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Urban Living Labs

A living lab way of working

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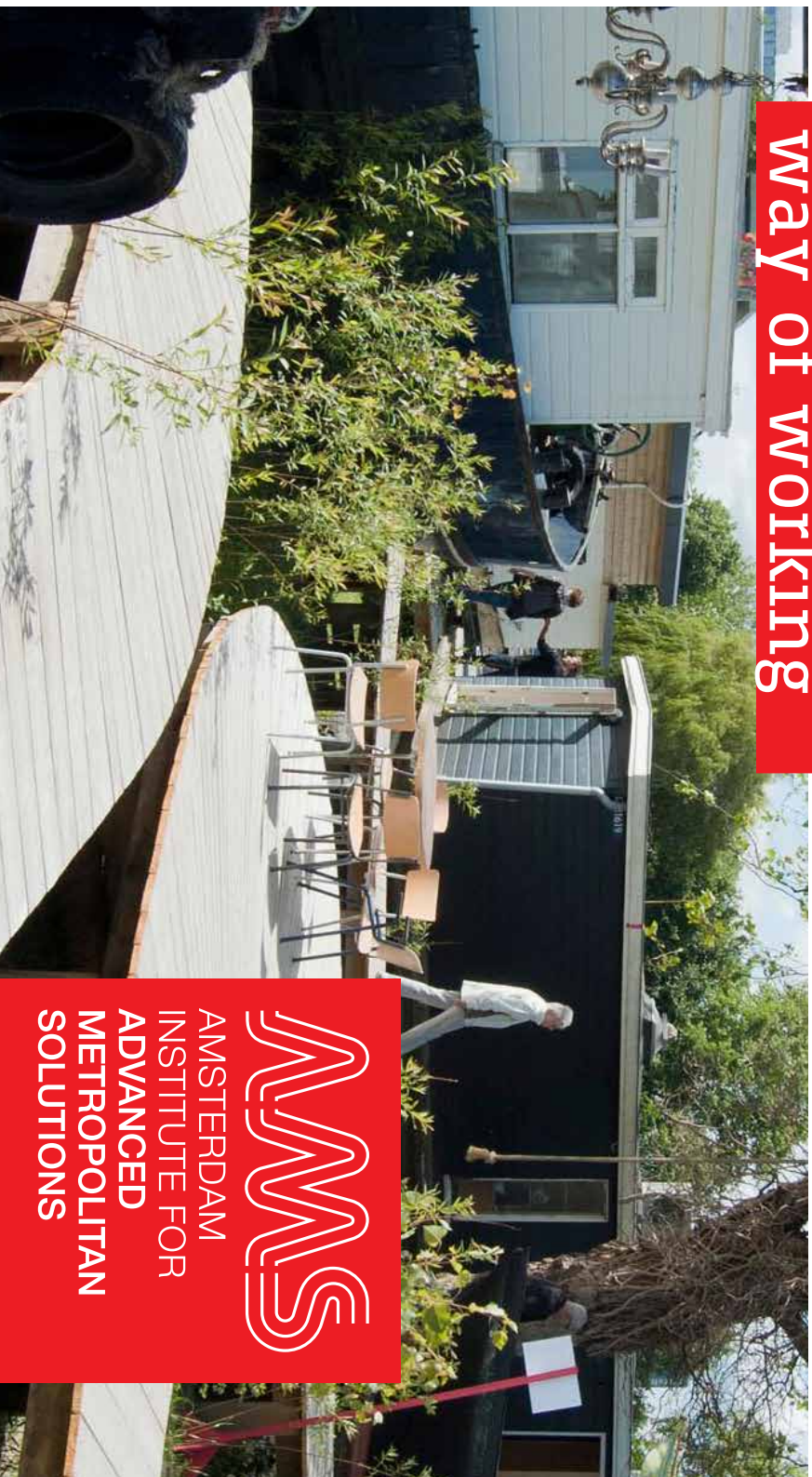
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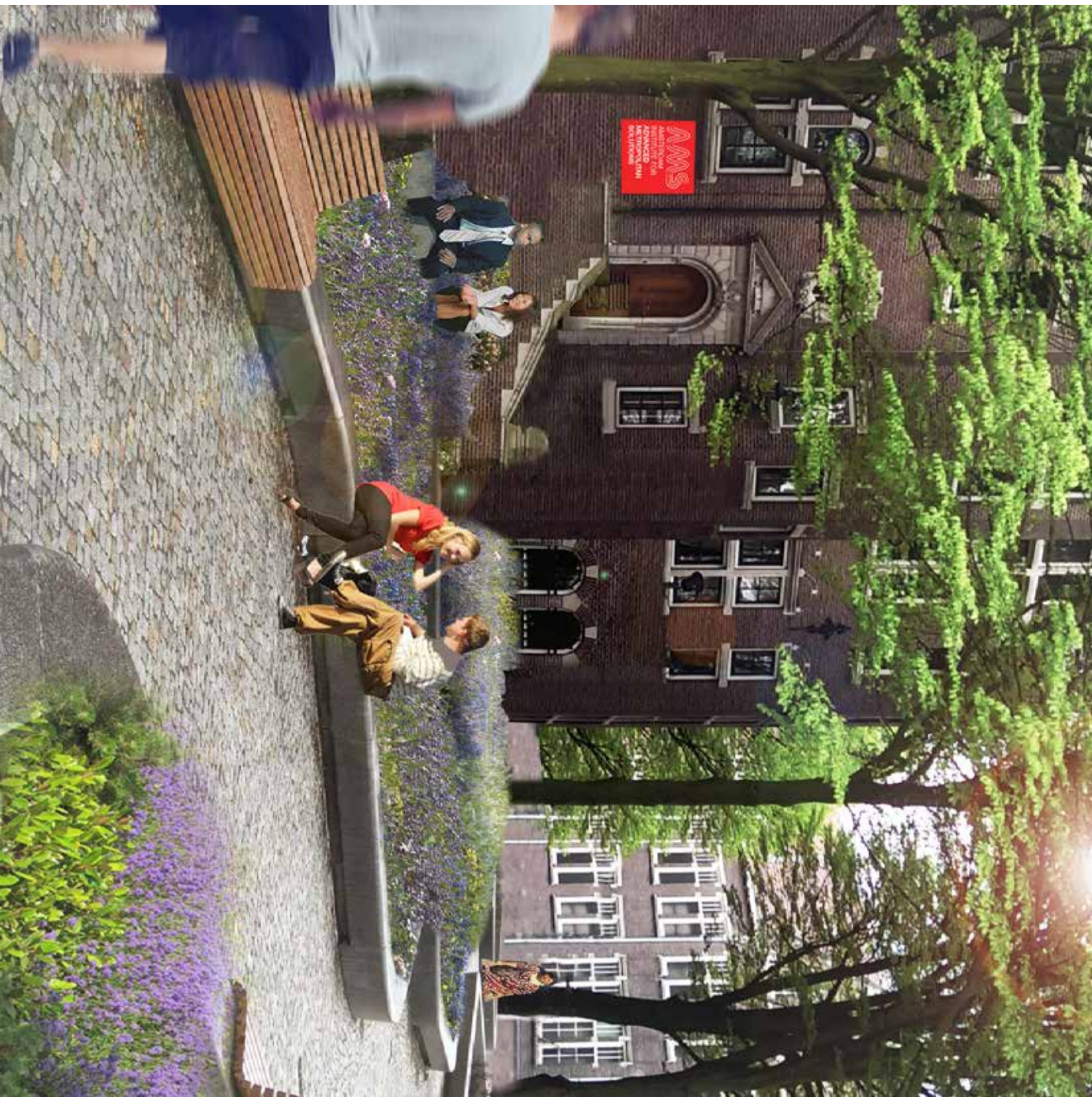
Urban Living Labs

