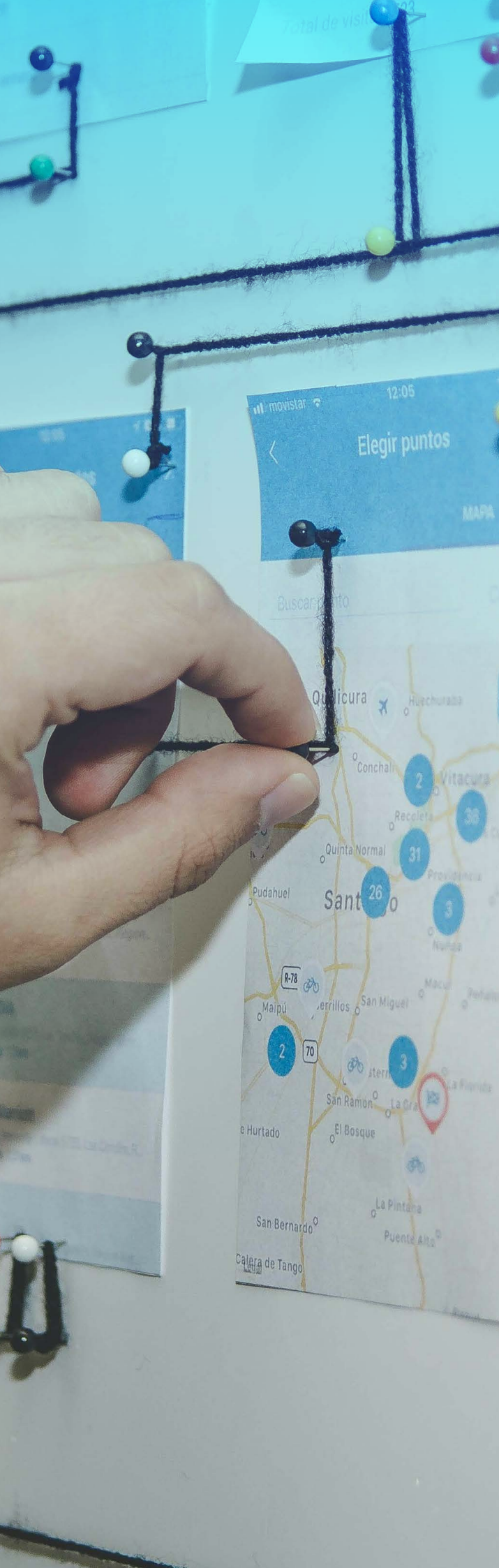
### Legend

 City-wide

 Neighborhood-level

 Site-specific

Figure 12. Urban Ecosystem Mapping overview.



## PHASE 1

### Building a Mapping Strategy

#### Why is it relevant?

Setting a vision and objective for Urban Ecosystems Mapping is the foundation for all subsequent mapping steps CENTRINNO pilots will take. Between CENTRINNO's nine pilot cities (i.e. Barcelona, Amsterdam, Paris, Milan, Geneva, Blönduós, Copenhagen, Tallinn & Zagreb ) missions, challenges and needs significantly differ. For Barcelona, for example, addressing the gentrification challenge may be a higher priority, while the rural community of Blönduós are faced with the opposite struggles to attract and keep young talent. One pilot might enter the Urban Ecosystems Mapping process with a clear idea which resources they want to identify in their urban ecosystems, while others start off with no more than a general sense of how, who and what they want to map. Thus, before diving into specific mapping methods and tedious data collection processes, it is worth starting to build a pilot-specific goal and vision: What information about our urban ecosystem do we hope to find throughout the mapping process? How can a local cartography of the urban ecosystem, and its resource assets help to achieve each pilots' local mission?

#### What will we do?

CENTRINNO's three pilot sprints each kick-off with a **mapping strategy workshop** that guides pilots, and local partners and initiatives in drafting their own comprehensive mapping strategy. Consequently, the second sprint workshop will occur to improve the previous strategy that each pilot has originally created in the first sprint.

An abbreviated version of the first mapping strategy workshop, occurring during M08 of the CENTRINNO project, is presented in Figure 13. During the first step of this workshop, pilots were asked to revisit their local challenges and missions in relation to the five key concepts of CENTRINNO: circular economy, heritage, vocational training, social inclusion, and fab city hubs. Some indicative questions that aid the discussion with pilots are listed in Figure 13. The remaining time of the workshop will be spent on scoping which mapping methods are most relevant to local needs and challenges.

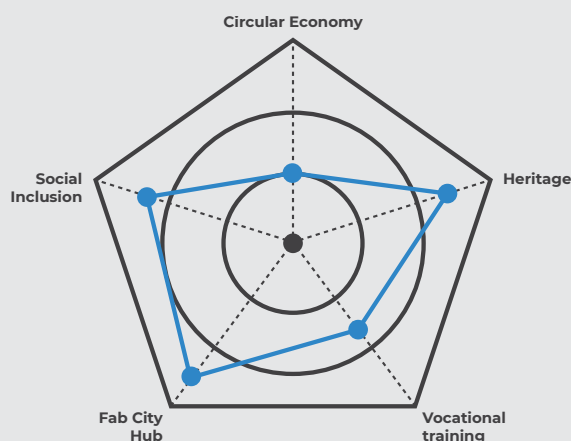
#### What are the outcomes?

At the end of the mapping strategy workshops, we have defined:

- ✓ A clear list of **geospatial context information** that describe the context of urban nature, urban communities, and urban industries
- ✓ A first set of **resource categories** potentially useful for pilots
- ✓ A defined **scope for the mapping process** that lays out how each method (presented in the next sections) will be used
- ✓ A **timeline** for the first mapping cycle

# TEMPLATE FOR BUILDING A MAPPING STRATEGY

## 1 Mission & Cartography Objectives



CENTRINNO pilots have each defined a spider-web diagram that visualizes pilot-specific focal points on the project's five key concepts. Urban resource mapping and a resulting cartography can help in each of the areas.

To kick-off the Urban Ecosystem Mapping process, we will build on each pilots' mission to scope out how a cartography can support their objectives.

### Defining challenges & mission of CENTRINNO pilots

#### Circular Economy Challenges & Mission

- Which circular economy/ ecological challenges exist in your community?
- Which information about your city's ecological context could help you to learn more about these challenges?
- Which circular economy mission does your pilot want to take on?
- How can a cartography of your urban ecosystem support you to achieve this mission?
- Which waste resources/ tools/ equipment/ infrastructure could help you achieve this mission?

#### Social Inclusion Challenges

- Which social/ socio-economic challenges exist in your community?
- Which information about your city's social context could help you to learn more about these challenges?
- Which social mission does your pilot want to take on?
- How can a cartography of your urban ecosystem support you to achieve your social mission?
- Which resources could help you achieve this mission?

#### Heritage Challenges

- Which cultural challenges you want to address?
- Which information about your city's cultural context could help you to learn more about these challenges?
- Which cultural/ heritage mission does your pilot want to take on?
- How can a cartography of your urban ecosystem support you to achieve your cultural mission?
- Which resources could help you achieve this mission?

#### Educational challenges

- Which educational challenges does your site/ community /district want to address?
- Which information about your city's educational context could help you to learn more about these challenges?
- Which educational mission does your pilot want to take on?
- How can a cartography of your urban ecosystem support you to achieve this mission?
- Which resources could help you achieve this mission?

#### Other challenges

- Which other challenges does your local community face that do not fit into these key themes?

## PHASE 1

## PHASE 2

## PHASE 3

## PHASE 4

## 2 Scoping exercise - What to map?

The CENTRINNO Urban Resource Mapping process starts with broad brainstorming workshop.

### Step 1

Brainstorm all statistics, parameters and geospatial data that could help you to understand the context of your city. Vote and rank for the ones that are most important.



### Urban Industries

**Geospatial context information**  
(statistics, parameters and land use)

**"Must have":** Current and former industrial land use zones

- e.g. abandoned infrastructure and brownfields;
- e.g. city-wide breakdown of manufacturing sectors;
- e.g. SME composition of neighbourhoods.



### Urban Communities & Culture

**Geospatial context information**  
(statistics, parameters and land use)

**"Must have":** employment & unemployment rate, population density

- e.g. educational background (level of education);
- e.g. social relation (trust level or community dependency);
- e.g. cultural or heritage areas.



### Urban Nature

**Geospatial context information**  
(statistics, parameters and land use)

**"Must have":** Green space distribution

- e.g. air quality;
- e.g. biodiversity;
- e.g. land use zones;
- e.g. community's small green spaces;
- e.g. forest cover;
- e.g. soil quality.

### Step 2

For each layer, brainstorm all resources you are aware of or you want to gain more information about. Use an extra sheet of paper to mind map freely before filling out resource cards about the most important resources.



### INDUSTRIAL RESOURCE CARD

Name:

Furniture waste

Stakeholders owning this resource

Local recycling stations

Do we have information/ data about this resource?

Contact name, address

Which mapping method can help?

Material Flow Analysis



### SOCIO-CULTURAL RESOURCE CARD

Name:

Digital weaving skills

Stakeholders owning this resource

Design Collaborative X

Do we have information/ data about this resource?

Contact name, address

Which mapping method can help?

Stakeholder Survey



### NATURAL RESOURCE CARD

Name:

Cultural heritage crops

Stakeholders owning this resource

Community gardens

Do we have information/ data about this resource?

Contact name, address

Which mapping method can help?

Stakeholder Survey





Figure 13. Building a mapping strategy.



## PHASE 2

### Applying mapping tools and methods

Four mapping methods and tools will form the core of CENTRINNO's Urban Ecosystem Mapping process:

	Geospatial context analysis 2.3.1
	Material flow analysis 2.3.2
	Stakeholder surveying 2.3.3
	Ethnographic mapping 2.3.4



#### METHOD 1

### Geospatial context analysis

Layer relevance



#### Why is it relevant?

Geospatial context analysis helps us to build knowledge on the diversity of neighbourhoods, community profiles, and living conditions existing within cities. Some neighbourhoods have a high level of industrial land, while others are dominated by retail and consumption spaces. Green infrastructure might be abundant in one area, and absent in another. A geospatial context analysis sheds light on how a (post-)industrial site or historical monument relates to the socio-economic, ecological, and cultural context of the city.

#### What will we do?





We will gather publicly available spatial data on population statistics, geodemographics, land uses, green space distribution, and other relevant geospatial parameters<sup>1</sup> for pilot sites and their surrounding areas. Results from the mapping strategy workshops (Phase 1) help us define the scope and scale of the geospatial context analysis.

