

# Roadmap

## Circular Resource Efficiency Management plan

Version

15.05.2020





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Circular Economy and Urban Metabolism

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# Introduction

## Background

The Pact of Amsterdam was adopted in the first half of 2016, during the Dutch Presidency of the Council of the EU. The Pact strives to involve Urban Authorities in achieving Better Regulation, Better Funding, and Better Knowledge on 12 Priority Themes. The relevance of this involvement is highlighted by the statistic that cities and urban areas now house more than 70% of all Europe.

Each theme has a dedicated partnership. These partnerships bring together cities, Member States and European institutions and develop workable ideas focused on EU legislation, funding and knowledge sharing. The Partnership on Circular Economy determined the priority issues to assist cities in their aim to develop a Circular Economy on city level.

Cities are increasingly dependent on resources from outside the city. Despite this knowledge only a few cities that have taken action to reduce their dependence. That is why the idea arose to use the learning from those cities and develop a roadmap to enable other cities in developing their own resource-efficiency and circular policy. Figure 1 provides an overview of the content of the roadmap.

## ROADMAP ON RESOURCE MANAGEMENT

Most cities strongly focus on getting waste out of their city as quickly as possible. However, waste has economic potential and should be considered a valuable resource. Given their vast knowledge of, and experience with municipal waste management, cities are well equipped to facilitate the transition to resource management.

| Pillar 1: Identifying urban metabolism   | Pillar 2: Brokerage Activities  | Pillar 3: Monitoring and Evaluation   |
|--|---|---|
| <p>The process of resource mapping aims to discover which resources go where in the city, possibly providing information on the social, financial, economic or environmental impact on the city.</p> <p>This information allows for the construction of activities within the city aimed at improving the resource efficiency of the city.</p> | <p>Having performed the resource mapping exercise of pillar 1, cities can now design brokerage activities together with relevant stakeholders within the city.</p> <p>These activities should aim to connect different resource flows and stakeholders and, as such, close the different loops within the city.</p> | <p>To know whether the activities under pillar 2 are effective, it is essential that a city is able to monitor and evaluate the results of these actions.</p> <p>To do this, a city needs to have data, develop a monitoring and evaluation framework and organize workshops with relevant stakeholders accordingly to monitor any progress made.</p> |

**This Roadmap provides:**

1. A step-by-step plan that guides cities through the resource management development process.
2. Considerations and a substantiated framework to make well-informed decisions in order to specifically tailor the plan to the ambitions and possibilities of your city.
3. Background information on resource management.

Figure 1: Overview of the content of the roadmap

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## The need for a Circular Economy

Currently, about 85% of global GDP is generated through cities and such rapid growth puts enormous pressure on urban resources, carrying capacities and quality of life. At the same time about 70% of the energy is used by cities and the proportion of the world's population living in urban areas is expected to increase, reaching about 70% by 2050. Quantitative analysis of the global resource requirements of future urbanization shows that material consumption by the world's cities will grow from 40 billion tonnes in 2010 to about 90 billion tonnes by 2050.

Cities keep on growing and are therefore more reliant on the surrounding areas for resources, whether this being construction materials, food, energy or otherwise, which (as explained before) will, in the future, be increasingly rare or even unavailable. The planetary boundaries of the linear economic model are reached; raw materials become scarce and more expensive, clean water and air become scarcer, climate is changing and biodiversity is rapidly declining. This is even more pressing for cities given their enormous expansion.

Cities can become less depend of their surrounding if they are able to increase their resource efficiency, meaning the reduction of the use of virgin resources and an increase of the use of secondary resources. These threats also represent enormous chances for cities.

City leaders across the world who want to capitalize on these opportunities rethink the way current urban systems operate and explore new ways of value creation and optimisation, while ensuring long-term prosperity, well-being, economic viability and resource sufficiency in urban areas worldwide. The circular economy is equivalent to that new approach. The Ellen MacArthur foundation designed the infographic below to show how the circular economy work.

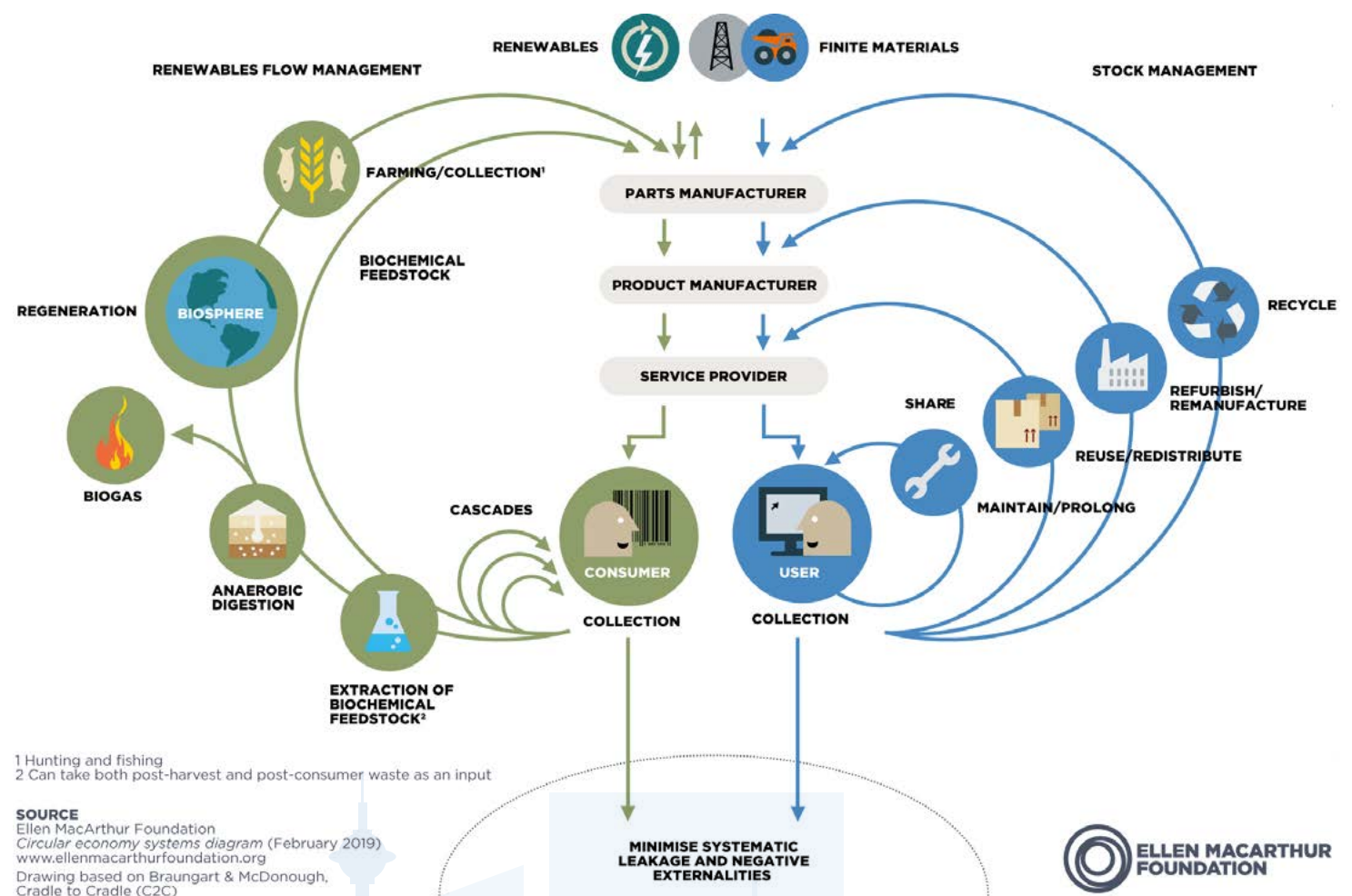


Figure 2: Infographic on circular economy

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As the figure clearly shows, the circular system has two cycles of materials. The biological cycle in which residual materials return to nature safely after use and thus regenerate living systems, such as soil or water. Technical cycles recover and restore products, components and materials at high-quality levels, via strategies like reuse, repair, remanufacture etc (multi R-strategy) in order to be able to keep the loop going and retain the economic value as much as possible.

According to the The Ellen Macarthur foundation the circular economy is based on the principles of a) designing out waste and pollution, b) keeping products and materials in use and c) regenerating natural systems. These three principles are the foundations of a new circular economic system. For cities to be able to facilitate the transition towards a circular economy a better understanding of these cycles would be necessary. This means understanding the flows of energy, resources and waste through the cities.

## Circular Economy and Urban Metabolism

Urban metabolism and its accompanying inventory methods provide cities with an instrument to acquire insights in the cities resource flows. The methods of urban metabolism perceives a city as a natural organism and by doing so, cities can be perceived as “urban ecosystems” with inputs and output.