A living lab

way of working



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Urban Living Labs

A living lab

way of working

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June 2017

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Contents

4	Preface	24	Chapter 2	82	List of figures
8	Chapter 1	28	A living lab way of working	84	List of visuals and sources
	What are urban living labs?	36	Step 1. Initiation		
		46	Step 2. Plan development		
			Step 3. Co-creative design	86	Appendix I
	Intermezzo				
16	Innovation “Ceuvef”	56	Intermezzo	91	Colophon
18	Innovation “Manifesto Circular Buiksloterham”		Innovation “Cross Chain Control Centre”		
20	Innovation “Hemelswater CODE BLOND”	58	Innovation “Online platform Gebiedonline”		
22	Innovation “Urban Solution Sloterdijk III”	60	Step 4. Implementation		
		66	Step 5. Evaluation		
		70	Step 6. Refinement		
			Intermezzo		
		72	Innovation “The ArenaA Battery”		
		74	Innovation “Sustainability Company ZOEnergy”		
		76	Step 7. Dissemination		
		80	Step 8. Replication		

Preface

AMS Institute is an internationally leading institute where talent is educated and engineers, designers, and natural/social scientists jointly develop and valorize interdisciplinary metropolitan solutions. We work as a networking organization, initiating platforms with local and international partners, both private and public, and above all with citizens and users.

Our mission is to develop a deep understanding of the city – **sense the city** – to design solutions for its challenges, and integrate these into Amsterdam's metropolitan area. Our research focuses on applied technology in urban themes such as water, energy, waste, food, data and mobility, and the integration of these themes in the urban domain, either through the design and engineering of concrete developments and projects, or in its governance.

The multidisciplinary nature of this research and education makes that it is important to include a step in between fundamental research at our founding universities Delft University of Technology, Wageningen University and Research and Massachusetts Institute of Technology, and society wide implementation. The analogy of the Triple-Jump ('Hop-Step-Jump') symbolizes this. In this analogy, the Living Lab approach forms an important in-between-step to achieve more impact faster, and above all a better society-wide implementation. The Living Lab approach, despite requiring a substantial effort in organization, facilitates the process of collecting information and data, sharing and integrating expertise from different academic fields, and testing and evaluating tools and the results of the research within the double complexity living environments comprise.

Urban living labs have become a trend in cities all over the world. The term is used to refer to a wide variety of local experimental projects of a participatory nature. The aim is to develop, try out and test innovative urban solutions in a real-life context. The wide variety of forms and focuses of urban living labs, however, makes more and more cities and citizens wonder what exactly urban living labs are and how they can be set up. In our view, the living lab concept embraces an extensive range of activities and it is regarded as an approach that involves actors in a process of co-creation that potentially facilitates the construction of innovative values.

A common definition of a Living Lab approach seems to be far from established. However, several authors have pointed out fundamental characteristics. Comparing different research approaches (Lab research, Action research and Living Labs), Higgins & Klein (2011), give a basic description of the key elements that constitute the specificity of a Living Lab approach. The first characteristic relates to the work subject, which has to be placed in a real-world setting, in which multiple stakeholders from multiple organizations and expertise interact. Secondly, the users play an active role as co-innovators in order to 'create, prototype, validate and test products, services, systems and technologies in a real-life setting' (Westerlund & Leminen, 2011). Thirdly, research teams are actively involved in the research setting facilitating the multidisciplinary dimension to achieve the goals. Finally, the last key characteristic is the collaboration in this physical and virtual space of interaction in order to create the desired outcome. In conclusion, real-life setting, active roles of users/researchers from multiple-disciplines, and active collaboration, are considered essential elements to achieve the goals of the research in the context of urban transformation process (Maiullari, 2017).

This report presents a simple methodology for setting up urban living labs. It is based on an analysis of scholarly texts and documents and on an analysis of 90 local experimental projects in the Amsterdam region. The following chapters introduce a definition and a step-by-step approach to urban living labs: a living lab way of working.