#### What are the outcomes?

At the end of this second phase, we have:

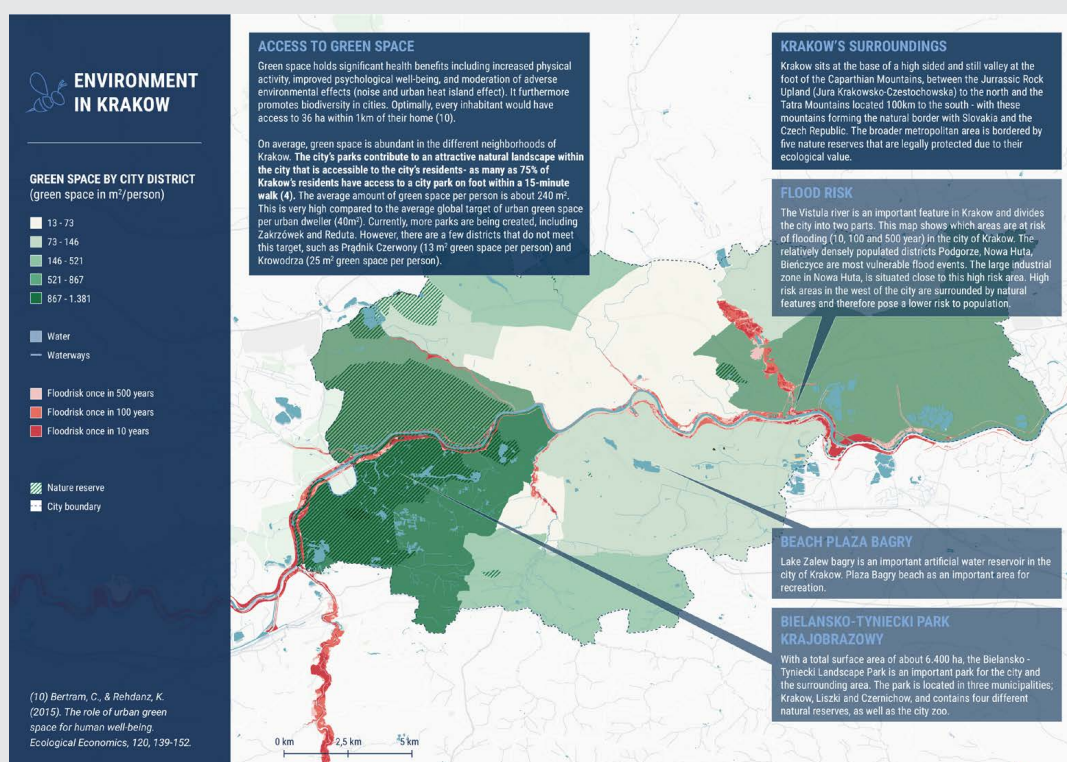
- ✓ A **set of maps** that present socio-economic and ecological characteristics of the city and how this relates to revitalization sites
- ✓ A first **inventorization of potential resources** (e.g. infrastructure, assets) around the project site
- ✓ An indication of **local challenges and opportunities** to work towards urban regeneration

<sup>1</sup> Other parameters could include employment rates, occupational profiles of a neighbourhood, soil pollution, air pollution, and housing prices.





PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

## Methods in action: Geospatial context analysis in CENTRINNO

In Barcelona's Poblenou district where gentrification is a major concern, analysing the geospatial context can help the pilot to visualize the development of housing prices over time. In Tallinn, where community-building and social inclusion is a highlighted mission, a geospatial context analysis could build out a detailed community profile of the formerly industrial neighbourhood Kopli to tailor outreach and communication to the local population. In Paris, where real estate development threatens urban food production a geospatial context analysis could map out hotspots where urban farms are most at risk to be lost to real estate markets. These are just a few of many scenarios how CENTRINNO pilots profit from analysing their geospatial context before diving into other mapping activities.



**Figure 14. Environmental context of Krakow** - this map was prepared for the *Circular Cities Poland* project by Metabolic. It shows the differences in green space access between Krakow's neighbourhoods and highlights areas under flood risk. Source: Metabolic, 2021.

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

## Action steps for performing a geospatial context analysis

### 1 Defining scope and scale

CENTRINNO pilots might choose a different set of geospatial data layers to analyse their local context: Paris' pilot may start out with an analysis of green areas in relation to housing prices within city boundaries, while the small town of Blönduós benefits from expanding their analysis to the whole region. To ensure a common baseline for geospatial context analyses across all pilots, Metabolic recommends a few "must-have" geospatial context information (Table 1) that describe the three mapping layers (urban nature, urban communities, & urban industries). Pilots are then encouraged to pick two or three additional indicators per layer to target the analysis on their local objectives (Table 2).

**Resources:** Overview table of geospatial layers ([Annex 2](#))

### 2 Assigning a "data champion"

It can be helpful to assign a so-called data champion<sup>2</sup> to the different datasets. These people are responsible for collecting the selected datasets, and are the primary point of contact for any questions that might arise.

### 3 Gathering public datasets

Once the relevant geospatial layers have been selected and data champions have been appointed, it is time to gather the data sources. Many geospatial datasets may be available to the public, and can be found on public databases.<sup>3</sup> While not often available at a high spatial resolution, European or global databases might also have datasets relevant to the urban context. Browsing through these portals is a good starting point to collect easy-to-reach data about cities and regions. The majority of geospatial information pilots will need for a high-level context analysis should all be accessible through open-source platforms, and it is highly recommended to start out with these easy-to-reach datasets.

### 4 Requesting additional (semi-public) data

Some data may be available on-demand by the municipality or private organizations but it is not readily publicly available. Which datasets may fall into this category will become apparent once pilot teams start to search public data portals. For the purpose of requesting this data, we have created a template, the CENTRINNO data request document. Assigned data champions within pilot teams can resort to this document to request additional information and spatial data from the municipality or other parties.<sup>4</sup>

**Resources:** Overview table of geospatial layers ([Annex 3](#))





### 5 Processing data and creating baseline maps for the CENTRINNO Cartography\*

Once all data is collected, it is time to process the data and bring it to life in the form of a map or digital cartography. One method to integrate various geospatial parameters describing an area or community is the "**Neighborhood Typology**" approach ([Annex 1](#)).

2. Data champions may be a person or organization who will be in charge and responsible to collect data required for the geospatial context analysis. Data champions should be knowledgeable on data collection and management, and have a good understanding of local databases or platforms. If pilot teams do not possess this expertise, it is recommended to reach out to local students or universities for support.

3. e.g. [OpenStreetMap](#), or a local municipal data portal.

4. Our CENTRINNO data request template ([Annex 3](#)) also contains a section to gather municipal data for conducting a Material Flow Analysis (Method 2). We bundled these two request templates to reduce the diversity of forms and data requests sent out to municipal authorities. Within CENTRINNO, the forms will be integrated into the project's Pilot Dashboards to further streamline data collection.

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

Each neighborhood has unique characteristics that can play an essential role in achieving a sustainable future. For example, we can design outer city neighborhoods to produce excess renewable energy for the entire city as production centers by building on their post-industrial nature, proximity to natural resources, and existing infrastructure. In contrast, neighborhoods in the dense city-center might consume more due to their higher densities and older building stock. However, their inner city location might continue to provide many of the cultural and commercial functions that are essential to any city. Each neighborhood can contribute to the city-wide ambitions in a different way.





Synthesizing different geospatial context maps helps us to evaluate the role that individual neighborhoods can play in the wider city. We can combine different spatial characteristics across the city and classify their values into different "neighborhood typologies". For example, we can use green space and population density data to classify which neighborhoods serve as "oases of green space and nature", and which neighborhoods can be characterized as "urban jungle". Which geospatial parameters are chosen for the creation of neighbourhood profiles is flexible, and depends on each pilot's specific mission.



**Figure 15. Neighbourhood profiles** - this figure shows an example of a basic neighbourhood typology based on population density, built form, unemployment rates and functional mixes. In this example, neighborhood A has a high population density and residential use, making it a suitable location for small repair hubs, close to residents. Neighborhood C, in contrast, has a low population density and extensive industry in the area, making it a potential suitable location for larger upcycling warehouses.



**Note:** Creating spatial maps with mapping software such as QGIS and ArcGIS requires some technical expertise. During the CENTRINNO project, the Metabolic Institute will support pilots in processing the gathered data into spatial maps. For urban changemakers that are interested in applying this methodology but do not have the necessary GIS knowledge available, it is recommended to find an organisation with this technical knowledge to aid in this methodology. A potential place to find this knowledge is by approaching local universities.

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

**Table 1** provides an overview of several “must-have” geospatial context layers that will be evaluated across all pilots in the CENTRINNO project. These layers provide a solid and coherent foundation for each pilot to build upon. **Table 2** presents a set of additional geospatial context layers for inspiration. Each pilot will choose which of these (or other) layers or most relevant to include in their cartography.

**Table 1. Highly recommended data layers needed for a geospatial context analysis**

CENTRINNO URBAN ECOSYSTEM LAYER	GEOSPATIAL CONTEXT INFORMATION	POTENTIAL SOURCE	ASSIGNED DATA CHAMPION
Urban Communities	Population density, employment	Municipality's own datasets	
Urban Nature	Land use (e.g. built environment, grassland, forest)	Open Street Map	
Urban Industries	Infrastructure (e.g. waste treatment plants, industrial zones)	OpenStreetMap/ Google Maps API	

**Table 2. Additional data layers of geospatial context information**

CENTRINNO URBAN ECOSYSTEM LAYER	GEOSPATIAL CONTEXT INFORMATION	POTENTIAL SOURCE
Urban Communities	Population density	Municipality/publicly available (Wikipedia)
	Average median income	Municipality/National database
	Age distribution	Municipality / National database
	Employment rate	Municipality
	Land ownership (e.g. public area, private area)	Municipality
	Vacant lots	Municipality (land and building registry)
	Total employment in different sectors	Municipality
	Housing prices	Municipality/local real estate data platforms
Urban Nature	Air quality & Air pollution (PM2.5, PM10, NOx)	<a href="#">European Environmental Agency</a>
	Soil pollution (e.g. hydrocarbons and heavy metals)	Municipality
	Water quality	Municipality
Urban Industries	Building density	OpenStreetMap
	Local services and companies	Open Street Map/ Google Maps API
	Waste density	Municipality



## PHASE 2



### METHOD 2

## Material flow analysis

### Mapping the flow of waste streams through the city

#### Layer relevance



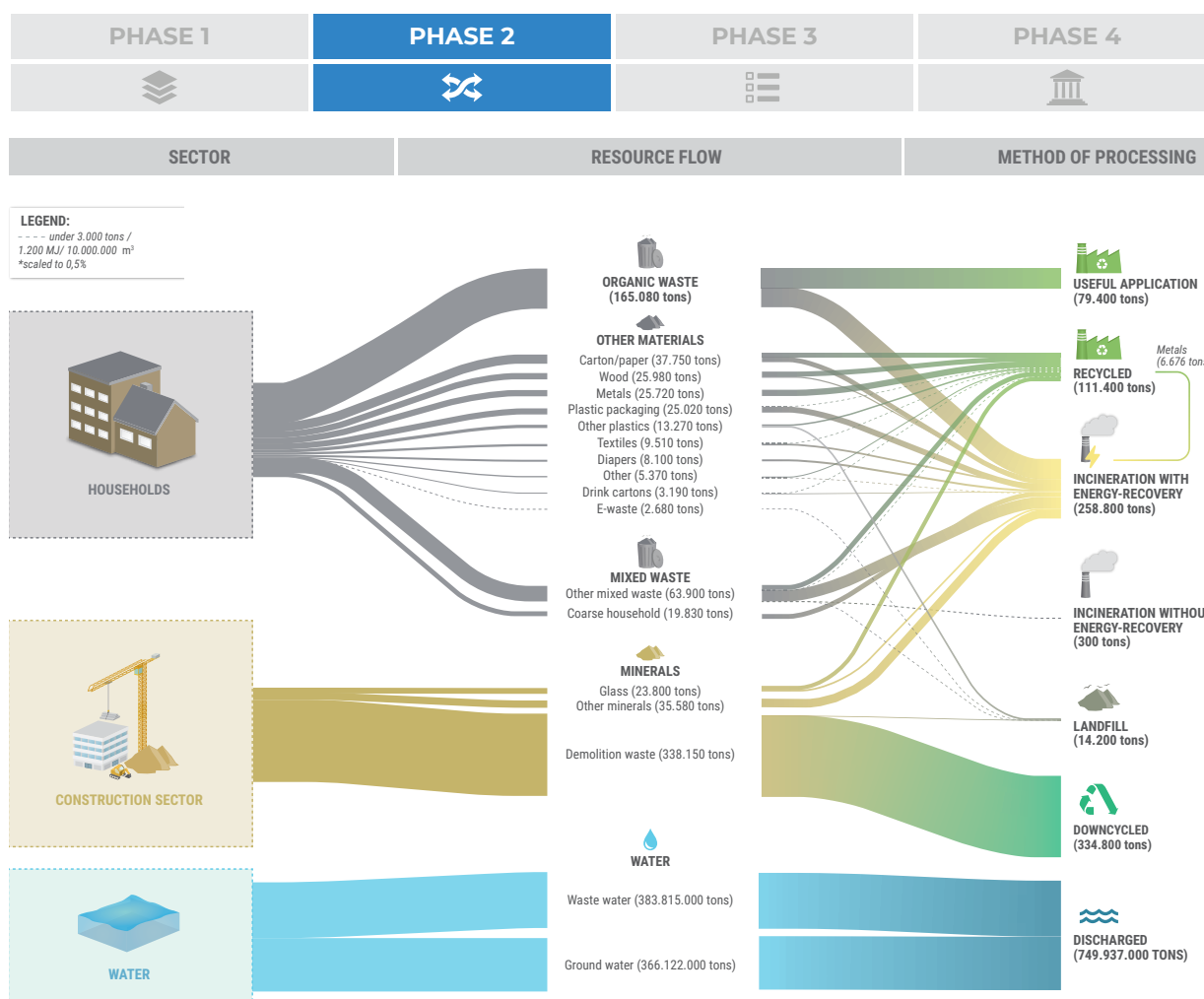
After gaining a good understanding of a site's geospatial context, we can start to apply tools and methods that identify resources that circulate within a city. Since our definition of "resources" is deliberately left broad, no one method is able to cover the diversity of tangible resources (e.g. waste streams, biological resources, physical infrastructure) and intangible resources (e.g. skills and knowledge to operate tools). The material flow analysis (MFA), presented in this section, is a method that systematically helps us to create insight in how physical resources (e.g. waste streams, energy, water, or biomaterials) are used in a city. It is particularly useful to map high-level waste and material streams, and to gain a first overview on hotspots of waste generating industries or districts. Additionally, the stakeholder survey is more suitable to map intangible resources.