With the growing concern of climate change and depletion of resources, the use of the urban metabolism model has become a key element in, not only, determining resource flows in cities but also take consideration environmental ecological, social and economic impact into consideration. Urban metabolism methods are called assessment methods and are often presented in a so-called “assessment framework”, such as an overview table or flow chart that could look like this:

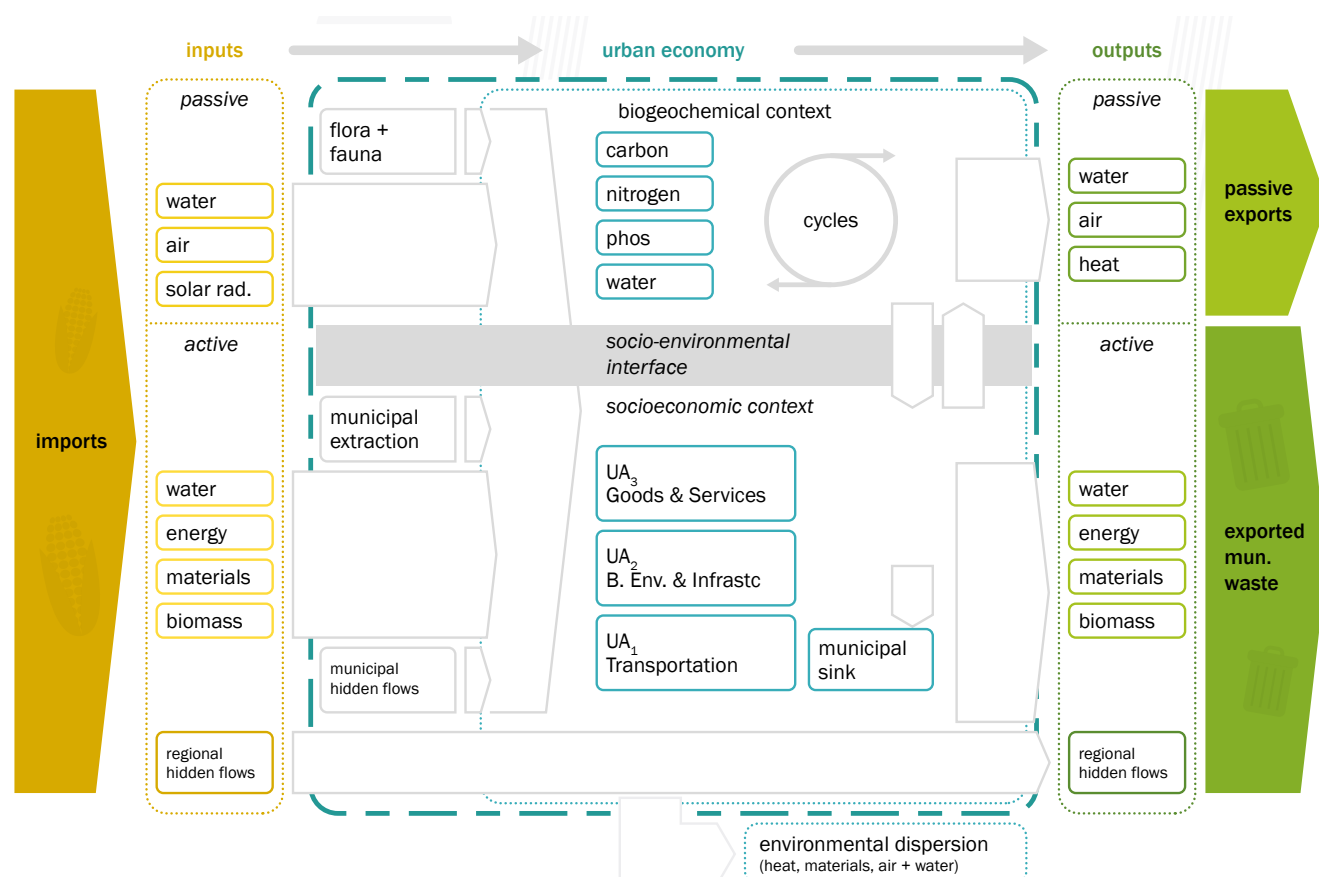


Figure 3: Urban metabolism framework.

The Urban Metabolism framework helps to provide an overview of all the streams and helps to study the interactions of systems, and therefore works well for a city. So a city can gain more insight into the characteristics of resources and resource flows, such as; which resource flows are going through the city, are stored there, are changed because of different metabolic processes (for instance waste treatment), flow rates, involved stakeholders, economic value and are leaving the city.



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Having knowledge of these resource streams and characteristics allows a city to determine and apply appropriate interventions aimed at improving resource efficiency. This should lead to a decline in valuable waste being wasted through value-loss and thus to a more resource efficient and circular city. Managing this is known as resource management.

## Cities and Resource Management

Because cities have been responsible for waste management at the local level, they have fast knowledge on waste management in their cities. In this sense they are uniquely positioned to help address the complex problems that arise when improving resource efficiency.

Other than knowledge on management of household waste, within cities a lot of knowledge is residing, which can be used and will be necessary to be able to organize resource efficiency in a structured way. Overall governance, enabling businesses, public procurement, consumption and resource management are the themes that have a bearing upon the development of circular economy concepts within cities and on which cities are able to exercise influence. Although, at present most cities strongly focus on getting waste out of the city as quickly as possible and at the lowest possible costs. The logical step for cities to take would be to shift from urban waste management to urban resource management.

An important aspect of this shift would be the use of the economic potential of waste materials as a valuable secondary resource for new products. The basic principles of the 'value hill' is that it not only wants to create value out of "waste" in which cities are traditionally very strong, but make resources more valuable because of their "multi functionality".

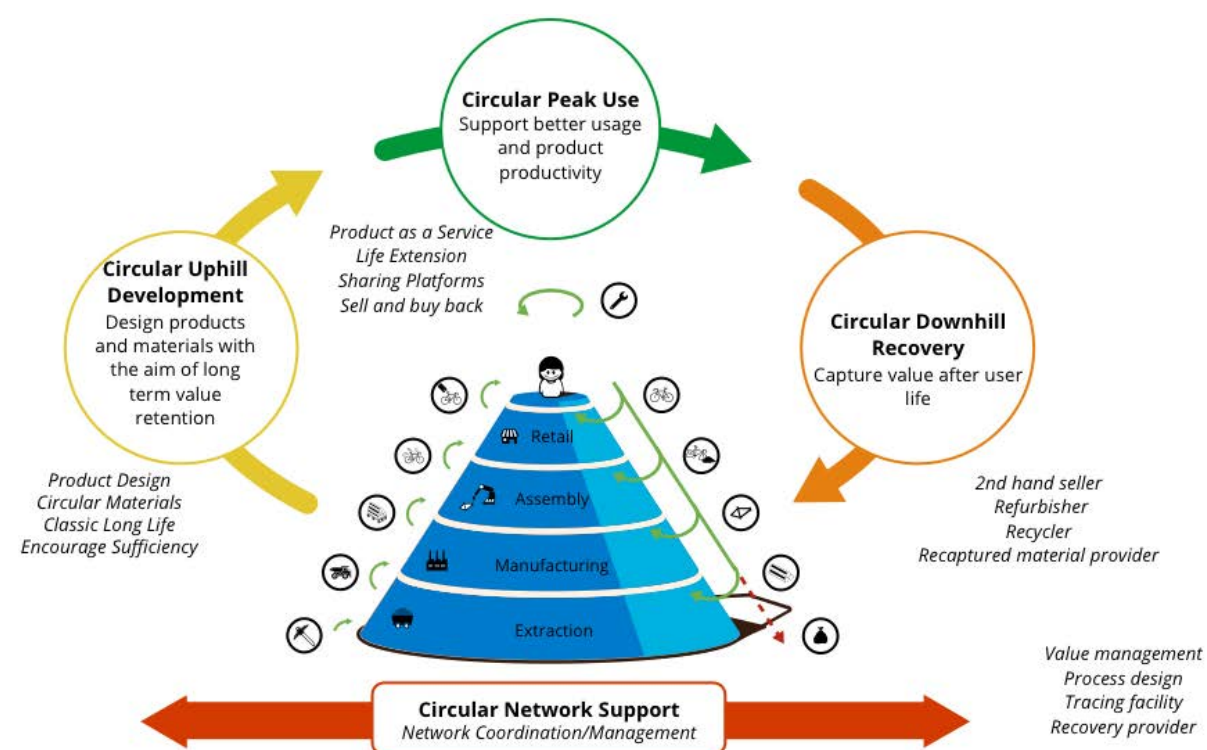


Figure 4: The 'value hill' of circular economics.

Given their vast knowledge of, and experience with municipal waste management, cities are well equipped to facilitate this for the benefit of local economic activity and employment. Supporting and enabling organisations and businesses to identify and explore and exploit the opportunities of the value hill may help to speed up cities' transition towards a circular economy in terms of resource efficiency in the value chain. In this way the Value Hill shows clearly the value of (secondary)

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resources that is residing within cities. This does not mean that waste management will become completely obsolete, but the primary focus will shift to waste as a secondary resource.

To better understand the cities' metabolism insight and understanding of material stocks and flows within the city and knowing which intervention can be undertaken to make use of the intrinsic value that is residing within "waste" is needed to increase resource efficient and circular city.

This roadmap provides assistance for cities to do so and thus speed up transition towards a circular resource efficient city.

## Transition management

The use of the roadmap initiates and speeds up a transition, the change from a linear system to a circular system. Running the roadmap cycle just once will not be enough to realise this system change. Given the outcome of The Circularity Gap Report - 2020 stating that our world is only 8,6% circular the 'Roadmap cycle' needs to be repeated several times.

Transitions have a high level of complexity and uncertainty and are therefore not completely shape-, manage-, make-, engineer- and predictable and take about 20 to 50 years to be completed. The general course of a change in the systems can be clarified by the so-called S-curve.