According to N. John Habraken, “intimate and unceasing interaction between people and the forms they inhabit uniquely defines the built environment”. His central argument is that the built environment is universally organized by the orders of Form, Place and Understanding, corresponding roughly to physical, biological and social domains. Within the double complexity of (urban) living environments these domains meet and sometimes clash. This makes that the in between step of real life research with its multiple stakeholders, in a co-innovating inclusive setting – or living lab – is crucial to achieve metropolitan solutions with impact, that will be adopted smoothly and swiftly by all involved, and thus help achieve prosperous living environments that are more livable, sustainable, resilient and just. A clear methodology to set up such research settings is conditional. Besides giving an extensive overview of Amsterdam region based projects from the scope of living labs, this report provides an excellent starting methodology for a scientifically sound setup of living labs.

Enjoy reading, and apply this to your work.

Arjan van Timmeren

Scientific director

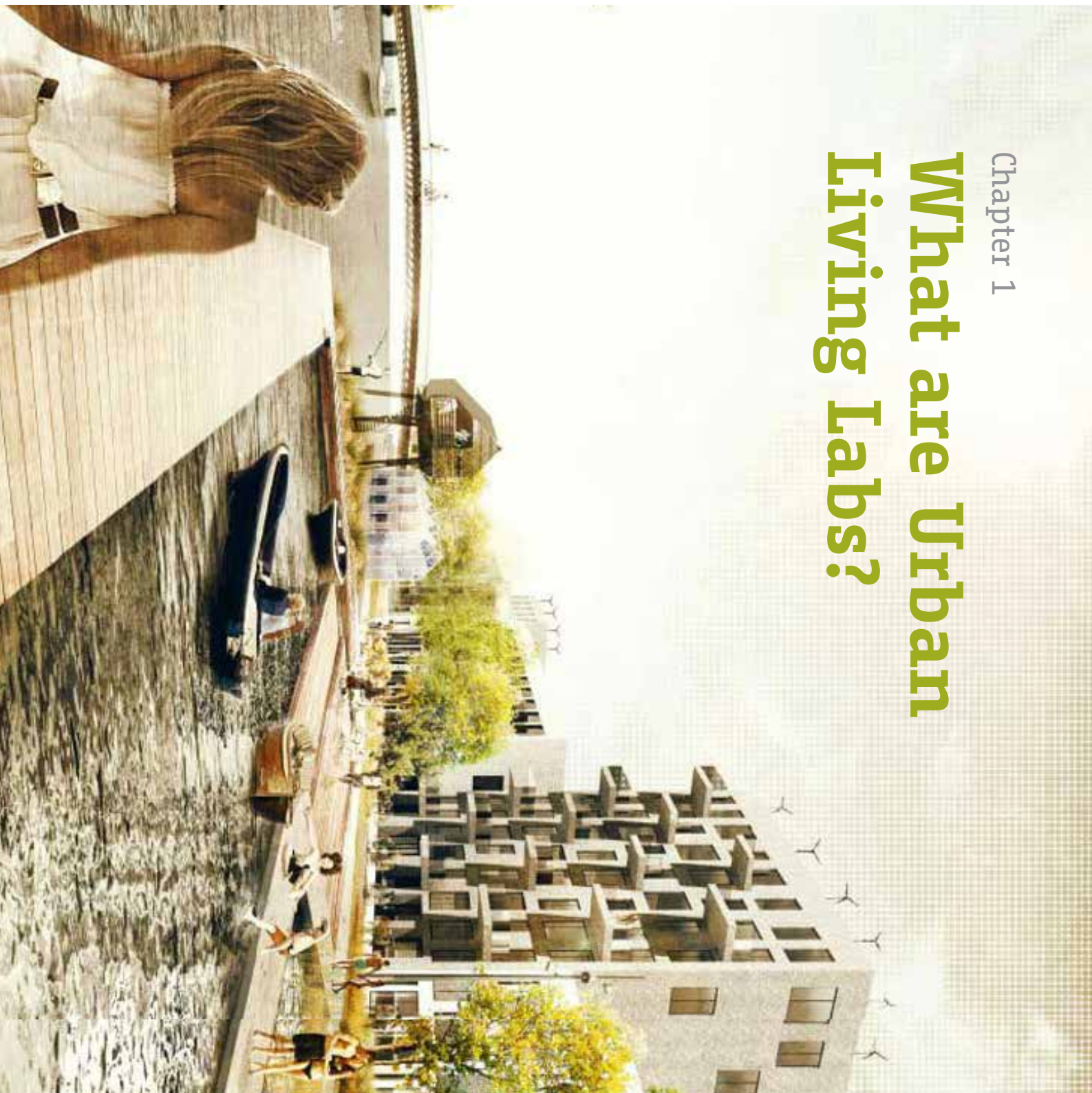
AMS Institute

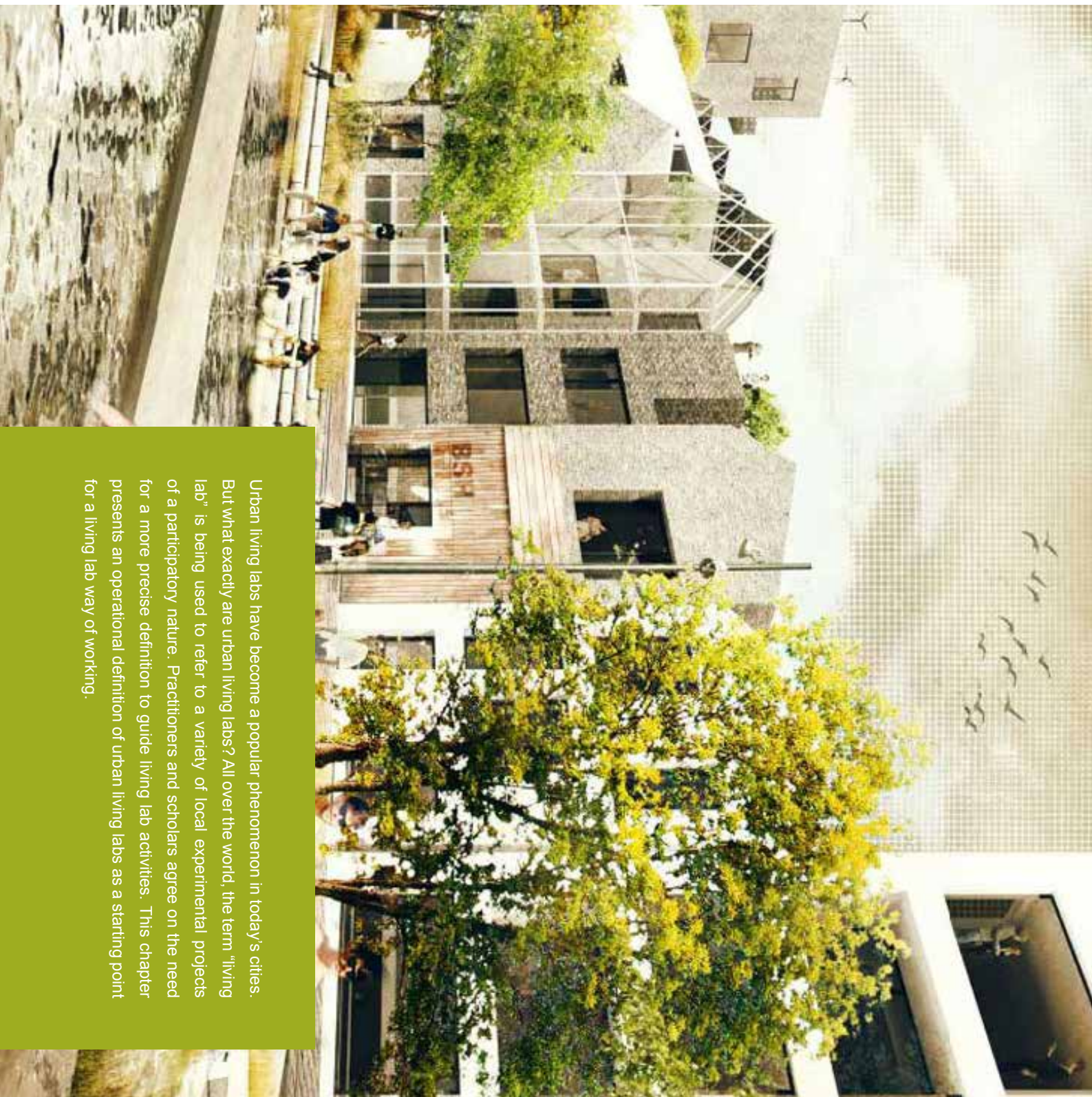
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Chapter 1