#### Why is it relevant?

In recent decades, a growing pressure on natural resources has sparked an awareness and necessity to alter the way we produce, use and consume materials. As hotspots of material consumption and waste generation, cities carry a key responsibility to enable more efficient and sustainable use of resources. Cities consume around two thirds of global resources and emit between 50% and 80% of global emissions (Lucertini & Musco, 2020). Urban metabolism (UM) studies are the predominant way we attempt to understand resource processes in the urban context. The MFA is the most common method applied in UM research that quantifies the resources entering and leaving a predefined space and time (Brunner & Rechberger, 2004). In CENTRINNO, it will allow pilots to identify leverage points for changing predominantly linear production and consumption systems related to their specific focus sectors and industries.

#### What will we do?




During this phase, pilots will be supported to perform a material flow analysis of waste streams that circulate through the city on a yearly basis. For the purposes of CENTRINNO, the focus for the MFAs will be placed on the output of materials from urban activities, while less importance is given to the inflow of products and goods. The advantage of conducting a waste-based MFA for CENTRINNO is twofold. First, information about waste resources is seen as more relevant to help pilots generate new industrial and manufacturing value chains for the circular economy. Second, waste-based MFAs will allow us to attribute a spatial element to waste flows: We will do this by explicitly mapping the waste management facilities that have been identified during the research and data collection on municipal waste systems.



**Figure 16. Waste-specific MFA at a city-scale** - this sankey diagram shows the volumes and types of waste leaving the city of Rotterdam. To interpret a sankey diagram, we follow the lines from left (waste generators) to right (destination of waste flows). The thickness of lines represents the volume of a material flows, allowing us to easily spot the largest waste streams per waste generator. Source: Metabolic, 2018.

**Table 3. Types of data required for conducting a waste-based MFA**

WASTE FLOWS		COLLECTION		EOL	
Type (ton)	Data	Method	Data	Method	Data
Mixed waste	• Total volume (ton)	Municipal residual waste collection	• Contract holders for municipal waste management (name, address)	Recycling	• Location of waste management facilities (spatial)
Organic waste	• Collections bins (spatial)	Municipal recycling schemes	• List of private waste schemes for businesses (name, address)	Incineration	• Amount and type of waste handled at each facility (tons)
Paper & cardboard	• Major waste generator addresses	Drop-off		Landfill	
Plastics		Onsite waste management		Composting	
Textiles		Private recycling providers		Reuse	
Metals		Private haulers			
Glass					
Electronics					

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

### What are the outcomes?

By performing a material flow analysis, we gather the following insights:

- ✓ A description of the large waste flows in the city (e.g. a flow of municipal waste, organic waste, textile waste, etc.)
- ✓ An understanding of the quantity of the studied resource flows (e.g. the number of products, the volume of water, or the weight of materials)
- ✓ A specification of the location and contact data of key waste handling facilities (e.g. recycling facilities, landfills, or sorting stations) that process the existing urban waste

These results are usually represented in a Sankey Diagram (see Figure 16) which is a graphical and accessible image to understand how different quantities of resources are used by different actors in the urban environment.



**Note:** Conducting a material flow analysis requires significant data processing skills. During the CENTRINNO project, the Metabolic Institute will support pilots in processing the gathered data into visual sankey diagrams. For urban changemakers that are interested in applying this methodology but do not have the necessary knowledge available, it is recommended to find an organization with this technical knowledge to aid in this methodology. A potential place to find this knowledge is by approaching local universities or local organizations with experience in this type of calculations.

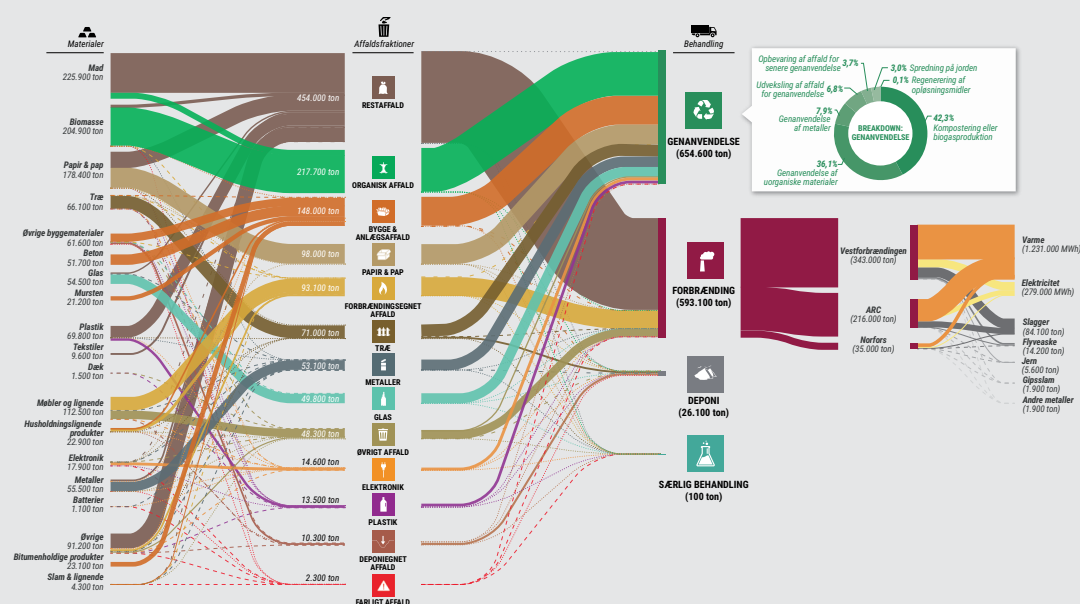
PHASE 1	PHASE 2	PHASE 3	PHASE 4

## Methods in action:




### Material flow analysis in CENTRINNO

Located in a small town at the Icelandic rural northwestern coast, the CENTRINNO pilot in Blönduós seeks for new solutions to use wool resources sustainably. A regional MFA of wool and textiles can help Blönduós to quantify how wool is produced, processed and wasted from production to waste treatment. By identifying the hotspots of waste and environmental impact in the textile value chain, an MFA can support the small town to develop strategic plans for sustainably using Icelandic wool.

For Copenhagen, the scope and focus of an MFA may look differently. Instead of mapping material flows through an entire region, the Copenhagen pilot may use an MFA to highlight local waste resources within the neighbourhood of Nordvest. With the goal to spur resource sharing between local creative and productive industries, a neighbourhood-level MFA in Nordvest highlights the types of waste streams, such as wood scraps, textiles, paper, or organic waste, collected within the neighbourhood.



**Figure 17. MFA of households waste streams in the Capital Region of Denmark.** Based on regional waste data. Source: Metabolic, 2020.

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

## Action steps for conducting a material flow analysis

To perform an MFA, pilots will build on the scope and objectives that were identified during Phase 1 (Building a mapping strategy). The following steps provide an action plan for gathering data. This research method benefits strongly from having a partner with experience in data collection and processing during the CENTRINNO process, the Metabolic Institute will support pilots in collecting the relevant datasets and processing this data into a sankey diagram.

### 1 Scoping the MFA

Each MFA starts with setting the scope for analysing material flows. Defining the scope, or the boundaries of the system, means that pilots will narrow down (1) the type of material streams, (2) the geographic area, and (3) the time dimension for their MFA.

#### What type of resource flows that I want to gain insight on?

While some pilots may choose to focus the MFA on one specific material with a higher granularity (such as wool or wood), others will analyse high-level waste streams across various categories (such as mixed waste, organic waste, paper waste, plastic waste, etc.).

#### What are the geographical boundaries of the system?

An MFA requires a clear delineation of the geographical boundaries in which we are mapping resource flows. Examples of geographical scopes are neighborhood administrative boundaries, municipal city boundaries, and provincial boundaries. It is important to align the geographical scope with the (expected) available data sources. If most information about resource flows is collected at the level of the municipality, it is helpful to choose the municipal boundaries of the city as the geographical scope for the urban MFA.

#### What is the time dimension that I am mapping for?

Most commonly, MFAs represent the flows that go through a system throughout a single year. Unless there is an explicit reason to choose a different time frame, this time dimension will be suitable for most MFAs.

### 2 Collecting data

Next, the relevant data can be collected to map out the resource flows. For each of the flows in the scope, the following information should be gathered:

- **How much and where is a waste flow generated?**
- **In what form does the waste flow leave the system?**
- **What treatment does a waste flow receive?**

In the EU, part of the required information is often publicly available through statistical portals of the municipality. For information that is not publicly available, municipal departments often have additional data available. [Annex 3](#) provides a **data request template** that can be copied and adjusted to fit the scope that was previously defined during action step 1 "Scoping the MFA".

### 3 Composing the MFA

Once all data is gathered, a series of calculations can be performed to assure that the gathered data matches the scope of the desired MFA. This can sometimes mean that data needs to be scaled-down (e.g. national data might need to be scaled down to the level of a municipality), or scaled-up (e.g. data about the consumption patterns of individuals can be scaled up to provide insight at the level of the municipality). In addition, it is important to evaluate the MFA with local experts to assure an accurate interpretation and representation of the data. Throughout the CENTRINNO process, Metabolic Institute will process the gathered data and turn them into graphic sankeys in collaboration with in-house graphic designers.



## PHASE 2



### METHOD 3

## Stakeholder surveying

Identifying urban actors that possess physical and intangible resources

### Layer relevance



### Why is it relevant?

In the section above, we have described how a material flow analysis can generate initial high-level insights into local material and waste streams. Yet, to get a more nuanced and granular map of a city's or a community's resources, we need to identify specific organizations, stakeholders and individuals that control physical and intangible resources. The **stakeholder survey** can effectively fill this gap. It is designed to collect complementary information on specific waste materials, tools, production capacity, knowledge and human resources from relevant stakeholder groups. Depending on the local context, stakeholder surveys can be sent out to local schools, universities, SMEs, neighbourhood organisations, and individuals to take stock of what they have to offer. It can map the type and overall volume of food waste from local restaurants, supermarkets, or hotels that could be available for community composting; how much wood waste a local miller can share with craftsmen; or which manufacturers can offer processing capacity for textiles. Since surveys are flexible and open in their questions, it is important to be specific about the type of data that should be collected, and which stakeholder groups the survey should be sent out to.