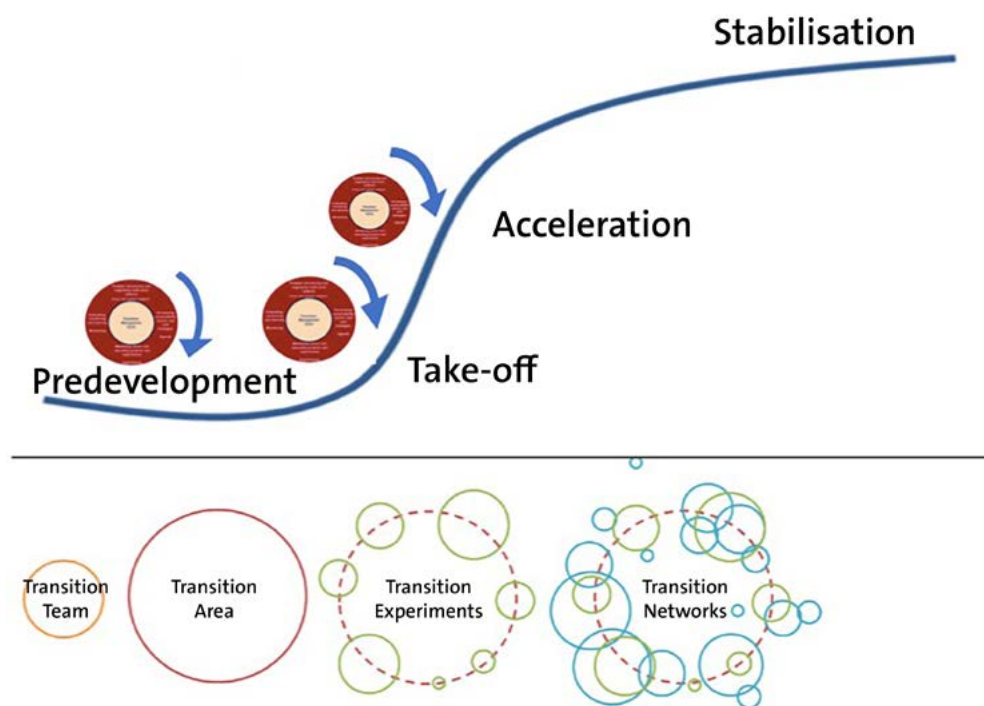


Figure 5: The transition S-curve with roadmap cycle and involvement the network.

In Figure 5, the red circle represents the cycle of the roadmap. While running the roadmap, the transition is moving upwards the S-curve, from predevelopment, to take-off and further up the S-curve. In the process, the transition network will expand and the number of people involved will increase. It is not be predicted how often the cycle of the roadmap has to be completed to realize a (100%) circular economy. Nevertheless, it is certain that each cycle of the roadmap increases the circular resources efficiency.

A different and more complex way of looking at (and manage) transitions is reflected in the X-curve. In the X-curve, a distinction is made between patterns of assembly and disassembly. Note that, the assembly and disassembly phases are mentioned together within the timeline. However, these phases do not necessarily move together. For instance, a part of the transition might already be in the institutionalisation phase while another is still in the optimisation phase, this is what makes transition so hard to manage.

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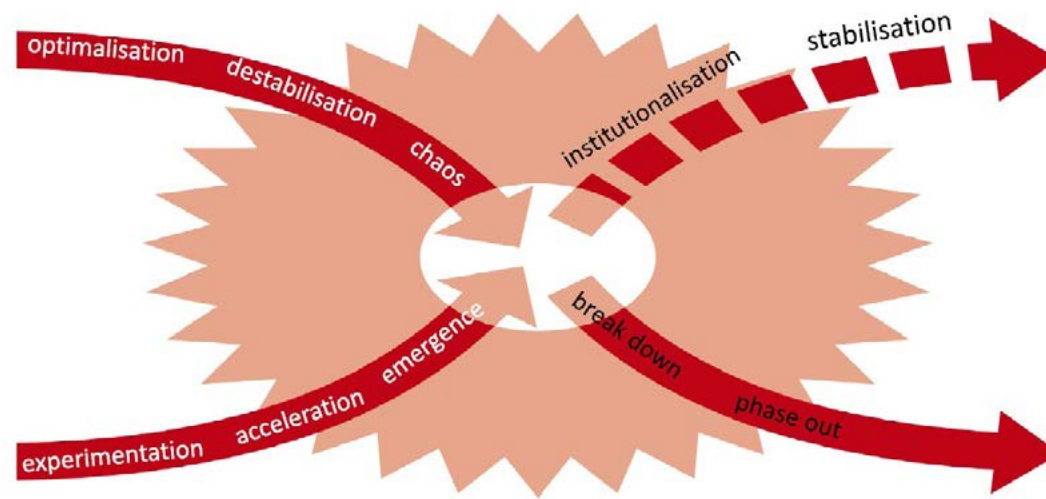


Figure 6: The X-curve of transition management.

Below the phases are explained individually, starting on the left side. Every phase includes two terms in the upper and lower part of the X-curve.

Governments tend to control and avoid risks from the point of view of maintaining and protecting existing rules and systems makes introduction and large-scale applications of renewed products difficult. This acts as a break on system change.

Nevertheless, it is also the government that is (often) a continuous factor in a changing society and that can exert its influence in all parts of that society and thereby also set in motion structural change based on the idea that the desired or necessary change is good for society. Governments also have the executive power and capacity to sustain and manage transitions. A specific task then lies with governments to take all those involved on the path of transition towards a circular economy despite the fact that we do not know exactly what that path looks like and what we will encounter on the path.

## Development of the Roadmap

To be able to develop this roadmap, a variety of cities, that have experience with the development of circular resource efficiency management or a circular policy plan, have been consulted. Their plans have been analysed on the subjects of resource mapping, city characteristics, brokerage activities and monitoring. In more detail the plans have been analysed about the methods of resource inventory, the type(s) of resources and how the priority flows have been inventoried. Lastly, it is determined if, and if so which stakeholders were involved and in which phase of the development they have been involved.

In Table 1 an overview is given of the plans that have been analysed and the cities representatives that have been interviewed.

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| City              | Method            | Analysis | Resource Mapping | Brokerage Activities | Monitoring      | Type of City                         |
|-------------------|-------------------|----------|------------------|----------------------|-----------------|--------------------------------------|
| <b>Amsterdam</b>  | Hybrid            | MFA      | x                | x                    | x               | Harbour / Tourism                    |
| <b>Antwerp</b>    | Hybrid            | MFA      | x                | x                    |                 | Harbour / Industry / Transit         |
| <b>Bilbao</b>     | Accounting method | MFA      | x                | x                    |                 | Manufacturing / Harbour / Tourism    |
| <b>Brussels</b>   | Hybrid            | IOA      |                  | x                    | x               | Services                             |
| <b>Charlotte</b>  | Hybrid            | MFA      | x                | x                    |                 | Manufacturing/ services              |
| <b>Catalonia</b>  | Simulation        | -        |                  | x                    | x               | Services                             |
| <b>The Hague</b>  | Hybrid            | MFA      | x                | x                    | x               | Services                             |
| <b>Poort Genk</b> | Simulation        | -        |                  | x                    | x               | Industry                             |
| <b>Glasgow</b>    | Hybrid            | MFA      | x                | x                    |                 | Manufacturing / Food                 |
| <b>IJmond</b>     | Accounting method | MFA      | x                | x                    |                 | Harbour / Industry / Transit         |
| <b>London</b>     | Hybrid            | -        |                  | x                    | x               | Services                             |
| <b>Maribor</b>    | Hybrid            | -        |                  | x                    | x               | Manufacturing / Transit              |
| <b>Paris</b>      | Accounting method | MFA      | x                | x                    |                 | Services                             |
| <b>Prague</b>     | Accounting method | MFA      | x                | x                    | KPI per project | Utilities / Construction / Household |
| <b>Rotterdam</b>  | Hybrid            | MFA      | x                | x                    |                 | Harbour / Industry / Transit         |
| <b>Vienna</b>     | Accounting method | MFA      | x                | x                    | x               | Services                             |

Table 1: Overview of cities with circular plans that have been analysed

A large number of cities (Rotterdam, Paris, Maribor, IJmond, London, Brussels, Antwerp, Charlotte, Glasgow, Amsterdam) have been interviewed to receive more detailed information on for instance; goals, use of circular principles, involvement and role of stakeholders or underlying information on why certain resource flows were prioritized. The consultants involved in the development of the above mentioned plans were moreover interviewed about used data, calculation methods and inventory methodologies. The information retrieved from these interviews has been used to make this roadmap as practical as possible, providing actual examples of city practices.

This roadmap will provide you with the process steps for setting up the resource mapping process and thus acquire more insight in your cities resource metabolism. It will help you to develop effective and efficient brokerage activities and set up a system to monitor the execution of the interventions and change in resource efficiency. The roadmap is, therefore, an instrument. This roadmap will provide you with the process steps for setting up the resource mapping process and thus acquire more insight in your cities resource metabolism. It will help you to develop effective and efficient brokerage activities and set up a system to monitor the execution of the interventions and change in resource efficiency. The roadmap is, therefore, an instrument



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## How to use this roadmap

The purpose of this document is to provide cities with a clear outline on how to improve their resource efficiency based on three main elements: RESOURCE MAPPING, BROKERAGE ACTIVITIES and MONITORING.

This roadmap offers concrete steps for each of the three elements that will lead to a resource efficiency plan based on circular principles. With it, a substantiated assessment framework is provided to specifically tailor the plan to the characteristics, ambitions and possibilities of your city. To realize this, each chapter of the roadmap will follow the same approach. Firstly, a step-by-step plan that guides you through the development process in combination with a substantive assessment framework to make well-founded decisions, so that the plan can be adapted to the characteristics and ambitions of your city and thirdly the associated background information is given, to deepen, if necessary, the knowledge about the topics involved.