What are Urban Living Labs?





Urban living labs have become a popular phenomenon in today's cities. But what exactly are urban living labs? All over the world, the term "living lab" is being used to refer to a variety of local experimental projects of a participatory nature. Practitioners and scholars agree on the need for a more precise definition to guide living lab activities. This chapter presents an operational definition of urban living labs as a starting point for a living lab way of working.

What are Urban Living Labs?

Living labs are usually defined as “user-centered, open innovation ecosystems based on a systematic user co-creation approach in public–private–people partnerships, integrating research and innovation processes in real life communities and settings” (ENQL, 2013).

This definition contains many elements of and assumptions about what living labs are and what they are supposed to achieve. However, this definition is too abstract to provide an action perspective to citizens, planners, decision-makers, and other stakeholders who want to start or will be engaged in an urban living lab.

Based on a literature review of living labs and urban living labs and a quick scan of 90 local innovation projects in the Amsterdam region, the following defining characteristics of urban living labs have been identified:

10

* The product of a living lab can be an object (e.g., a solar panel), a service (e.g., waste recycling services), a technology (e.g., decentralized sanitation), an application (e.g., electric cars as energy storing systems at home), a process (e.g., a participative neighborhood development method), or a system (e.g., a new logistic waste collection system).

Figure 1. The defining characteristics of urban living labs
>>

The characteristics of urban living labs

Goal

Innovation

Developing new products* to find new solutions to existing or new problems.

Knowledge development for replication

Producing and exchanging knowledge of the developed products and processes to achieve these products.

Increasing urban sustainability

Sustainable development emphasizes the need for supported, local solutions.

Activities

Development of innovation

Living labs aim to develop an innovation or a product, and not only, for example, to test or implement a pre-developed solution.

Co-creation

The participating actors together give shape to the innovation process.

Iteration between activities

The feedback gathered from use and evaluation of the product is used to further develop the product.

Participants

Users, private actors, public actors, and knowledge institutes

Actors from these four groups are active contributors to the innovation and development process taking place within a living lab.

Decision power

All participants, including the users, have decision power in the various stages of the innovation process.

Context

Real-life use context

The living lab activities are enacted in a real-life use context.

Living lab platforms

Living labs are usually organized around the development of a particular innovation focused on solving a particular problem. In practice, we also see living labs that are defined by a geographical area that forms the arena for multiple living labs focusing on various problems. These area-defined projects can better be referred to as a living lab *platform*. Such a platform aims to form a breeding ground for innovation, rather than directly developing innovations. The management of a living lab platform is concerned with giving rise to multiple living lab initiatives within a particular urban area, and creating supporting conditions.

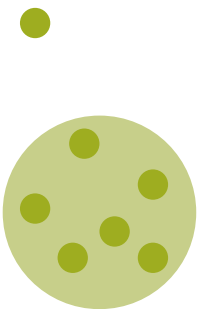


Figure 2. The distinction between a living lab (left) and a living lab platform (right)

Key challenges of local innovation projects

Despite the popularity of living labs, stakeholders engaged or about to be engaged in living labs are struggling with what they are actually supposed to do in a living lab. A quick scan of 90 place-based sustainable innovation projects in Amsterdam revealed that only 12 projects actually qualify as living labs. Surprisingly, most of these are not the projects calling themselves “living labs” or “labs.”