### What will we do?

During the CENTRINNO project, pilot research teams are designing a survey for inventorying local resources by building on the template provided in [Annex 4](#). This template draws on other community asset mapping toolkits and processes, such as the [Community Resource Mapping Toolkit](#) from the University of Minnesota, the [Participatory Asset Mapping Toolkit](#), and the [MakeWorks](#) survey to map local manufacturers. Pilots choosing to use the survey as a main tool for mapping will co-create an adjusted and expanded version with support from Metabolic Institute.

### What are the outcomes?

At the end of the stakeholder surveying process, we have:

- ✓ A list of specific local waste materials that could be treated locally
- ✓ A list of local actors (e.g. companies, social initiatives, municipal services) which have access or provide resources, knowledge, tools or skills
- ✓ An increased understanding of where and how resources circulate through the neighborhood, in space (e.g. used infrastructure) and time.

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

## Action steps for surveying stakeholders

### 1 Scoping the target audience

Depending on pilots' objectives for resource mapping, priorities, and previous mapping progress, there are several potential pathways on how to integrate a stakeholder survey into CENTRINNO pilots' mapping timeline.

#### Pathway 1

##### Survey existing networks and partners

The first option is to use the survey as a first tool to inventory resources (materials, technology, infrastructure, knowledge or values) present within **known partnering or supporting organizations**. An advantage of surveying organizations that are already part of CENTRINNO pilots' networks is that it is a simple starting point to test-run the questions and refine the survey before reaching out to unknown organizations. Tapping into existing networks and close partnerships also improves the response rate and increases the likelihood of organizations to actively engage in the CENTRINNO activities in the future.

#### Pathway 2

##### Build on the results from the MFA , geospatial analysis or ethnographic mapping to survey key respondents

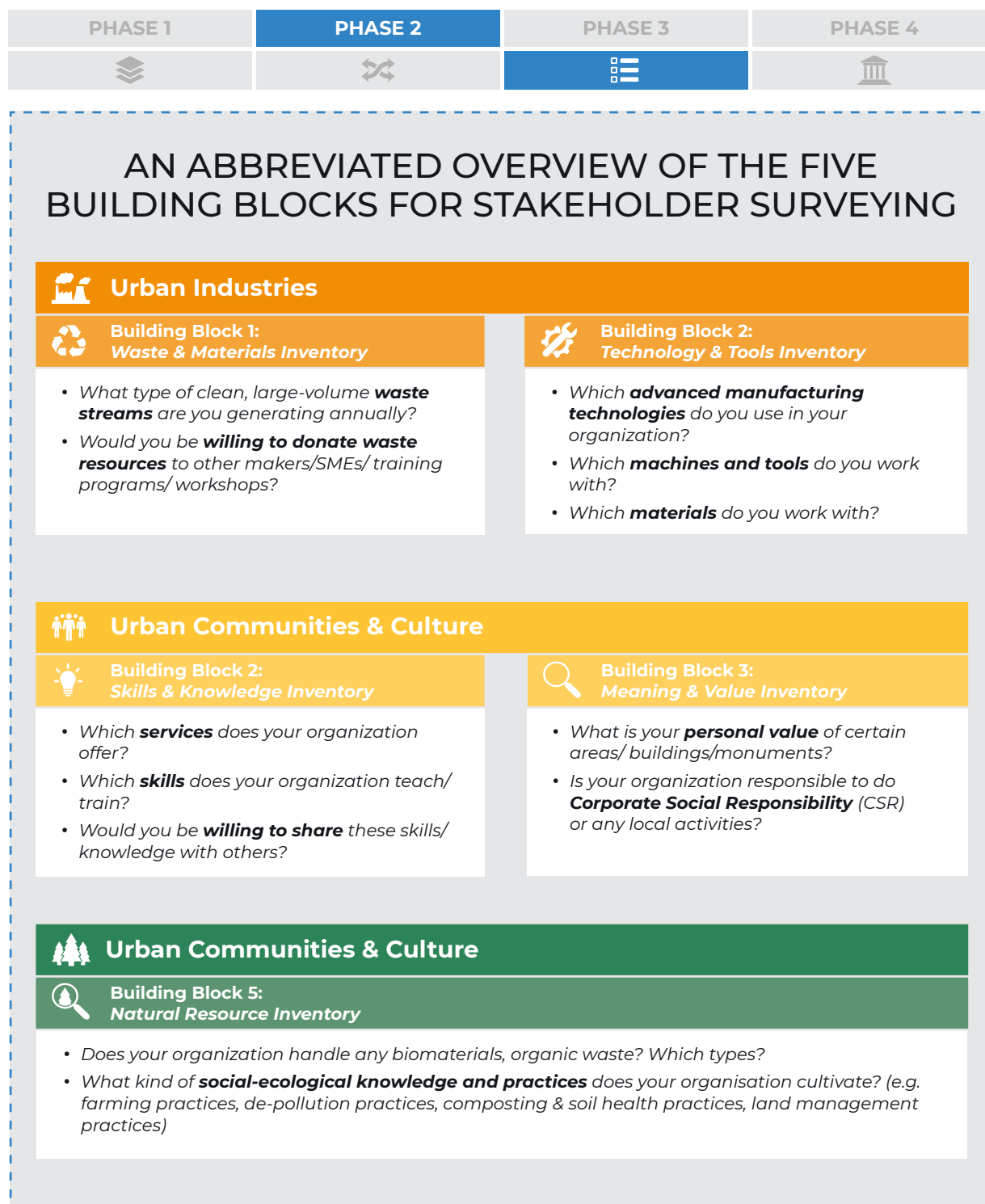
Secondly, a stakeholder survey can serve as an additional tool to fill gaps and follow up on potential resources that emerged from any of the previously described methods. For example, a municipal MFA may have identified large-volume waste streams attributable to a specific sector or industry, without providing detail on the exact composition and character of the waste. In this case, a targeted stakeholder survey reaching out to key facilities or institutions may help to get a more nuanced understanding of waste resources.

Apart from gathering complementary information on waste flows, pilots can also use the stakeholder survey to gather information on socio-cultural resources, such as skills, knowledge and practices present in local communities. Ideally, the geospatial context analysis described on [page 31](#) has provided pilots with a high-level overview of the socio-cultural and economic profile that exist within local communities.

### 2 Survey Design

To support CENTRINNO pilots in drafting a stakeholder survey, Metabolic Institute developed a flexible and adjustable template with a set of suggested questions ([Annex 4](#)). The survey template is structured in several "building blocks". These building blocks each take stock of different resource categories associated with the three layers of the CENTRINNO Urban Ecosystem Mapping Framework (see Part A of this guidebook).

The following graphic (Figure 18) provides an overview of the five building blocks with a selection of key questions.



**Figure 18.** Five building blocks for stakeholder surveying.

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## Designing stakeholder surveys



### Be clear about what type of resources you are most interested in

- Are you interested in a **specific waste stream** (e.g. coffee grounds) or do you just want a **general overview** of different waste/ resource types?
- How important are **exact quantities** and the **frequency** of waste generation over the course of a year? If you just want to get a sense of potential resources available, it may not be necessary to ask for detailed amounts.
- Use the **five building blocks** to help you draft questions tailored to inventorying urban resources in urban industries, communities and nature.



### Be clear about how you hope to use resources, skills or technology from organizations you are surveying

- Do you want to use waste streams for **making new products**? If yes, make sure to ask if the business/ SME or industrial manufacturer is willing to donate materials and discuss potential logistical agreements for storing and collecting useful waste streams.
- Do you want to find potential manufacturing capacity for local makers? If yes, start off with a **list of technologies, tools or machinery** that your focus sector may need.
- Do you want to identify traditional craftsmanship skills or knowledge that a stakeholder could teach in training sessions?
- Are you more interested in crowdsourcing data on the more intangible community assets, such as values and attitudes connected to a (post-)industrial site, a heritage item, or a specific element of your urban ecosystem? Consider creating a **map-based survey** (with platforms like [maptionnaire](#)) to crowdsource data from individuals.



### Be sure to include a section on data protection and privacy

- To comply with the **EU General Data Protection Regulation** (EU GDPR) and provide adequate protection of private data, it is very important to ensure the survey includes fulfills all of the criteria stated in [the EU GDPR checklist](#)<sup>5</sup> and discloses how data is used and processed.



### Get your questions validated

- Identify one organization from each stakeholder group that can **validate and test run the survey** before sending it out to your wider target audience.

5. Data collection, processing and storage will be aligned with the EU General Data Protection Regulation.

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

### 3 Outreach & data collection

Depending on the target audience and pilots' objectives for this survey, there are several options on how to disseminate it.

- **Wider Audience:** Use social media and email lists from public business registries to spread the online survey amongst a wide audience of local businesses, industrial players, community organizations and individuals.
- **Local Municipality:** Work directly with the local municipality and ask for a list of key organizations in your target sector (e.g. wood-working industries).
- **Leverage Existing Networks:** Make use of other planned networking activities and public events (e.g. through the CENTRINNO Network) to disseminate the survey with event participants.

### 4 Analysis and preparation of data

Lastly, collected inventories from stakeholder surveying need to be analysed and prepared to be integrated into the CENTRINNO Cartography. What this Cartography will look like will manifest itself over time. A few questions can help us structure and categorize the gathered data:

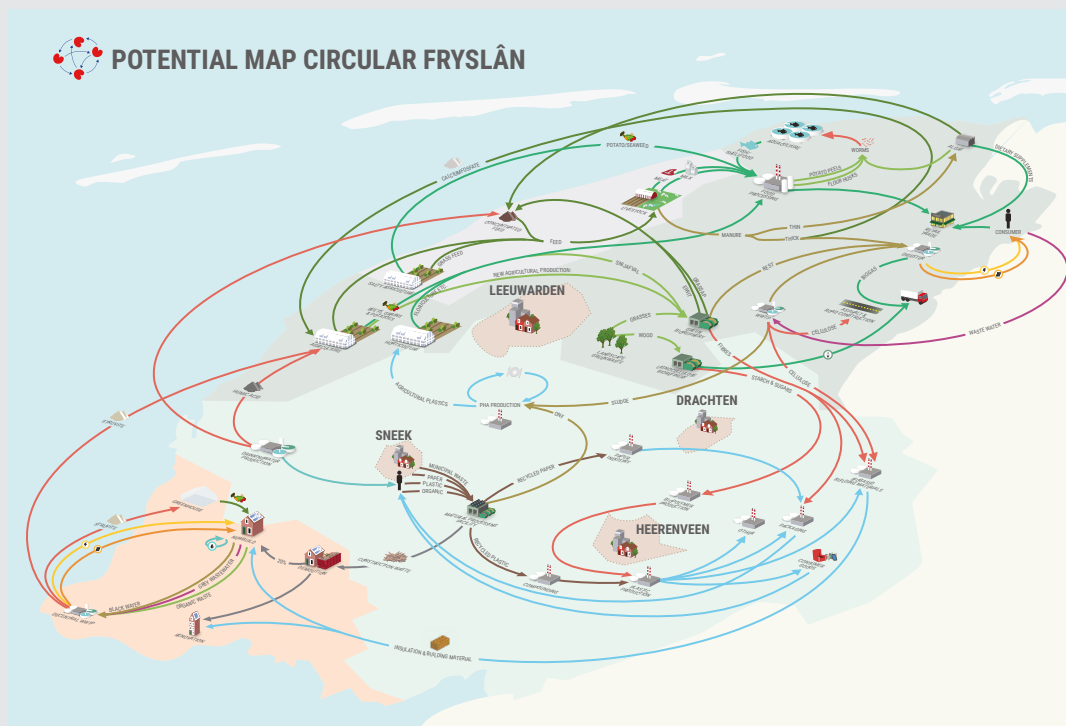
- Which information from the surveys aligns with the pilot's goals and should be included in the CENTRINNO Cartography? Should it be possible to see resources of individual organizations or overall resources available in a neighbourhood?<sup>6</sup>
- How to categorize different types of resources? It may be necessary to establish a harmonized typology of resources for the Cartography that reflects the objectives you have previously identified.
- Review and adjust your questions: During and after analysing the collected information, the questions should be critically examined. Was there confusion about specific questions? Any areas that were left blank repeatedly? Is it necessary to revise and improve the survey iteratively before starting a second round of outreach? If yes, how do we avoid operability issues between the different versions of the questionnaire?