## STEPS PER PILLAR

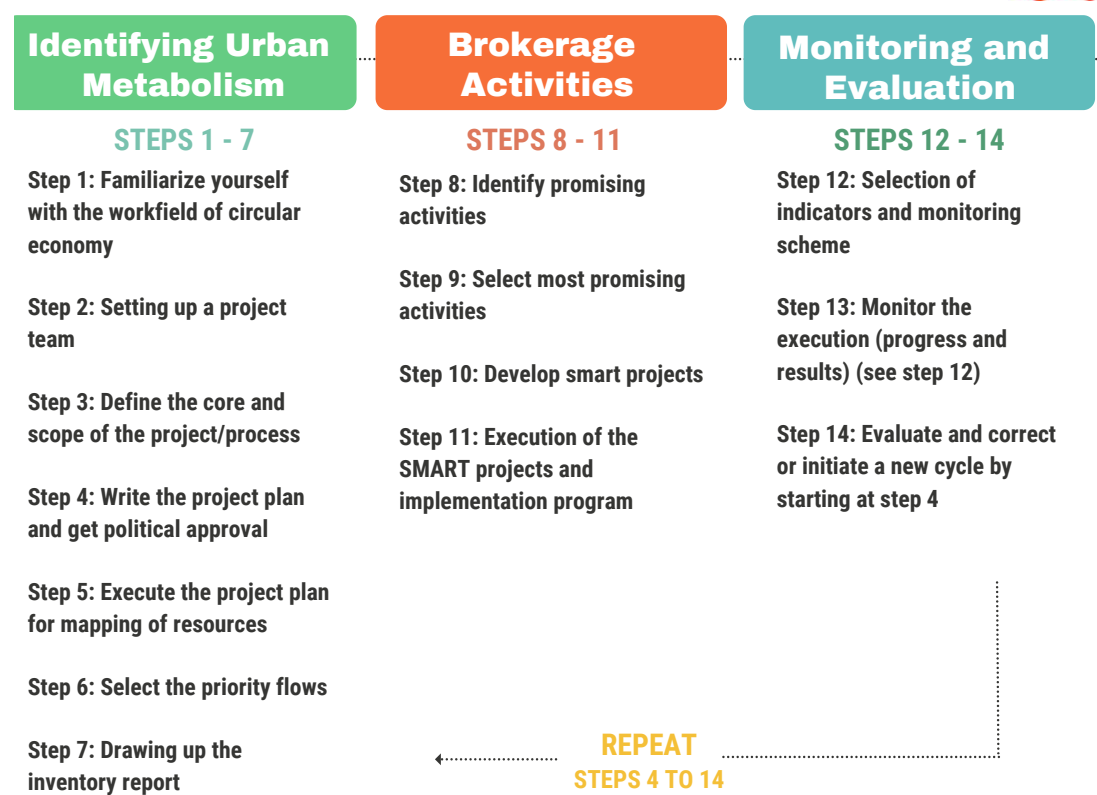


Figure 7: Overview of steps per pillar.

### I) Identify a cities metabolism

Although not obligatory, commonly, the first main element will be to gain more insight in the cities' metabolism, resource flows and resource characteristics like quantities, flow rates, owners, involved stakeholders, availability, quality et cetera. This is done through so-called resource mapping. Knowledge on resource flows can help identify the possibilities for increasing circular business models. Not only mass or economic value is important in this respect, but also knowledge about the circular potential of flows and the involvement of relevant local stakeholders and their ability to be active. The steps mentioned above will guide you through the process to gain the insight you want to create on your cities resource metabolism.

### II) Brokerage activities

The second pillar will outline how value hill strategies, tools and measures can be helpful in connecting supply and demand of secondary resources. Most stakeholders are not aware of or familiar with the available tools at their disposal. Local authorities are in a position to help create awareness, have purchasing power and are able to

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create a market environment that is resource friendly. This second element consists of multiple steps that will lead to well-considered choices in selecting the right measures that suit your city and will lead to increased resource efficiency.

### III) Monitoring

At present, there is a need to develop indicators and hands on monitoring tools that will provide cities with information about the progress made with regard to the execution of the brokerage activities as well as the progress in improvement of the cities resource efficiency. This chapter will zoom in on the necessary steps towards determining the available and required indicators and selecting the indicators that your cities values most.

### IV) Repeat

Because the transition towards a resource efficient and circular city cannot be achieved by just once running this roadmap, it is constructed in such a way that it is applicable in all phases of transition towards a circular and resource efficient city.



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# 1. Identifying Urban Metabolism

1

## 1.1. Introduction

To start off, this section identifies the process steps which should be considered in setting up a resource management plan. The roadmap provides effective and practical steps to assist in developing a Circular Resource Management plan tailored for your city. Per step a number of questions are provided which can help you in defining your goals and outcomes while developing your own resource management plan.

When starting your resource mapping process, it can be difficult to gauge which resources should be the focus of the mapping, which stakeholders should be involved and what goals should be prioritized. The difficulty arises from the fact that there is an almost innumerable amount of resource flows, stakeholders and goals which to choose from in the first place.

To guide policy makers, it is important to know there can be different reasons for start the mapping process. In this Roadmap, these reasons are termed considerations and should be considered as guiding principles. Having background knowledge about the reasons and considerations can help a city to make the right decisions within the mapping process.

## 1.2. Process steps

This roadmap identifies different process steps that allows a city to develop an inventory of resource flows within their city and, as such, gives valuable insights in the cities' metabolism. The steps are lined out below and each step will be further elaborated on:

- Step 1: Orientate on the city metabolism and project team
- Step 2: Set up a project team and determine the need for an advisor
- Step 3: Define the core and scope of the project/process
- Step 4: Draw up and get political approval for the project plan
- Step 5: Execute the project plan for mapping of resources
- Step 6: Select priority flows
- Step 7: Draw up the inventory report

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## Step 1: Familiarize yourself with the work field of circular economy

### Step 1

The starting point of your plan can originate from multiple angles. From the interviews conducted with experienced cities, different reasons have been identified, such as:

- a concerned policy officer wanting to make steps towards a circular economy;
- an initiative from a department responsible for sustainable development;
- an administrative instruction;
- the wish of or initiative from stakeholders.

Regardless of where or by whom the initiative was taken, it is important to gain insight in the actual work field, what is meant by circular economy or resource or material efficiency, urban metabolism and which substantive knowledge areas are associated with this. Subsequently, it can be determined how the project team that will be running the project could look like. The following questions will help you to do so:

- What is meant by the terms “circular economy”, “resource efficiency” and “city metabolism”?
- What are the principles of resource efficiency? What could and should (not) be included? (raw materials, energy, space, etc.)?
- What are the existing policies, goals and targets of your own, and other (governmental) organizations?
- Is the realization of a circular or a resource-efficient city only the responsibility of you or your department or are there also tasks and responsibilities (and thus opportunities to cooperate) with other departments in the organization?
- Should other people or departments be involved (knowledge, expertise, capacity) or directly related organizations and / or possible other stakeholders in the city?
- Should the impact of the project concern its own department, its own organization, affiliated organizations and / or other stakeholders in the city?
- What could/would be the scope of the project? Is it primarily aimed at creating awareness, or about organizing projects to tackle the barriers that hinder the application of circular principles, or to create insight into the resource flows in order to determine effective brokerage activities;
- Not all possible stakeholders have the same role, tasks or responsibilities or possibilities. Investigate which role stakeholders can, may and want to play and in which phase of the project and make sure that this is clear to all involved.

By all means, this list is not exhaustive and more questions can be taken into account. However, these questions help you to provide a first orientation in the field, content and meaning of the concepts of circular economy and raw material efficiency. They help you to prepare for the following steps.

## Step 2. Setting up a project team

### Step 2

Depending on the “outcome” of step one, a decision needs to be made about who should be part of the development process of the resource efficiency plan (which fields of knowledge, related internal departments and officers). Determine whether you think a single project team suffices or a project organization with multiple working groups (perhaps on special themes) is more appropriate.



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This can, of course, also be discussed with potential partners you want to involve in the development process. Assemble the project team and make sure everybody knows what to do, what the tasks and responsibilities are.

The outcome of the first two steps can be that not enough time can be freed up or that knowledge and expertise is lacking among the members of the project team and stakeholders. For instance, issues such as, determining common ground, project management or the inventory of resources etc. Therefore external knowledge, expertise and time can be hired.

## Step 3. Define the core and scope of the project/process

## Step 3

To determine the core and scope of the project plan the questions below should be addressed. In this way the implementation will provide the answers that have been determined in advance to be important. Because these can differ per city, the results can therefore also vary per city. Based on the experiences of other cities, the questions below are important in any case, however not exhaustive. It remains important to be critical and to consider whether other aspects may be of interest to your city:

### 3.1. Determine the definition, principles and goals of your plan

- a. Which definition of “circular economy” and “resource efficiency” will be used as general direction?
- b. Which (general) circular economy principles, goals (targets) and strategies are taken into account?
- c. Which circular economy, waste management or other affiliated policies (economic, climate, mobility, etc.) are already in place within the organisation and which goals have been set in these policy statements ?
- d. Which other governmental organisations on different levels (regional, national, EU, global) have formulated relevant policies and goals and do they need to be taken into account for this plan?

### 3.2. Determine specific city characteristics

- e. Identify the characteristics of your city to form an idea about the city metabolism.
- f. Identify the present political preconditions and make sure to take them into consideration;
- g. Check if other policy domains within the city administration (such as, energy, mobility, spatial planning, procurement etc.) have formulated objectives that may be related to resource efficiency or a circular economy and could be taken into consideration. Determine how they can participate in the project and contribute their knowledge.
- h. Find out about the current circular activities and initiatives by stakeholders in the city and who is involved;

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### 3.3. Determine within the main scope of the project/process.

- **Resource flows.** Understand the resource flows, their characteristics and impact to determine an effective and efficient approach to improve resource efficiency in the city;  
→ Follow all the steps in logical order.

#### Example city: Amsterdam (construction and biowaste)

##### The Netherlands

The national circular program shaped Amsterdam's choice concerning which value streams to focus on, namely construction and organic waste streams. Cities can use national circular programs and goals to choose own value chains and determine their own goals.

- **Enforcing Circular Policy.** Insight in resource flows is not a necessary requirement. Insight in (all) policy documents and targets related or supporting the circular economy or resource efficiency are inventoried. Strengthening the policy in the field of a circular economy or resources and efficiency can be achieved in two ways:
  - Existing policies and goals from affiliated policies can be used to realize circular policy or goals and
  - Policies based on circular ideas can be integrated into affiliated policy in order to further strengthen the current circular policy.→ After determining if and if so which stakeholders you want to involve (step 3.4) please move on to step 8 in pillar II.

#### Example region: Catalonia, Spain and

##### Example city: Maribor, Slovenia.

Catalonia was one of the few consulted stakeholders which did not map resources, however mapped plans, programmes and actions that are already being implemented by the government and are directly or indirectly associated with green and circular economy.