The sustainable urban innovation projects in Amsterdam differ from each other along two main lines: the innovation activities performed in the project, and the degree of user involvement intended in the performed activities. Only when users participate in the *development* of an innovation one can speak of co-creation – a key feature of living labs.



While ideally an innovation project would cover all the phases of the innovation process, in reality, we observed that the projects aim at one particular activity in the innovation process, as visualized in figure 3. Projects that solely focus on researching, testing, implementing, or demonstrating a pre-developed product in a real-life environment are often referred to as living labs, whereas in fact they are pilot projects, show-cases, test sites, or demos of existing innovations.

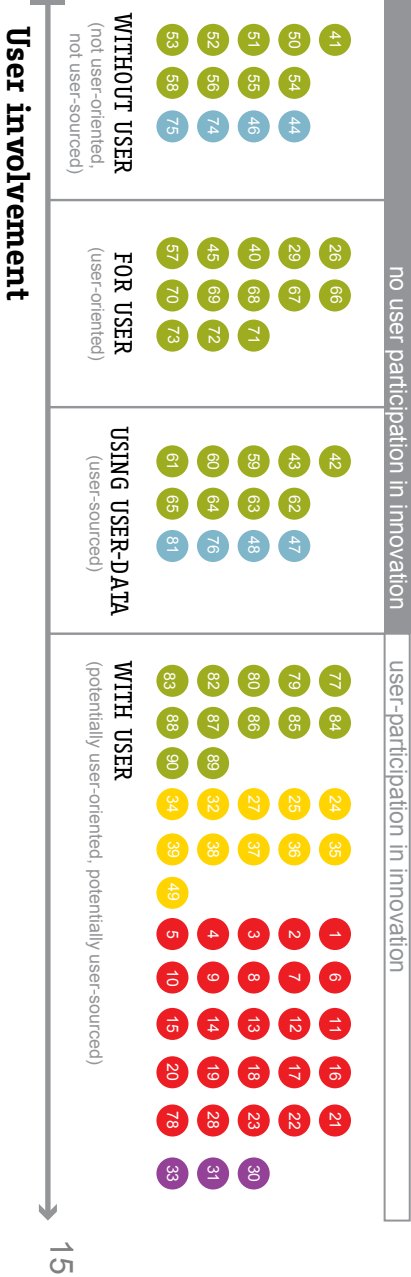
The analysis of the Amsterdam local innovation projects further revealed that user participation in the innovation process only takes place in 51 of the 90 projects. Of these 51 projects, 38 are concerned with testing, implementation, or demonstration activities, in which user interaction is inherent. *Development* with the user is more rarely seen, namely in only 12 of the projects.

Many of the projects that call themselves labs or living labs that do not include user participation, do display a significant focus on user-related activities, conducting either user-sourced or user-oriented activities. The user does not directly participate in these activities: There is no co-creation. However, the user is included in other ways, for example, by specifically aiming at providing solutions from the perspective of the user ("user-oriented"). "User-sourced" indicates that project activities are performed using user-data actively or passively provided by the user, for example by using data collected by sensors, smart meters, or apps. Although all 90 projects somehow refer to innovation and user involvement, the quick scan shows that to fulfill the ambitions of innovation by *co-creation* of living labs, there is a need for a method or approach.



Figure 4. Division of 90 sustainable urban innovation projects in Amsterdam according to the degree of user involvement intended in the innovation activities