6. During the CENTRINNO project, pilots will co-design the CENTRINNO Cartography. Which information about local organizations and their resources is included in the final CENTRINNO Cartography will be scoped out during a range of workshop sessions, starting in M08. See "Phase 3 - Building a Cartography" for more information.

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

## Methods in action: Stakeholder surveys in CENTRINNO

The CENTRINNO project emphasizes the engagement of community-based organizations, small and medium-scale enterprises, vocational training institutions and local makers in urban regeneration strategies. Stakeholder surveying can give each CENTRINNO Fab City Hub insights into the community assets and resources that local stakeholder groups hold. Interested in the intangible heritage embedded in local craftsmanship, the Amsterdam pilot can tailor a stakeholder survey that takes inventory of the expertise and skills that local organizations bring with them. Paris, characterized by a thriving urban farming scene, can create a survey to map heritage crops, old agricultural practices or traditional recipes across the city's community gardens and farms. For Milan, the stakeholder survey can become a bottom-up tool to inventory locally available waste streams and map out opportunities for neighbourhood-scale material and resources exchanges between organizations.



**Figure 19. Stakeholders and their resource exchanges** - this map shows connections between different stakeholders in Friesland. It was created through stakeholder interviews as a complementary approach to a metabolism analysis. Source: Metabolic, 2015.



## PHASE 2



### METHOD 4

## Ethnographic Mapping

Ethnography tools to engage with the dynamics of culture, heritage & values

### Layer relevance



### Why is it relevant?

Top-down mapping of municipal cultural monuments and heritage sites, such as historic buildings, natural or industrial heritage would fail to encompass this diversity of meanings and interests that an individual or community attributes to these items. What is labelled as a “heritage asset” or “cultural resource” for one person might not be shared throughout all individuals or groups of people. Engaging with the dynamics of culture, heritage and values is therefore a critical part of the CENTRINNO Urban Ecosystem Mapping process.

### What will we do?

In the course of CENTRINNO, pilots will go on a three-stage ethnographic journey that identifies local attitudes towards tangible and intangible heritage items (Table 4).<sup>7</sup> How each of these stages of ethnographic mapping are realized in each of the nine pilot sites will be scoped out during two “coaching sessions”, guided by ethnography experts from Reinwardt Academy and Imagine IC.<sup>8</sup>





### What are the outcomes?

At the end of this phase, pilots will have:

- ✓ A better understanding of the location of local heritage items, and of the diversity of perspectives that surround them.
- ✓ An opportunity to integrate potential stories and anecdotes on local heritage items as “meta-data” into the cartography.

7. Tangible heritage is a term used for physical sites, buildings, or artefacts appointed by certain groups or individuals in reference to the past as important to safeguard for the future. Likewise, intangible heritage refers e.g. to traditions, crafts, rituals, practices, memories, and stories considered worth fostering.





8. [Reinwardt Academy](#) and [Imagine IC](#) will facilitate these one-to-one sessions with pilot teams.

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**Table 4. Stages of CENTRINNO Ethnography**

STAGE	APPROACH	CORE OBJECTIVE	MAPPING POSSIBILITIES
1 - Explore the area	Ethnographic fieldwork	To gather ideas about items of (prospective) heritage on and around the area surrounding (post-)industrial sites by walking around, sensing, observing, and recording.	Walking routes and noted observations (lines and pins).
2 - Dig for meaning	Emotion networking (EN)	To uncover people's dynamic positionality in relation to selected (prospective) heritage items through a moderated conversation and listening exercise in which participants take and (may) change their emotionally set positions vis-a-vis the selected item.	Location of an item (pin), where possible.  Location information about the participants (pin), where permitted, pseudonymised. <sup>9</sup>
3 - Show what is hidden	Engaged curation	To collect and share negated, troubled and/or forgotten stories harnessing multiple forms of knowledge and traditions that inspire (culturally and practically) the regeneration process of sites.	Locations mentioned in the stories, including narrators (connected pins, network).

9. Data collection and processing will be aligned with EU General Data Protection Regulation.

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

## Action steps for ethnographic mapping

### 1 Explore the area with ethnographic fieldwork

Ethnographic fieldwork is a way for initiatives engaged in regeneration projects to gain a deep sense of what is occurring around a site, building or street. Compared to the city-wide resource mapping methods presented before, ethnological site explorations are suitable to zoom into the socio-cultural context at a micro-scale. For CENTRINNO pilots, this micro-scale could be delineated by the street or neighbourhood where (post-)industrial regeneration activities are occurring, or where building reuse projects are planned.

Similar to how ethnographers or anthropologists, or even archeologists and historians, would conduct field research, it is important to take time for intensive and ongoing immersion through physical presence and participation in day-to-day life, experiencing and recording what is going on (Schmidt-Lauber, 2012). Nose around, talk to people, go out for observational walks, make mental maps, use all your senses while doing site research.

As a result of this fieldwork, pilots can identify which tangible and intangible (prospective) items of heritage could be selected to 'dig deeper' into stage 2. Moreover, this fieldwork itself can be represented as geospatial information: Where did the walk take place? Where were specific notions sensed and recorded? Specific templates for the documentation of the fieldwork will be developed in collaboration with the pilots. The documentation may include texts, visuals, and sound recordings.<sup>10</sup>



**Figure 20.** Ethnographic walks in and around car park Kempering - As part of an event titled "Negotiating Heritage in emotion networks", residents and non residents engaged with each other's contrasting feelings towards the planned demolition of a parking garage in Bijlmer, Amsterdam South East. Source: Imagine IC.

### 2 Dig for meaning with emotion networking





Based on the exploration of the site, one item (e.g. a building or a social practice) may be selected for collaborative research in an emotion networking (EN) session. More sessions can be organised if more such items are to be subjected to this collaborative research method.

EN has been developed as a tool to help people to understand and approach the act of labeling things as "heritage" as a cultural practice. Heritage - an item of heritage - is the preliminary result of a complicated process of negotiation, appreciation and selection, which involves power relations and many other factors, including some very practical ones.

Taking place in a moderated conversation, stakeholders are invited to reflect on their own feelings in relation to a (possible) item of heritage, such as a tradition, a monument or a museum object. During conversation, a range of information may emerge, including beliefs, pain, attitudes, and values.

While these results cannot always be straightforwardly mapped onto a spatial cartography, the process itself is important to ensure the development of inclusive urban regeneration projects that deal with heritage. One important aspect to take into account here is that session participants could object against the publishing of their attitudes or feelings in relation to a site. It is, however, possible to highlight those heritage items or cultural sites that have become

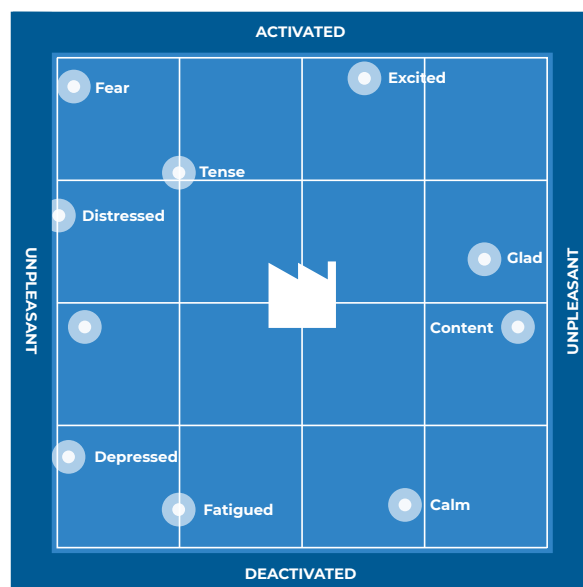
10. As an example and further background on walking seminars are found in (Shepherd et al., 2018) <https://www.reinwardt.ahk.nl/lectoraat-cultureel-erfgoed/publicaties/publicatie/the-walking-seminar-embodied-research-in-emergent-anthropocene-landscapes/>

PHASE 1	PHASE 2	PHASE 3	PHASE 4
			

an object of EN to visualize potential (and potentially shifting) interests and attitudes from before and after the networking sessions. How and if such visualization of EN results can be openly published is an option which needs to be discussed with each pilot and each participant group individually.

The method also lends itself very well to conduct stakeholder mapping, as it helps to identify where friction emerges, as well as being open to inviting participants to invite “missing” stakeholders: to build an inclusive process. To ensure bottom-up and democratic work, a process of EN has to allow participants to identify more participants and stakeholders - in the interest of identifying, understanding and visualising as complete a network as possible, as well as to be sure that inclusivity of voices is ensured.

Detailed workshop implementation plans and facilitator guides to run a EN Session can be found in the [Annex 5](#), which provides clear step-by-step information on how to conduct EN sessions, including guidance on facilitation (who facilitates, what role does that person have and how can conflict be handled constructively). In CENTRINNO, this workshop is meant to take place in the first of three pilot sprints, but depending on the need of the pilot it can be done in the 2nd or 3rd pilots as well.



**Figure 21. Facilitated emotion networking workshop.** During a facilitated EN workshop, pilots will map out the diverse feelings and attitudes towards a selected heritage site, and visualise and discuss how positions may shift in interaction. Source: Reinwardt Academy (AHK).

### 3 Show what is hidden with engaged curation

The EN sessions provide many leads and insights into the values, attitudes and dispositions people hold toward (prospective) heritage items in and around the (post-)industrial site. In the CENTRINNO Living Archive<sup>11</sup>, these are collected in the form of stories. Depending on the creative storytelling method and overall curation objectives (e.g. to show a decolonial narrative of the industrial site), such stories can be generated through field interviews, oral history projects, creative writing, photography series or other crossmedia forms. Geospatial information included in these stories, such as places referred to by the narrator, can be included in the Cartography including direct hyperlinks to the contents of the Living Archive.

In addition to this three-stage process, it is important to create space in the process for inclusive participation and reflection. Note that EN is a collaborative exercise, in which different stakeholders first map individually their own position and then reflect in the same session with the other stakeholders the result of this mapping exercise from a metaperspective. As such, it can be considered as a tool for network building through collaborative research (Dibbitts, 2020a; Dibbitts, 2020b).