This can also help for instance to strengthen the policy in the field of a circular economy or resources and efficiency.

- **Creating awareness.** No insight in resource flows is required. Various types of (general) awareness campaigns can suffice.  
→ After determining if and if so which stakeholders you want to involve (step 3.4) please move on to step 8 in pillar II.
- **Remove barriers.** Even with little or no insight in resource flows, the parties involved can consult with each other to share which obstacles and challenges they face and which actions are needed to overcome these barriers.  
→ After determining if and if so which stakeholders you want to involve (step 3.4), please move on to step 8 in pillar II.

#### Example city: Charlotte (USA)

The policy offers of Charlotte assessed ways of removing the barriers because there was a lack of data to measure resource(s) and resource flows flowing through the city. By gathering stakeholders and addressing issues such as, increasing costs for waste management, the need for job creation and economic mobility.

There may be several reasons why the project team decides not to generate insight into the urban metabolism (resources), but to go straight to Pillar II to generate the brokerage activities (among which

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are creating awareness, lifting barriers or enforcing policies):

- The resource mapping has already been done or that priority sectors, chains or flows have already been selected;
- There is a lack of resources and capacity to carry out the inventory;
- The project team decides to do resource mapping at a later time;
- The choice of leaders (orders)
- There is a lack of data to determine the cities' metabolism

### 3.4. Determine the involvement of stakeholders.

Stakeholders can be any actor active in the chain (e.g. producers, product designers, recyclers, distributors, consumers, government, etc.) or other actors that have a direct impact on the circular economy strategy (such as entrepreneurs, academic institutes, financial institutions, etc.). To determine this, at least three aspects have to be taken into account:

- *Involvement Yes or No:*  
Make sure that the project team agrees on whether to involve the stakeholders or not and, in case they will be involved, in what phase of the processes/project this will be.
- *When to involve them:*  
In general, stakeholders can be involved in three phases of the project:
  - after establishing the project team and the decision whether stakeholders will be part of the project team (Pillar I, step 2);
  - when selecting the priority sectors or flows (Pillar I, step 6);
  - when the possible activities and actions per priority flow are determined (Pillar II, step 8).  
*This means that if Pillar II comes into play, the project team must reconsider whether and how stakeholders can and/or should be involved in the development process (see step 8).*
- *Which responsibility the stakeholders get:*  
Stakeholders can be involved in different ways. They can be asked to deliver an effort or can be asked to also be responsible to execute projects and achieve targets (could differ per phase).

### 3.5. Determine the desired insight in the cities' metabolism

Every city or region has a specific metabolism, although of course there are similarities each city or region has its own characteristic pattern of resource flows and associated impact.

That image can be created by answering the following questions.

- A. Which streams do I want to know more of and in what detail: water, air, material resources [plastics, paper, metals], waste streams, energy et cetera?
- B. Do I want to know ingoing and outgoing resource streams or also the material stocks stored within the city?

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- C. Do I want to know how the resource flows behave in the city itself?
- D. What kind of impact do I want to know (tons of resource, CO<sub>2</sub>, PM<sub>x</sub>, Nitrogen, economic value, jobs, land use, etc.)? Be aware: this point relates to point H
- E. Do I want an overview of the resources flows organized per stream, per sector or per chain?

**Geographical and time dimension**

- F. Do I limit the inventory of resources and impact to my city borders or do I extend it to the region, provincial, national or even global level, given our global economic society.
- G. Do I want to know the resource flow based on a snapshot or do I want to know the developments of past years or perhaps the predicted developments for the coming years (for instance housing developments)?

**(Local/global) environmental impact**

- H. Do I want to know the ecological and/or environmental impact of the streams?

**Economic/Social impact**

- I. Do I want to know the present economic value of the resource flows and resources stored in the city?
- J. Do I want to know what economic value can be created when the circularity of a resource is increased?
- K. Do I want to know whether jobs are created through increased circularity?
- L. Do I want to know which education opportunities come to existence as a result of increased circularity?



## 1. Identifying Urban Metabolism

### 1.1. Introduction

### 1.2. Process steps

### 1.3. Availability of data

### 3.6. *Based on the needed insight in resource flows determine which inventory method to use.*

Urban metabolism has different methods at its disposal to capture the cities metabolism. In the chart below, the most fitted method for policy makers is explained in further depth.

## Step 4. Write the project plan and get political approval

### Step 4

The project team (possibly with an advisor) draws up a project plan in which the choices of steps 1 to 4 are incorporated. The plan should contain: 1) why this plan has been drawn up, 2) concrete phases, 3) planning, 4) tasks, 5) capacity, 6) budget and 7) deliverables. It should furthermore also state whether an advisor is involved to assist the project team and why this is necessary. The project plan should therefore also state which activities will be outsourced.

#### **Make sure:**

*that your possible terms that have been given by politicians are taken into consideration in the project proposal (see item 1 in step 4). If no political preconditions have been given make sure that the preconditions are made clear when vying for political support. Political support is vital for all other steps in this process. For instance: involving stakeholders, execution of project, approval for budgets etc.*

## Step 5. Executing the project plan for mapping of resources

### Step 5

This step is not further specified because it concerns the actual implementation of the project plan. The implementation and planning is therefore taken up in the project plan itself, based on the results of the inventory.

#### **Be aware!**

*If external advisors are asked to draw up the inventory of resource flows they will probably have their own methods of generating, combining and calculating data. Make sure you get to know the data sources and the background on the calculations. Knowing this means that you are able to do this exercise yourself.*

## Step 6. Select the priority flows

### Step 6

Not all resources within a city can be changed into circular flows at the same time, simply because insight in flows or the effects of specific changes are not clear, available knowledge and/or capacity is lacking. Because transitions can take up to 20 to 50 years to take place it is important to prioritize the resource flows or perhaps the resources within specific sectors.

## 1. Identifying Urban Metabolism

### 1.1. Introduction

### 1.2. Process steps

### 1.3. Availability of data

## Step 7. Drawing up the inventory report

## Step 7

The report should contain;

- definitions
- goals, targets, aims
- result(s) of the inventory of the resource flows
- priority flows/sectors
- role of stakeholders
- visual map(s) (if necessary)
- data (sources), calculations, uncertainties of results etc.

### 1.3. Availability of data

Lastly, it is important to be aware of the availability of data concerning the resource flows you prioritize, as it allows you to monitor the impact of your interventions later on in the process.



2. Identifying Brokerage Activities

2.1. Introduction

2.2. Process Steps

## 2. Identifying Brokerage Activities

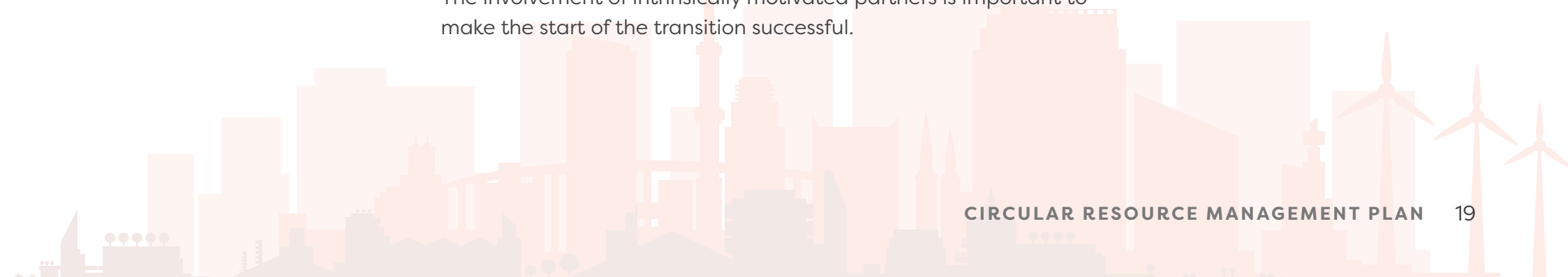
# 2

### 2.1. Introduction

The changeover or system change, for example from a linear to a circular economy, requires a long transition period. Often, the need for a shift is obvious and necessary, but how this should be done, what the end result will look like or what the characteristics of the required system are is unclear.

Because the new, required system, of which we do not exactly know how it needs to function, is not yet in place, the contribution of interventions to the new system is difficult to interpret. At the same time we need to assess the effects the interventions have on the breakdown of the present unwanted system. This, and other issues, makes that transitions have a high degree of complexity and uncertainty and are therefore not fully malleable. That is why it takes about one to two generations (20 to 50 years) to completely change a system.

Transitions are commonly not well-suited for an inflexible, hierarchical top-down approach due to a lack of information and difficulty with timing interventions. As such, one actor wanting to make a change, might lack the required information or data to design appropriate activities. Moreover, it might be difficult to respond timely to the complex changes that could occur in the city with the involved stakeholders. Therefore, this transition approach is designed to involve and support city administrators and other stakeholders to commonly work out a method to contribute to ambitious sustainable goals. In the first phase of the transition process, the crux lies in experimenting and learning; learning by doing. That is why it helps to involve partners who have experience with creative, product development or circular economy projects, and are willing to initiate the changes themselves. The involvement of intrinsically motivated partners is important to make the start of the transition successful.



## 2. Identifying Brokerage Activities

### 2.1. Introduction

### 2.2. Process Steps

After the design process of the project team and the selection of stakeholders, a start can be made with developing a program in which concrete projects are developed that are actually implemented (Pillar II) and whose progress and results are being monitored and evaluated (Pillar III).

## 2.2. Process Steps

After the cities' resource metabolism has been identified and the priority material flows, sectors or chains have been selected, it is necessary to determine what can be done to set the transition in motion. A wide variety of activities will have to be developed to shape the transition. These activities can differ per city, based on the characteristics and ambitions of the city and on the parties involved. Therefore, an approach has been developed in which activities are specifically targeted on city level, based on the principles and strategies for each priority material flow.