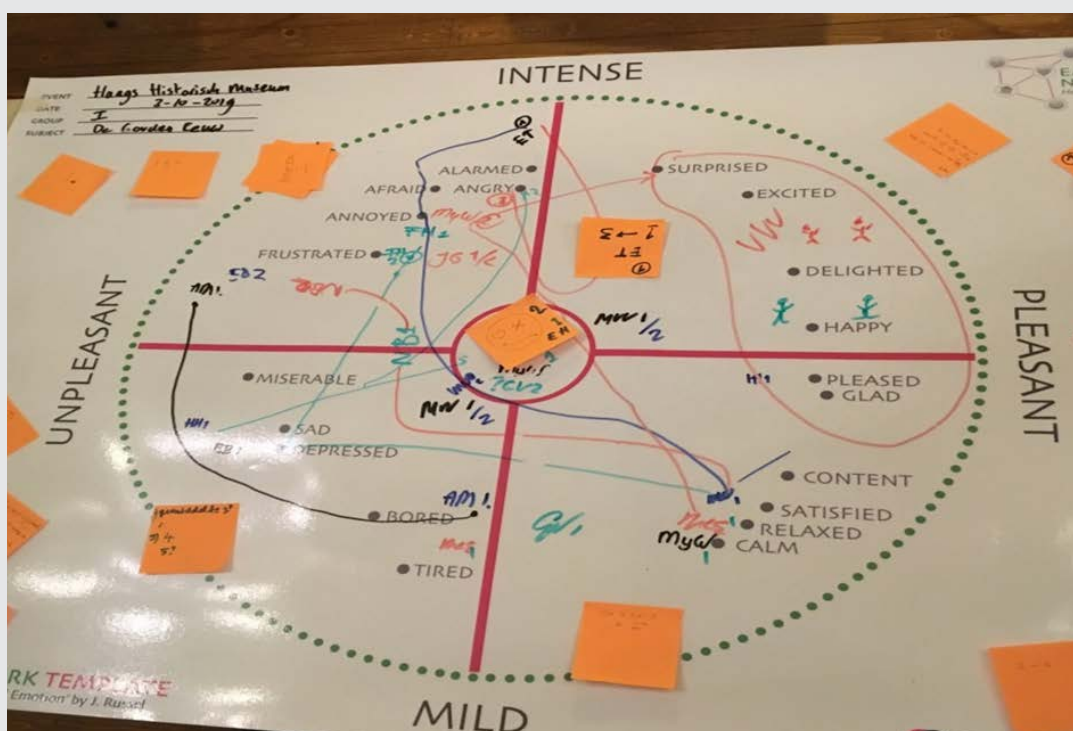
11. The CENTRINNO Living Archive is a publicly accessible multimedia, multilingual website with audio-visual information on the history, present and future of the CENTRINNO sites. It includes both good and painful memories, experiences, usages, and traces. It shows the richness of old industrial sites and living cultures then and now. Key purpose is to become a source from which new industrial configurations can be imagined which lead to circular and commons-based production ecosystems. The first iteration of this platform (D2.3, M17) will be accompanied by a report explaining the concept and timeline for building out the Living Archive.

PHASE 1	PHASE 2	PHASE 3	PHASE 4


## Methods in action

### Emotion networking in CENTRINNO

CENTRINNO hubs are anchored in areas with a rich industrial past - a past that may carry a different meaning to people. Through emotion networking (EN), local meanings and significance can be uncovered to both inform what the future of the site should look like, and we can make sure that these elements remain a part of the site's identity. For example, an EN exercise could be performed at the former shipping yards in Amsterdam. By using multimedia tools (like photos, notes, or Google maps), participants can record a range of observations. One may note the smell of polluted former buildings, while somebody else will marvel at the view of the water. Perhaps value is found in maintaining an open view onto the old shipyards and its buildings that remain from the time it was still in use, but is now in ruins. In Zagreb, an EN exercise might bring up stories about the people that used to work at the old meat factory. Inviting people that used to work at the old factory to participate in reflective interviews, oral history approaches or other storytelling methods, might allow pilots to share the perspective and history of the old factory.



**Figure 22.** Emotion networking with the local community. Source: Reinwardt Academy (AHK).



“Cartography is the  
art, science and  
technology of making  
and using maps”

International Cartographic Association

## PHASE 3

### Building a cartography

The CENTRINNO Cartography is the map-based platform hosted on the project's website that visualizes the urban ecosystems and local resources of CENTRINNO's nine pilot cities. While the details of developing and co-creating this platform are beyond the scope of this guidebook, it is worth outlining the basic idea and process behind the Cartography to illustrate one of the key outcomes of mapping.

#### What will the CENTRINNO Cartography look like?

In its simplest form, the CENTRINNO Cartography can be a **static map** that communicates geospatial information identified through the Urban Ecosystems Mapping process. As an example, Figure 23 shows a waste map of Lublin, including neighbourhood-level waste generation densities and key waste-producing industries.

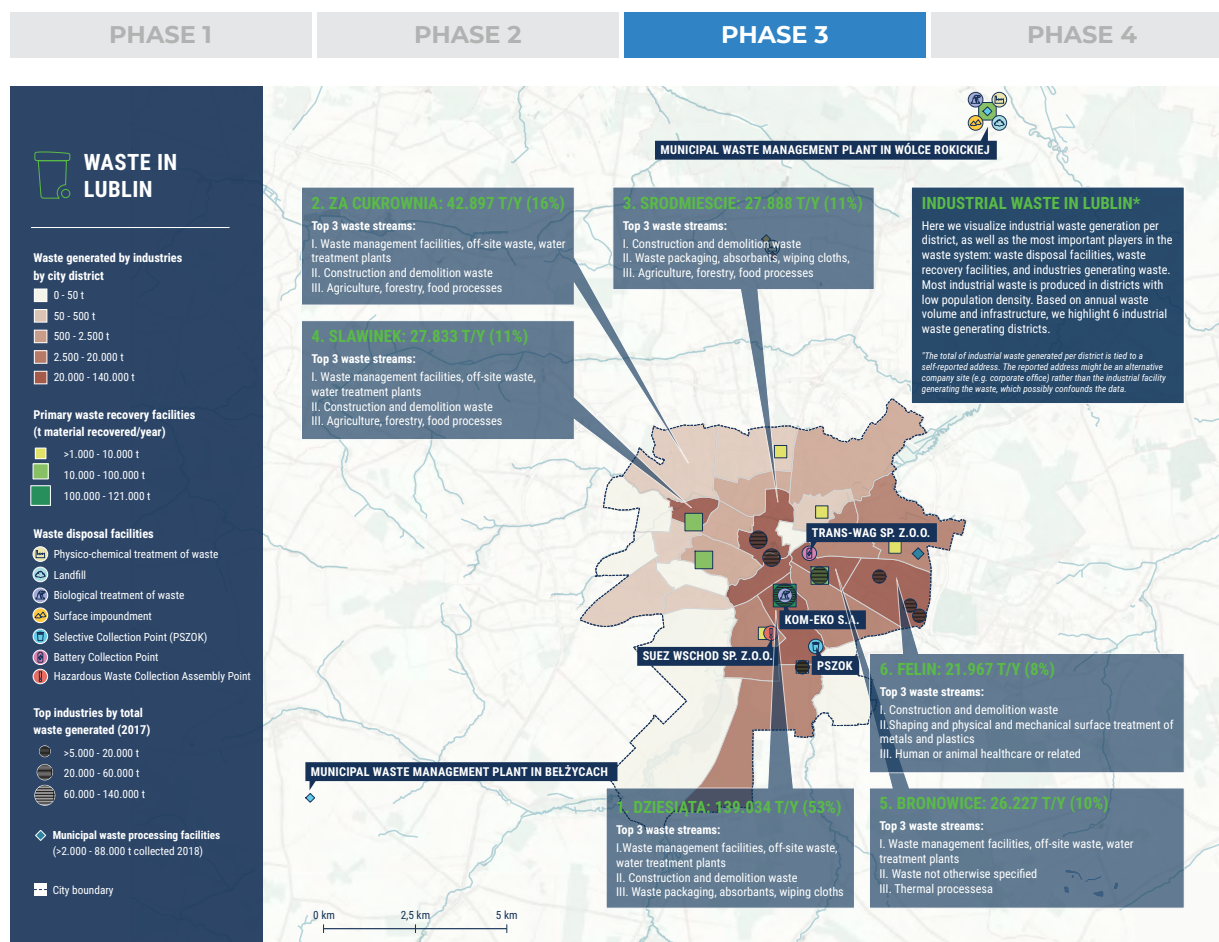
With web-based GIS maps rising in popularity, a whole range of interactive and engaging cartographies emerge that allow us to use maps more innovatively. They enable users to select filters, search for map elements, overlay multiple data layers, and even conduct simple geospatial analyses. An advantage of **digital GIS maps** (Figure 24) is that they do well at visualizing **complex information** about multi-layered ecosystems: How does a city look like through the lens of urban nature, urban industries, or urban communities? Are there any obvious connections between these layers? Maybe the density of traditional manufacturing businesses is lower in areas where housing prices are rising. Maybe areas with a higher diversity of educational and employment backgrounds are where we find most knowledge and skills. Cartographies help us see these interconnections more clearly, and communicate more effectively what they mean for a site, street, or district undergoing urban regeneration.

Other cartography formats are less informative about the geospatial context of a city but rather serve as a **searchable online directory** of organizations, people or places. The [Open Workshop Network](#) or [Make.Works](#) are good examples of such cartographies that let users search for resources, processes, sites or tools available in organizations around them.

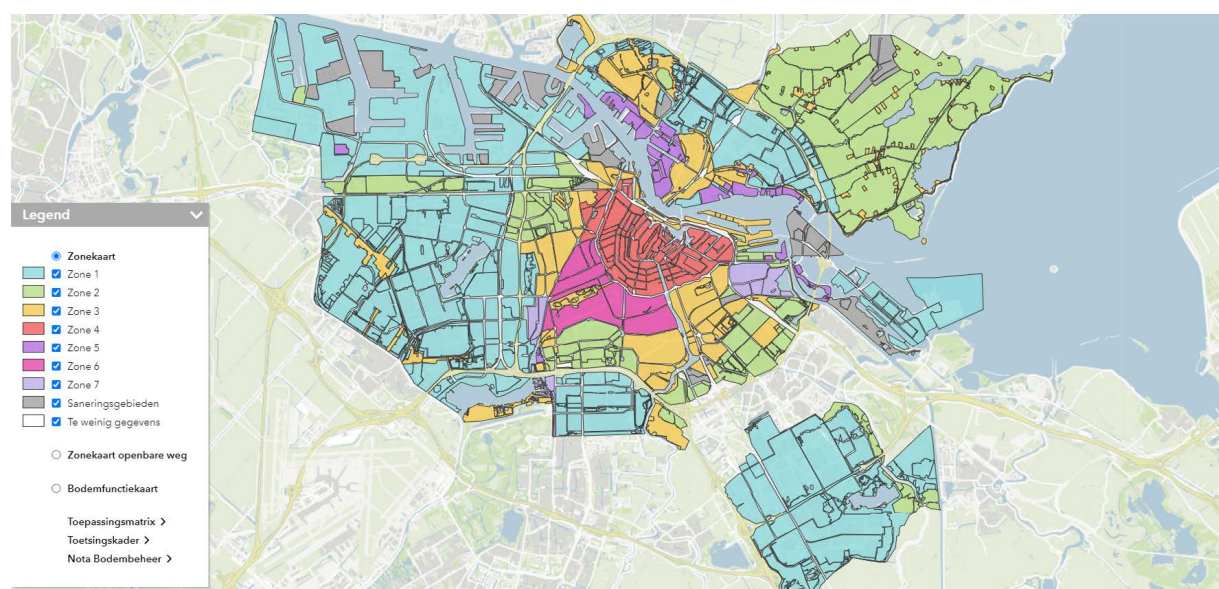
#### What are the outcomes?

At the end of the mapping strategy workshops, we have defined:

- ✓ A clear list of geospatial context information that describe the context of urban nature, urban communities and urban industries.
- ✓ A first set of resource categories potentially useful for pilots.
- ✓ A defined scope for the mapping process that lays out how each method (presented in the next sections) will be used.
- ✓ A timeline for the first mapping cycle.

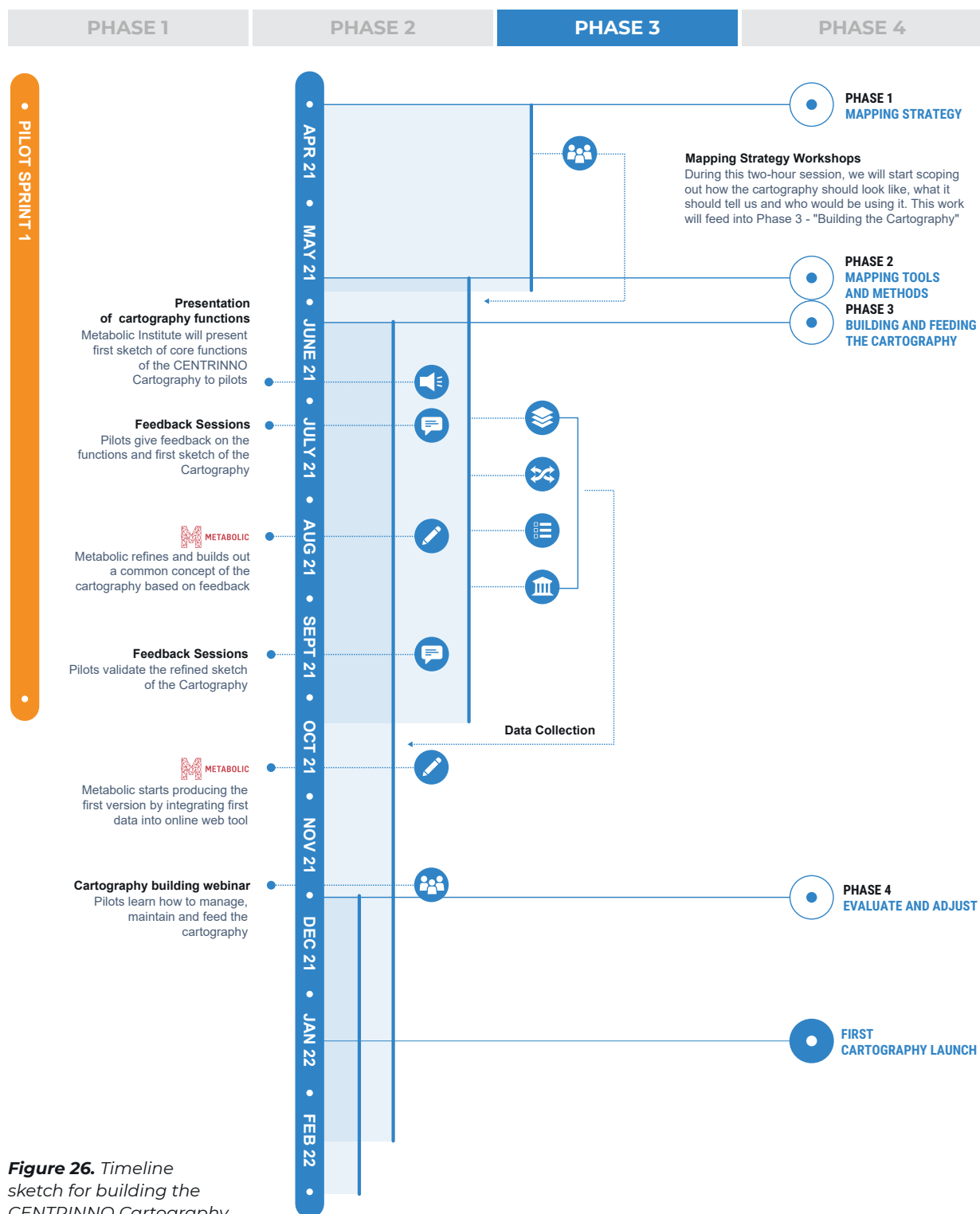


**Figure 23. Static waste map of Lublin** - this static waste map was produced by Metabolic for the City of Lublin. It shows how much waste each district generates, where major waste generating industries are, and where waste management infrastructure is located. Source: Metabolic, 2021.



**Figure 24. Digital soil map of Amsterdam** - this digital soil cartography is an example of an informative online map that allows users to access additional information (here: soil quality reports) about a site. Source: [Interactive maps of Amsterdam](#).



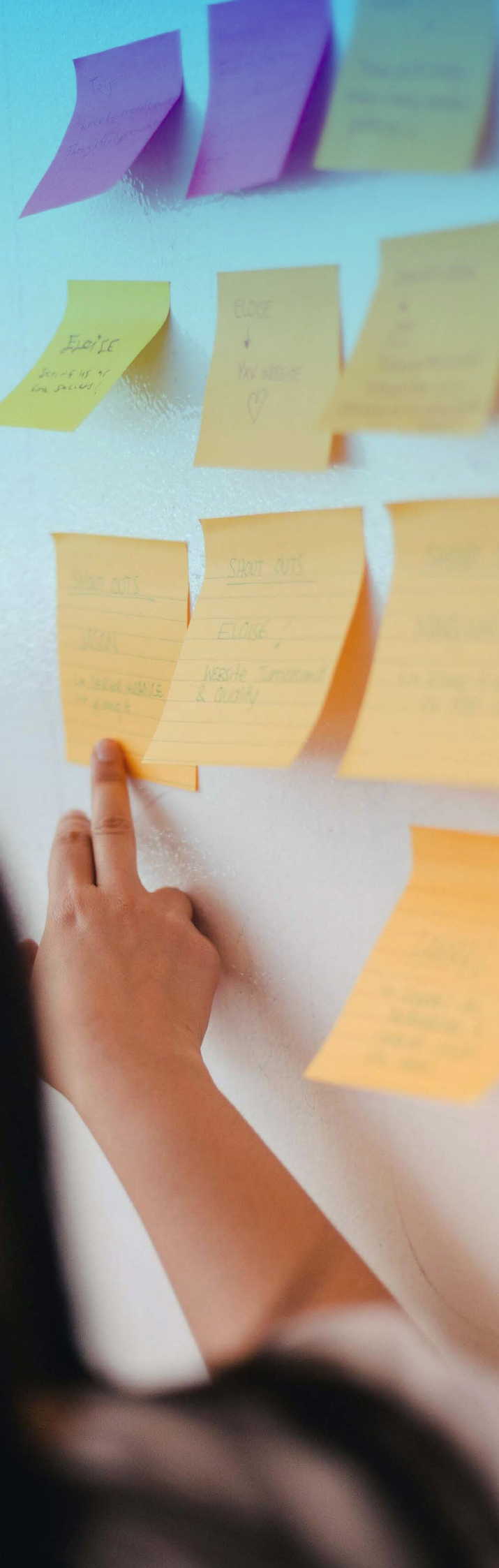


**Figure 26.** Timeline sketch for building the CENTRINNO Cartography.

## Connecting the CENTRINNO Cartography and the Living Archive

The CENTRINNO Cartography is only one of various products that will emerge from applying the urban ecosystem mapping tools and methods presented in this guidebook. Beyond the Cartography, mapped information can also feed into the remaining platforms developed during the CENTRINNO project, in particular into the creation of the Living Archive. For example,

while ethnographic mapping allows for the inclusion of cultural aspects into a digital online map, the Living Archive will provide much more insights into the stories sitting behind points on the exact process of co-curation, sharing and transfer - in short, the 'living' part - will be developed based on the experience of working with the pilot cities in the first sprint.



## PHASE 4

### Evaluating & adjusting the mapping strategy

The CENTRINNO Urban Ecosystems Mapping process ends with an evaluation and adjustment period after each mapping cycle to iteratively improve and build on the methodology presented in this guidebook. During this phase, pilots will reflect on (1) what insights can be gained from the mapping process, (2) what additional data should be collected during the second iteration, and (3) how to improve and adjust the Urban Ecosystem Mapping process.

Other changemakers and initiatives are also highly encouraged to evaluate the outcomes of mapping activities.

### Key evaluation questions

#### Reflecting on mapping outcomes

- How can we use the mapping results in local regeneration projects and CENTRINNO programming?
- What information on our urban ecosystem and embedded resources is missing to realize our regeneration project?

#### Reflecting on the mapping process

- What mapping methods and respective steps worked well?
- Which challenges emerged during data collection?

#### Adjusting for the next cycle

- Which additional skills, data champions, technology do we need to improve the process?
- Which additional expertise is needed within pilot teams to overcome challenges?
- Which other methods that we have not yet applied could help us to increase the functionality of the Cartography?





PART

C

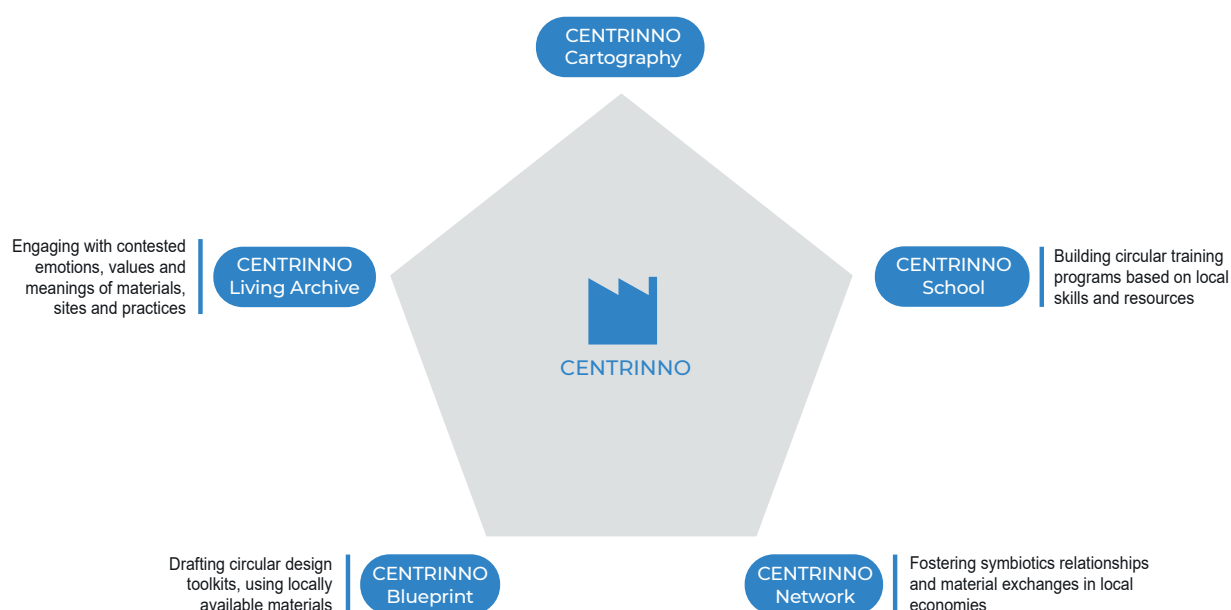
# C: FROM MAPPING TO ACTION

## FROM MAPPING TO ACTION

### Four scenarios to trigger circularity through the cartography

Mapping alone will not allow the pilots to harness all the resources or information for positive change in (post-) industrial and regenerating neighbourhoods. It is just one of the starting points to kick-start the roadmap towards

circular, regenerative, and inclusive urban regeneration. This section consists of four use cases that connect the CENTRINNO Cartography to the infrastructure that will be developed during the project's life under each of the other four elements of the CENTRINNO approach. Each use case includes a brief description about how the CENTRINNO Cartography relates to each infrastructure, as well as an example of how this could be implemented in the future.