The intention of the upcoming process steps is to develop activities that are concrete, supported by the stakeholders involved with their implementation and are in line with the objectives, ambitions and goals that have already been set or have been set in Pillar I. This also means that possible barriers have to be determined, addressed and resolved. Creating support among all involved is of the utmost importance. It is therefore important that the parties that are likely to be involved in the implementation are, preferably, also involved in the development of these activities.

After having identified the most promising activities, the next step will be to determine their impact and feasibility. Based on the outcome of this exercise, these activities are transformed into concrete and workable projects. This leads to the process steps mentioned below:

Step 8: Identify promising activities

Step 9: Select most promising activities

Step 10: Develop SMART projects

Step 11: Implementation program

### Step 8: Identify promising activities

### Step 8

The development of measures to convert linear raw material flows into circular can be done at different "levels", for example only for your own organization.

#### **Example city: Maribor, Slovenia.**

*The city of Maribor circular economy plan was based on a cooperative network of organisations closely related to the municipality and actions closely related to their policy areas (like reuse of soil and construction materials, sustainable urban transport)*

Of course it can also be done together with external stakeholders, such as social organizations, citizens and/ or business. To develop concrete actions for the priority flows you have selected and change the way these resource flows behave in a city, it is necessary to specify the main strategies for altering linear resource flows into circular flows. The circular strategies have been briefly mentioned in the preface. When translating the model of the Ellen MacArthur foundation and the Value Hill, the following hierarchy emerges, the multi-R strategy or also known as the R-strategy (see the figure below).



2. Identifying Brokerage Activities

2.1. Introduction

2.2. Process Steps

## Strategies in a circular economy

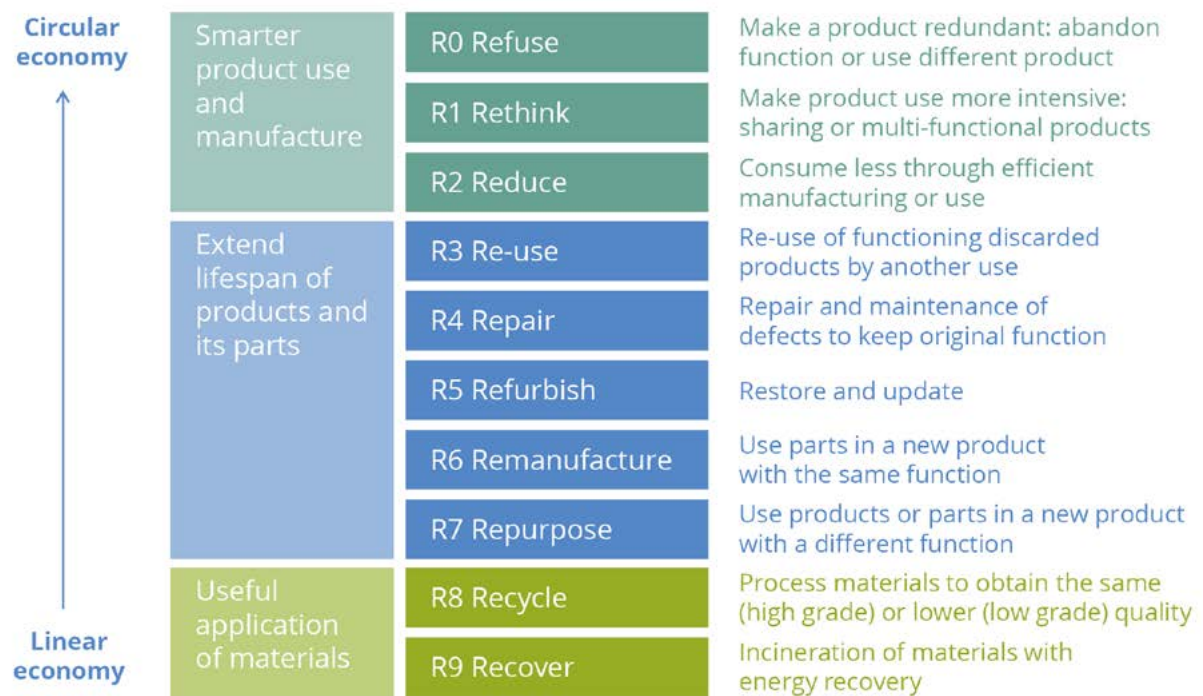


Figure 8: R-Strategies: Circular economy strategies.

Promising activities can be identified by specifying the multi-R strategy per priority material stream/sector or chain. An advisable way of doing this, is by organizing a brainstorm session. Especially for this step, it is important to keep in mind that creativity is essential for generating as many viable ideas as possible. In Appendix 1 a table is designed to moderate the workshop, structure the discussion (based on Multi-R strategy) and facilitate creativity as much as possible. It also offers a format to collect all results in a structured way.

It is important to engage those organisations directly involved in the development process, in order to strengthen the accuracy, involvement in both the development of the measures and their implementation. To identify the promising activities, it is important to involve relevant and suitable stakeholders for each selected priority resource stream/sector/chain. It is preferable to look for stakeholders which are known to be intrinsically motivated and willing to take action.

The outcome of the brainstorm should be a list of list of activities that the participating stakeholders feel that it's worth executing. A selection of found practices is mentioned below:

## 2. Identifying Brokerage Activities

### 2.1. Introduction

### 2.2. Process Steps



Figure 9: Mini recycling stations in Norway

### Marketplace and commodity bank (digital trading platform)

- Facilitate temporary storage sites for materials, such as fallow areas (material “showroom” / raw material bank) by land allocation
- Facilitating role to set the conditions to which materials should adhere to be recycled

### Sharing knowledge about the circular economy

- Set up a project group within the municipality/local government (to discuss, debate, share knowledge, make up plans etc.)
- Set up an entrepreneur helpdesk
- Collaboration of all stakeholders (companies, municipality, consumers)
- Manage a coordination platform for guiding the circular economy (interaction of knowledge between different sectors/actors)

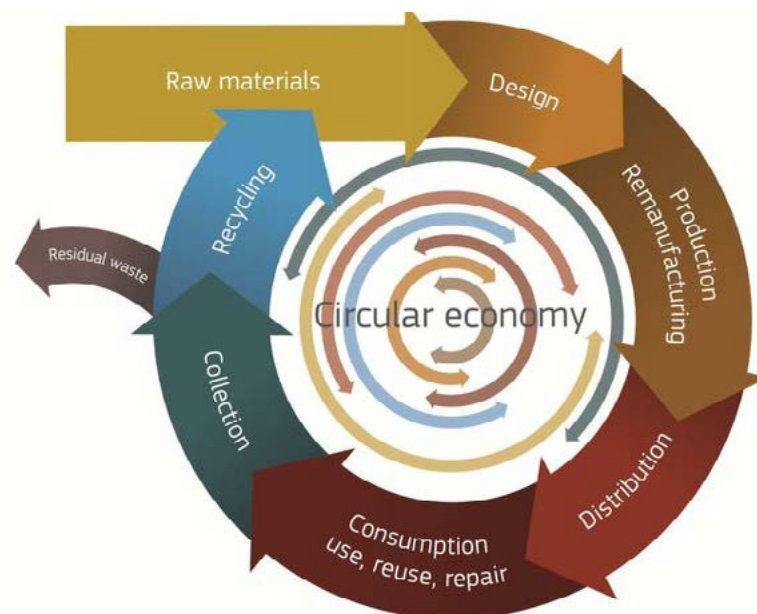


Figure 10: Circular Economy model

## 2. Identifying Brokerage Activities

### 2.1. Introduction

### 2.2. Process Steps

## Step 9: Select most promising activities

## Step 9

The list of promising activities, resulting from the brainstorm session, will probably contain all kinds of projects that have been developed to a greater or lesser extent. It will probably be unclear what the impact of these activities are, whether they are feasible and what it takes to carry them out. That is why the promising activities have to be charted step by step. To translate the promising activities into workable and executable activities, it is important to determine the possible impact and feasibility of the activities.

### **Determine the impact**

- *By quantifying*

In order to determine the effects that executing the promising activities the change of the impact criteria (social, economic, environmental, ecological) has to be made based on the selected impact criteria in Pillar I (Step 3.5). The quantification of the promising activities should be carried out by the same team that has performed the inventory. This team has access and is familiar with the data and the calculations and should therefore be able to calculate the impact of the activities.

- *By qualifying*

Quantifying is often the best option. If quantifying is not possible due to missing data or a lack of funding (required to the inventory) the second best option is to estimate the impact of the activities by scoring them points. For instance.: using recycled plastic for bottles has 1 very little (1), a little (2), average (3), much (4) and very much (5) effect on the impact. The impact could be number of jobs or reduction of CO<sub>2</sub> or use of virgin material. The scoring should be done by experts and people directly involved with the action.

### **Determine the practicability**

The practicability of the activities is assessed on the basis of two aspects:

- Assessing the challenges / barriers (which the activities face)
- Assessing the availability of tools.

### Challenges

The roadmap distinguishes four main categories of challenges that must be overcome:

- Institutional (existing habits and interests);
- Technical innovation (production changes; new focus on energy & resource use, choice of materials and design);
- Economic (focus on current business models, lack of finance);
- Social (lack of knowledge & education);

Based on the inventory and interviews with the experienced cities, other challenges were identified:

- Organisational (no coordination and leadership);
- Legislation (aimed at preserving the current system);
- Knowledge (no/less insight in type, amount and costs of resources and profitable waste);
- New balances (new partners, coalitions and markets);

## 2. Identifying Brokerage Activities

### 2.1. Introduction

### 2.2. Process Steps

## Tools

The second aspect when determining the practicability of projects is the availability of tools or measures. Tools have the ability to change the present linear flows into circular flows and can be divided into direct and indirect tools.

### *A. Direct tools*

Direct tools are based on statutory tasks (in a governmental body) which involves procurement, waste management, spatial planning and, of course, internal policy. For businesses, tools can be part of the core activities and is about purchasing, production, and product design.

### *B. Indirect / stimulating tools*

The aim of these tools is to get parties to move in the direction that is desired on a voluntary basis and for which there is no legal basis. This can be done for example in a cooperative form, by facilitating partnerships or networks and by bringing these networks together. This can also mean the implementation of targeted subsidies or by setting up targeted communication.

## Workshop approach

Making a selection of the activities on the basis of the impact and feasibility is, except for the quantitative impact assessment, not exact science, rather a matter of common sense and discussion with stakeholders. The way to perform this step is by means of a workshop-like approach. If the changes of impact need to be determined in a more qualitative way, an initial workshop (workshop 1) is required to determine the impact of the promising activities. If the impact has quantitatively been determined then only one workshop (workshop 2) is needed.

### **1st workshop**

If no quantitative impact assessment is available, in a workshop setting the impact of the promising activities can be determined in a qualitative way. As mentioned under “determine the impact”, the expected impact can be determined by scoring the expected change characteristics from 1 to 5. The scores can be awarded by the parties involved in the development of the promising activities or, if desired, by experts that are directly related to the activities.

### **2nd workshop**

In this workshop, the outcomes of workshop 1 are assessed in relation to possible challenges that might arise when executing the activities and on the tools that are available to actually implement them. Keep in mind that there are multiple options or that an activity can be placed in the table multiple times. This can be very sensible, because the use of multiple instruments makes it easier to develop an activity.



## 2. Identifying Brokerage Activities

### 2.1. Introduction

### 2.2. Process Steps

In order to determine the workability of the most promising projects, the activities need to be assessed on their feasibility. This is done in step 10 by subjecting the activities to the SMART criteria for the development of executable projects.

## Step 10: Develop SMART projects

## Step 10

Enabling projects to be properly implemented and managed, it is advisable to formulate them in a smart way. Translating the activities to SMART projects means applying SMART principles. SMART meaning: Specific, Measurable, Achievable, Realistic and Time-bound. The best way to do this is with the parties and stakeholders that are needed to execute these SMART projects and that are directly involved with the concerned resource flows.

The following example guides you to formulate a SMART goal: “Attracting circular textile startups to the city to stimulate re-use of textile” is not “SMART”. It should therefore be more like: “Attracting two or more circular startups to the city in 2020, which remanufacture, repair and re-use old textiles in order to achieve reduction of discarded textiles that prove to be financially healthy within the next three years.”

The SMART principles are explained below:



**Specific:** the goal of the project should be clear and concise. Ask yourself the W questions (what, when, where, who, why)

**Measurable:** measuring results is necessary to see if there is improvement. This helps to see if there are benefits, such as new (circular) jobs and less wasted clothing.

**Achievable:** be aware of the strengths and weaknesses of stakeholders involved. Make sure that the circular startups set realistic goals in what they want to achieve.

**Realistic:** goals should be reachable, such as having enough knowledge and funding. The local administration can support the circular startup by providing funding.

**Time based:** does not only mean setting a deadline, but also set limits to capacity (available hours). Within the next 3 years (e.g. measuring every year). but also how much time (hours) are available from which organisation to try and achieve the goals.

Converting most promising activities into SMART projects, is best done per priority flow by an activity leader. Because the activity leader will probably not be able to solely convert the activities into SMART project (s)he will need the support of relevant stakeholders to participate in this process. it is recommended to select stakeholders who may also be involved in the actual implementation phase (possibly in different roles: initiators, funding, regulations, etc.)

## 2. Identifying Brokerage Activities

### 2.1. Introduction

### 2.2. Process Steps

To create a common ground and commitment, all stakeholders need to be involved in translating the most promising activities into SMART projects. In this way, possible future misunderstandings are avoided as much as possible and is likely to ensure cooperation in the execution.

The output of this step will be a number of smartly formulated projects with an associated project team, which has indicated its willingness to be involved and held responsible for the implementation of the projects.

## Step 11: Implementation Program

## Step 11

The project team will translate the information (like: goals, planning and capacity and costs) from the smartly formulated projects into an implementation program. The implementation program and list of smart formulated projects will be discussed in the project team in order to determine which projects will be executed. Criteria for determining which projects will be executed, and therefore to be included in the implementation programme, could be impact, costs, manpower, knowledge, subsidies, availability of tools et cetera. It is the responsibility of all partners to take part in the discussion and perhaps even to discuss how potential execution problems can be solved by others (for example: high costs could be resolved by subsidy).

The project team also ensures that a monitoring team is composed of members of the project team and the project leaders. The monitoring team meets regularly to discuss the progress of implementation in all its facets and to give feedback to all involved. In addition, it can act as an intermediary in the event of possible problems. It is therefore advisable to make sure that there are people present who are able to fulfil this overarching function.



3. Identifying a Monitoring and Evaluation System

3.1. Introduction

3.2 Process steps

# 3. Identifying a Monitoring and Evaluation System

# 3

## 3.1. Introduction

Measuring the performance of cities in their shift towards a circular economy provides an opportunity for cities to self-assess their achievements and to adapt their development trajectory towards circularity accordingly.

Monitoring and Evaluation together refer to the observation process of activities, moments of reflection and feedback mechanisms that ensure that stakeholders get insight into the progress, processes, relevance, efficiency and / or sustainability of their interventions, results, the need for continuation and the contribution to the system transformation. Monitoring and Evaluation enables learning and gaining new insights which help with the development of new strategies, interventions, projects and/or programs that contribute even better to the set goals. This is even more important if these activities are aimed at achieving system transitions. Although monitoring and evaluation seem alike, there is a distinction:

### Monitoring

A continuous process of tracking and reviewing interventions, project progress and planned and unplanned outputs. With monitoring, the emphasis is more on achieving results: project leaders are often asked to account for time, public money being used, to show for the results of an intervention. Which criteria are used in this regard depend entirely on the agreements made by all partners involved in the development of the smart formulated projects.

Ideally, monitoring is a permanent part of project or program management. Lessons arising from monitoring should be used to adjust the planning of activities or to develop new activities. It is therefore directly related to Pillar II. To monitor any progress and results of the implementation plan resource efficiency indicators are required. An

### 3. Identifying a Monitoring and Evaluation System

#### 3.1. Introduction

#### 3.2 Process steps

Indicator being a number that is a reliable indication of the value of something.

### Circular economy monitoring framework

#### 1 EU self-sufficiency for raw materials

The share of a selection of key materials (including critical raw materials) used in the EU that are produced within the EU

#### 2 Green public procurement

The share of major public procurements in the EU that include environmental requirements

#### 3a-c Waste generation

Generation of municipal waste per capita; total waste generation (excluding major mineral waste) per GDP unit and in relation to domestic material consumption

#### 4 Food waste

Amount of food waste generated

#### 7a-b Contribution of recycled materials to raw materials demand

Secondary raw materials' share of overall materials demand - for specific materials and for the whole economy

#### 8 Trade in recyclable raw materials

Imports and exports of selected recyclable raw materials



#### 5a-b Overall recycling rates

Recycling rate of municipal waste and of all waste except major mineral waste

#### 6a-f Recycling rates for specific waste streams

Recycling rate of overall packaging waste, plastic packaging, wood packaging, waste electrical and electronic equipment, recycled biowaste per capita and recovery rate of construction and demolition waste

#### 9a-c Private investments, jobs and gross value added

Private investments, number of persons employed and gross value added in the circular economy sectors

#### 10 Patents

Number of patents related to waste management and recycling

Figure 11: Indicators set on CE on EU level

For instance: The number of new small businesses is a good indicator of the expected growth in employment. At the moment, there is no general accepted and/or prescribed set of circular economy indicators at the urban or regional level. Figure 11 shows the set of indicators on circular economy that has been developed at the European level.

Besides this list of indicators, a lot of initiatives have developed additional indicator(sets). An extensive overview is given in “Indicators for circular economy (CE) transition in cities - Issues and mapping paper”, by The Urban Agenda for the EU on Circular Economy. Developing a specific set of indicators for cities demands for a broader coordination and falls at present outside the scope of this roadmap.

## Evaluation

Evaluation is a periodic assessment of the relevance, effectiveness, contribution, sustainability and / or efficiency of the intervention(s), project(s) or program(s). Evaluation creates more clarity about the progress of certain processes, especially if these projects or programs aim to contribute to (system) innovation and transition. Lessons from evaluations are often used to adjust the strategy or for external accountability.

The process steps below will assist cities in developing a monitoring and evaluation system to adequately monitor the execution of the projects in the implementation plan which resulted from pillars I and II. This ultimately allows cities to steer these projects in alignment with the transition process.

### 3. Identifying a Monitoring and Evaluation System

#### 3.1. Introduction

#### 3.2 Process steps

## 3.2 Process steps

The next steps elaborates on the development and execution of the monitoring and evaluation framework.

### Step 12. Designing the monitoring and evaluation system

#### Step 12

The project team is responsible for the development of a robust monitoring and evaluation framework along with the appropriate indicators. It is recommended to appoint a special working group, the members of which come from the project team, possibly supplemented by experts. This working group draws up an advice on how to monitor and evaluate. In order to develop a framework and a set of indicators that has the approval of all relevant and involved stakeholders, the working group could organize workshops with relevant stakeholders to discuss the preferred pre-selected indicators.

Furthermore, it needs be determined who will be in the lead/responsible for drawing up the monitoring and evaluation report(s) and who will supply what kind of data so that the monitoring and evaluation report(s) can be drawn up.

The advice of the working group should consist of:

- A schedule for monitoring and evaluation.
  - Preferably, the monitoring will be done continuously and be reported on a yearly basis. This monitoring should focus only on the progress and result of the projects in the implementation program;
  - Evaluation can be done at the end of the implementation period. This not only means discussing the results of the projects but also discuss the process of transition that has been set in motion by executing the implementation program (see step 14);
- How to handle deviations in the project execution;
- Reporting template;
- The working group needs to make sure that the specific wishes of the project team and perhaps other relevant and important stakeholders is respected;
- A monitoring framework with indicators.