**Figure 27.** Five key concepts of CENTRINNO. Adapted from: CENTRINNO, 2020.

### **A peek into the future**

*Imagine your city has abundant urban forests and tree-lined streets that, each year, generate many tons of wood waste from pruning, as well as from the local timber industry. Before mapping the urban ecosystem, wood chips and left-over pruning waste were incinerated or used in low-value applications. But through concerted mapping efforts, it was possible to map out all suppliers of wood waste and bring them to one table with local makers, designers, and craftsmen. While not enough to feed large-scale production processes, the materials are made available for local workshops, SMEs and artisanal makers through the CENTRINNO Network. Today, wood residues are processed locally into furniture, design objects, and everyday objects, such as toothbrushes and to-go cutlery.*



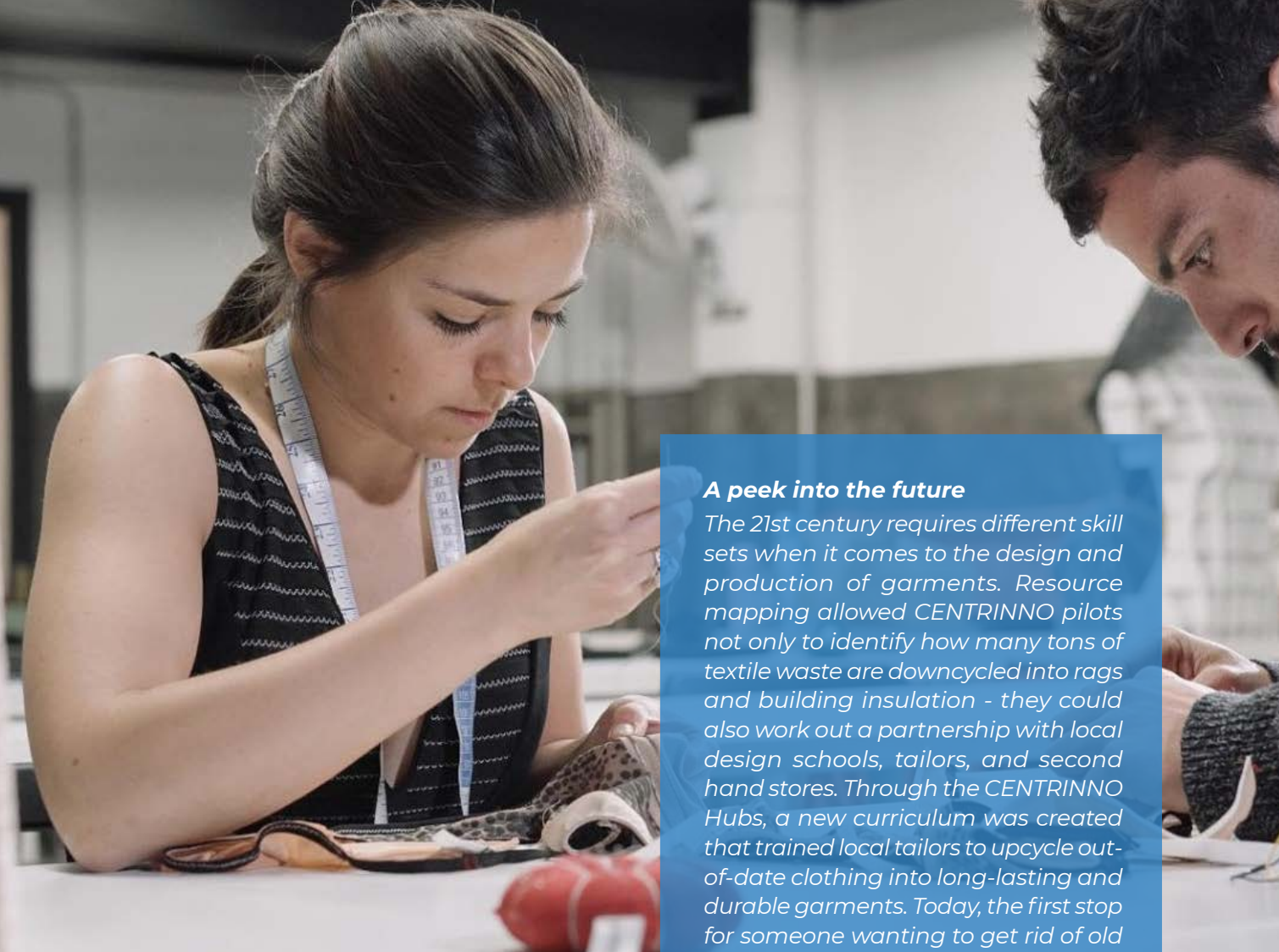
**Figure 28.** Craftsmanship and wood working.  
Source: Dominik Scythe on Unsplash.

## **Scenario 1 - CENTRINNO Network**

### **A network for circular industries**

The CENTRINNO Network will support pilot hubs in creating sustainable local dynamics and relationships. Through it, CENTRINNO pilots will engage with a wide range of local and global actors to foster bottom-up urban resilience through the commoning of resources. The CENTRINNO Cartography will be key to provide information on potential resources or gaps to be addressed by the pilot's community.

Commoning is the joint and sustainable management of economic, social, and political resources by a community to ensure the distribution of value and responsibilities to all its members. The CENTRINNO Network can become the core element to govern urban resources in each pilot, matching resource providers, identified through the CENTRINNO Cartography, with local needs arising from makers, craftsmen, and SMEs to increase sustainable material exchanges, knowledge sharing, and pooling of manufacturing infrastructure.



**Figure 29.** *Fabricademy program.*  
Source: Fab Lab Barcelona, IAAC.

### **A peek into the future**

The 21st century requires different skill sets when it comes to the design and production of garments. Resource mapping allowed CENTRINNO pilots not only to identify how many tons of textile waste are downcycled into rags and building insulation - they could also work out a partnership with local design schools, tailors, and second hand stores. Through the CENTRINNO Hubs, a new curriculum was created that trained local tailors to upcycle out-of-date clothing into long-lasting and durable garments. Today, the first stop for someone wanting to get rid of old clothes is not the collection container that ships items for sorting across the globe - it is the tailor next door.

## **Scenario 2 - CENTRINNO School**

### **Circular training programs**

The CENTRINNO School will create vocational training programs and curriculums that build out skills for Industry 4.0. In order to rethink the next industrial transformation in urban areas, it is essential to develop the skill sets and knowledge on designing and manufacturing products according to circular principles. Through the Cartography, the CENTRINNO School can develop workshops and training programs that build upon the existing tangible and intangible resources in the city.



### **A peek into the future**

Urban waste, soil pollution, derelict infrastructure, or other environmental burdens of past industrial activities have long been assigned a negative connotation without value or utility for local industries, makers, and communities. But after extensive sessions of emotion networking with the local community, it was possible to create new narratives about wasted places, materials, and buildings. The CENTRINNO Cartography helped to not only map out waste but illustrate the products and services that could emerge out of a circular economy. Today, the local community knows about the cultural and aesthetic value of different waste materials and is proud of the ways they have created to reuse it.

**Figure 30.** Reusing waste materials within the city.

Source: Unsplash.

## **Scenario 3 - CENTRINNO Living Archive**

### **Curating stories on resources and their value**

The CENTRINNO Living Archive will become an online repository of memories, personal stories and attitudes connected to historic sites and heritage practices identified around the CENTRINNO Hubs. While the Living Archive will exist and be developed separately from the CENTRINNO Cartography, the two platforms will be linked to each other. Thus, historic sites mapped through the CENTRINNO Cartography become the physical elements on the map that can be hyperlinked to the stories and attitudes ascribed to them, stored in the Living Archive.

Simultaneously, the cartography can also inspire local communities to explore the meaning of waste materials in their surroundings. One great example of a waste resource map created to uncover “material stories” is the [WasteZone exhibition](#) organized as part of the annual FutureBuilds industry exhibition in London. With industry members as participants, the exhibition collected common perceptions and material meanings that were associated with problematic and abundant waste streams in the city.



**Figure 31.** *ROMI Project.* Source: Picture by Sony CSL.

### **A peek into the future**

Urban agriculture is booming in many cities around the globe. Through mapping abandoned land and underused plots, cities wanting to boost urban food production have identified many locations suitable for small-scale orchards and agrifood forests. Locally grown food is later used by neighborhood organizations to develop local organic products in collaboration with a food-lab and sell them through local restaurants. The CENTRINNO Cartography was used in different moments of this process: to map the underused plots according to official planning data, to identify, using a survey, local businesses that commercialized organic food-products, and to detect an excess of specific food waste through the material flow analysis, suited to create organic compost. The combination of these tools results in a blueprint that could be followed in other parts of the city or adjusted in other cities in order to foster similar initiatives.

## **Scenario 4 - CENTRINNO Blueprints**

### **Creating circular design toolkits**

The CENTRINNO Blueprints will integrate the tools and approaches implemented and tested during the project to develop a Fab City Hub. Its main goal is to allow replication or adjustment of those tools for larger areas of the pilot cities or in other cities beyond CENTRINNO. Synergies between the CENTRINNO Cartography and

other resources in the project will be key to ensure a sustainable implementation of Fab City Hubs on local level and beyond through the CENTRINNO Blueprints. Specific approaches and findings of pilots on mapping or analysing resources at the local level could inform methods to replicate its approach beyond the pilot's focus area.



# CONCLUSION & NEXT STEPS

## CONCLUSION & NEXT STEPS

The need to redesign our cities to thrive within the planetary boundaries is paramount, yet the challenge is multi-faceted. From reconfiguring the urban landscape to designing new co-governance models that safeguard natural and cultural capital, the nine historic industrial sites within CENTRINNO are piloting a broad range of systemic solutions that can set us on track for building regenerative, inclusive cities of the future.

Mapping urban ecosystems is a critical part of the CENTRINNO process. Through the mapping methodology shared herein, urban changemakers can develop a granular understanding of the interconnectedness of social, ecological and economic challenges and craft holistic regeneration strategies that avoid unintended consequences within and beyond the city itself. Moreover, by mapping underutilized material resources, technologies and skills urban changemakers can tap into a city's hidden potential and spur local economic and industrial development towards positive socio-environmental impacts.

The Urban Ecosystem Mapping Guidebook presents a suite of tools and methods for mapping urban ecosystems that can become an asset for driving the transformation towards circular value chains and responsible heritage management. It is a living document, meant to inspire and support urban communities seeking to build collective knowledge on (post-)industrial sites and their role within broader urban regeneration. Within CENTRINNO, this guidebook will be deployed by pilots to (1) understand their local urban ecosystems holistically, and (2) collect data and insights that will feed the development of CENTRINNO's Cartography and Living Archive. The CENTRINNO Cartography will visualize the urban ecosystems and local resources of CENTRINNO's nine pilot cities (Barcelona, Amsterdam, Paris, Milan, Blönduós, Geneva, Copenhagen, Tallinn and

Zagreb). It will show the diverse resources, infrastructure and socio-cultural assets that exist in a local context and unveil novel opportunities for creating circular and sustainable regeneration pathways. By sharing a diverse inventory of narratives, the Living Archive will highlight the many forms of value and meaning embedded within physical places and facilitate deeper dialogues around urban regeneration.

Following the publication of the Urban Ecosystem Mapping Guidebook, CENTRINNO partners and pilots will enter into the first of three 6-month pilot sprints. Within the first sprint (May-November 2021) pilots will complete the first iteration of the guidebook's four-phase process: (1) Building a mapping strategy, (2) Applying mapping tools and methods, (3) Building a cartography, and (4) Evaluating and adjusting the mapping strategy (as shown in Figure 11). Together, these four steps will provide each pilot team with a systemic analysis of their city and its resources and contribute towards the activities and interventions each pilot sets as part of their regeneration strategies. The mapping process will be repeated and refined over the project's further two pilot sprints (April-October 2022; March-September 2023). After each mapping iteration, CENTRINNO pilots will reevaluate how the mapping process and the resulting cartography can be improved, built out, and adjusted to become more insightful.



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