The monitoring framework consists of three levels. These levels correspond to the three levels on which the roadmap is built on, namely a) the political level, b) the executive level and c) the level of urban metabolism. Every level is explained below.

**1. Policy level:** At this level, the political goals of the city and its organisation and the effort (manpower, resources) put in to achieve those goals are stated. In this regard, goals and indicators are overlapping. Whereas goals are fixed numbers (50% reduction of virgin materials by 2030), do indicators refer to the contribution that has been made to achieve set goals. These indicators can be used in different ways (long, short term, internal external) and can relate to metabolic indicators as well as to executive indicators. Indicative examples are:

Long term policy goals for the city:

- x % Increase in recycled household waste as per year;
- x % increase in direct jobs in CE as per year (identify by 5-digit SIC-code);
- Level of public awareness for circular economy and waste prevention.

Short term policy goals/indicator:

- Developed investment fund for circular start-ups;
- Functioning network for re-use of construction materials;
- Realised a resource centre;
- Realised a digital and physical material exchange platform.

Internal policy goal/indicator:

- Share of major procurement that includes environmental requirements;



### 3. Identifying a Monitoring and Evaluation System

#### 3.1. Introduction

#### 3.2 Process steps

- Setting up the circular economy department with X fte;
- Availability of a CE strategy at city level.

**2. Project level:** The indicators at this level are linked to the results of the execution of the projects and have been set in step 10 when determining the SMART projects (Pillar II). Project indicators could be:

- Goals realized within the agreed time;
- Goals realized within the agreed budget;
- The specific project goal has been achieved.

The projects in the implementation program can of course be aimed at the short term or long term, externally or internally. For this level of indicators that is of no concern. The indicators at this level should only be focused on monitoring the project execution.

**3. Metabolic level:** The implementation of the projects in Pillar II influence the metabolism of a city. The indicators at this level indicate the level of circularity or circular resource efficiency of the resource streams. Indicators can be set per unit (e.g. capita or time) or per set date. Examples of metabolism indicators are mentioned below:

- x % reduction of annual amount of solid waste (domestic and commercial);
- x % increase in use of renewable energy;
- x % reduction of use of virgin materials per 2030

Of course, the indicators can also be set per stream (e.g.: x % reduction of use of virgin steel)

## Step 13: Monitoring the execution of the projects

## Step 13

During the entire implementation period, monitoring will take place. Whenever adaptation is necessary, it should be undertaken. If political commitment or support is needed for adaptation, the project team should act accordingly.

Preferably a request for adaptation of the execution of project(s) should be done at the same time the regular progress report is drawn up. It is advisable to draw up a progress report regularly (every year).

The monitoring does not only concern the actual progress (use of resources and results), but also how the projects are being executed. Consider the following questions when monitoring:

| Type of Results       |                                | Monitoring questions  |
|-----------------------|--------------------------------|---|
| <b>Project output</b> | Direct results of the projects | <p>Did we do what we have agreed to? Are we proceeding according to schedule? Are the expectations met? Do the projects have side effects? What are the side-effects</p> <p>Can the project costs and hours be justified? Is there a good balance between costs and benefits? Could results have been achieved with less resources?</p> <p>What type of results do our interventions have at different levels? Which changes occurred? To what extent do short and medium-term results contribute to the ultimate goal? Are the indicators specific enough? How did the adaptations (if applicable) work out?</p> |

Figure 12: Overview of monitoring questions

At the end of the implementation period not only should the execution of the projects be assessed but also the contribution and impact of the projects to the transition. In this way, a well-founded advice can be given on how to shape the next phase in achieving circular resource management. In the following section the evaluation method is discussed in further detail.

3. Identifying a Monitoring and Evaluation System

3.1. Introduction

3.2 Process steps

Step 14: Evaluation

There is no direct, ready-made answer how to determine the progress of your transition. However, a tool that can be used to generate an indication of the phase the transition is in, is described below. This is done by dividing the transition into phases, determining the nature of the projects and locating them to the relevant transition phase. The “nature” of the project is derived from the goal of the project. The nature and relative number of projects in a phase of the transition is an indication of the overall status of the transition. The layout is based on the transition X-curve.

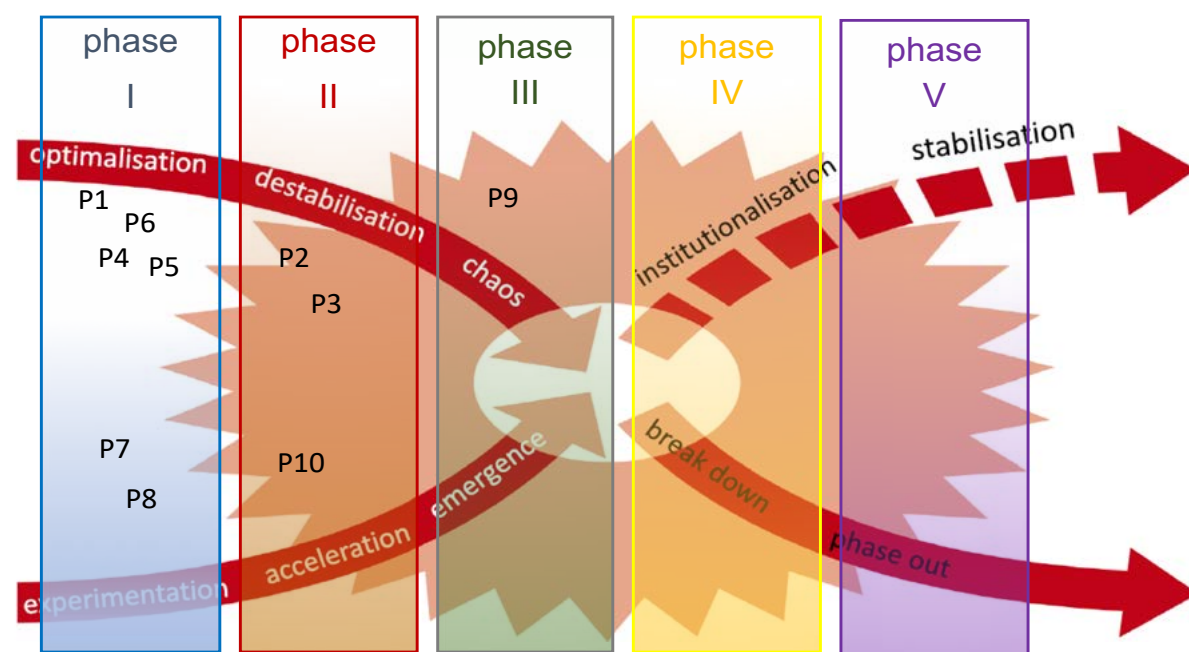


Figure 13: The division in transition phases in the transition X-curve

This approach only offers a method to get a general impression of the phases and offers insights to steer the nature of projects that could/ should be developed in a subsequent roadmap cycle. For instance, in this example most projects are aimed at experimentation and optimisation and therefore located in phase I. Based on the evaluation it could be determined that, for instance, for construction material new projects could be aimed at acceleration (prescribing a higher % of recycled material in new buildings) or destabilisation (a project on how to avoid use of virgin construction materials).

This qualification system only provides a very limited assessment on the status of the transition. It does not say anything about the impact projects have on the transition, possible alterations occurring within the system, the contribution of the projects to these alterations or the interaction of stakeholders as a reaction to these changes.

### 3. Identifying a Monitoring and Evaluation System

#### 3.1. Introduction

#### 3.2 Process steps

## Workshop

Interactions in a new system cannot be predicted and therefore, it is recommended to learn about them when evaluating the outcome and impact of the projects. Evaluating transitions is a developing science for which no standard set of indicators is available. In order to dive deeper into the change process and the responses accompanying it, it is important to ask additional questions to all stakeholders involved in the implementation. This can be done in an interview in which partners interview each other in order to learn about each other's experiences and what they think might be the next appropriate steps to take. Therefore, this is not about "hard data" but more about how the process is experienced, what people see, what works and what doesn't, how they react, how other stakeholders react to this and what people think about the future.

Of course, the overview on the transition phase is a good starting point for the interviews and discussions. The results of the interviews and discussion afterwards should be reported and used to design the next cycle of the roadmap. Examples of relevant questions (on different levels) that are applicable when evaluating are presented below:

| Type of Results        |                                      | Evaluation questions   |
|------------------------|--------------------------------------|--|
| <b>Process outcome</b> | Results brought about by the output. | <p>What changes in thinking and acting can be observed among stakeholders, organizations, networks?</p> <p>Are the changes of our projects permanent or temporary? Are the results and functions of the project being taken over by others? Are there perhaps other initiatives that (also) contributed to the process outcome?</p>  |
| <b>Impact</b>          | Effect of the outcome                | <p>Is the change going in the right direction? Are the results exploited by the target group and picked up by other institutions or initiatives? To what extent does the project contribute to the system change? What changes do we see in the long term? Are we on our way to?</p> <p>How do the projects contribute to changes at the levels of output, outcome and impact? Do the projects contribute in the way and in the place that we expected? What lessons do we learn about the steps we take? What does that mean for the following steps?</p> |

Figure 14: Overview of evaluation questions

The aim of the evaluation is to stimulate a reflexive learning process. Through the fundamental process of learning by doing, not only knowledge and new perspectives on the transition will be developed, but it will also help to develop innovative and more feasible projects for a new implementation program to speed up the transition process.

As mentioned before, a resource efficient city, will not be achieved by running the roadmap cycle once. It will take stamina and perseverance to run the cycle multiple times. Although it is impossible to predict how often the roadmap cycle should be repeated, it is clear that with every cycle the objective of circular resource efficiency is getting closer. To start a new roadmap cycle, start at [Step 4](#).