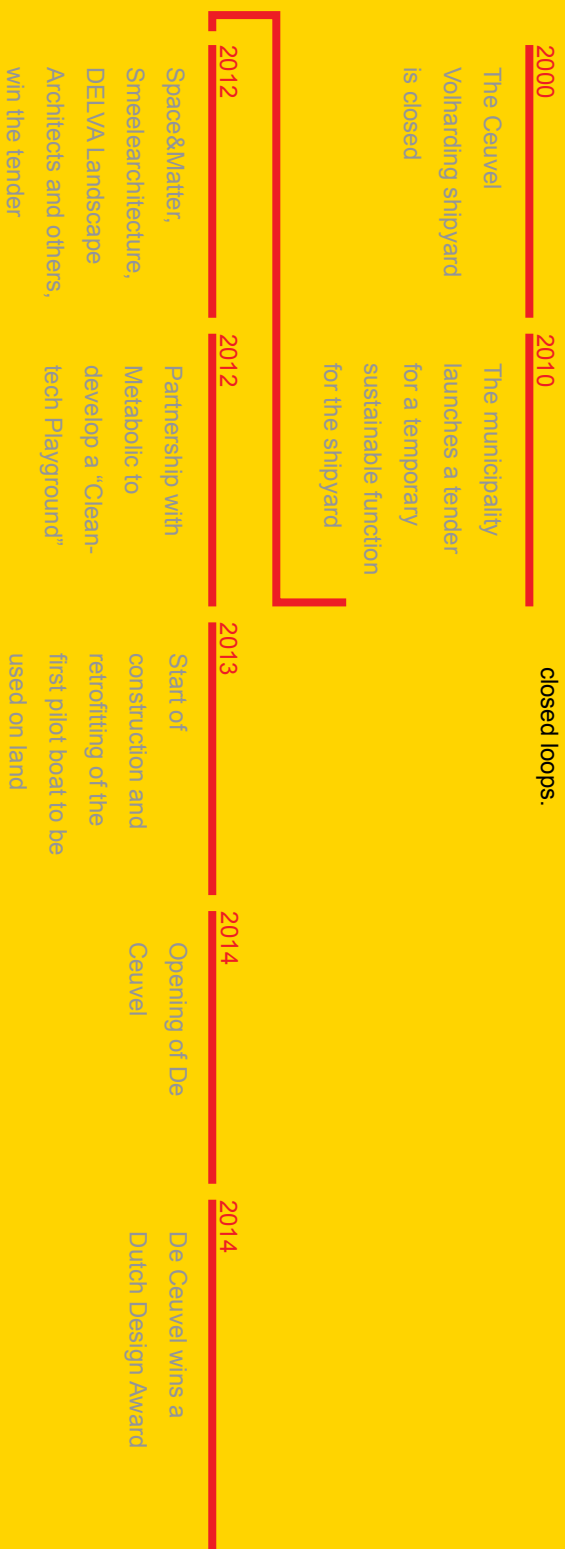
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De Ceuvel

In 2010, the idea for De Ceuvel was born following a municipal call for tenders for the temporary use of the Ceuvel Volharding site, a former shipyard in the district of Amsterdam North. The design proposals had to be sustainable and creative. This reflected the background of the area in which industrial activity had gradually been replaced by shared office buildings and the creative industry. These newcomers had, on their own initiative, started to create modern, future-proof buildings.

A consortium of young architects won the tender and developed a sustainable solution in which the land was covered by phyto remediation vegetation – a biological way of cleaning the heavily polluted soil. Meanwhile, creative workplaces and a boardwalk would be elevated on poles, to allow usage of the area while preventing contact with the polluted soil. New partnerships were created to develop this clean-tech playground, making De Ceuvel a site to test and implement sustainable technologies aimed at achieving an area with 100% self-sufficiency and circular, closed loops.



"The development of De Ceuveel was hard, but it was also one of the most gratifying things I've ever done. [...] It kick started a movement in Buiksloterham that is still continuing today and that induced a more integrated perspective on sustainable development [in Buiksloterham], that is so important in the light of the challenges we're currently facing."

- Eva Gladel, CEO Metabolic

LESSONS LEARNED

- The temporary use of vacant plots provides opportunities for sustainable experiments
- Open calls leave room for innovative and creative ideas
- Persistence and intrinsic motivation of small entrepreneurs are drivers of success
- Subsidies, loans, and donations were crucial for the feasibility of De Ceuveel
- The participation of users and local volunteers in the construction process contributed to the building of a community

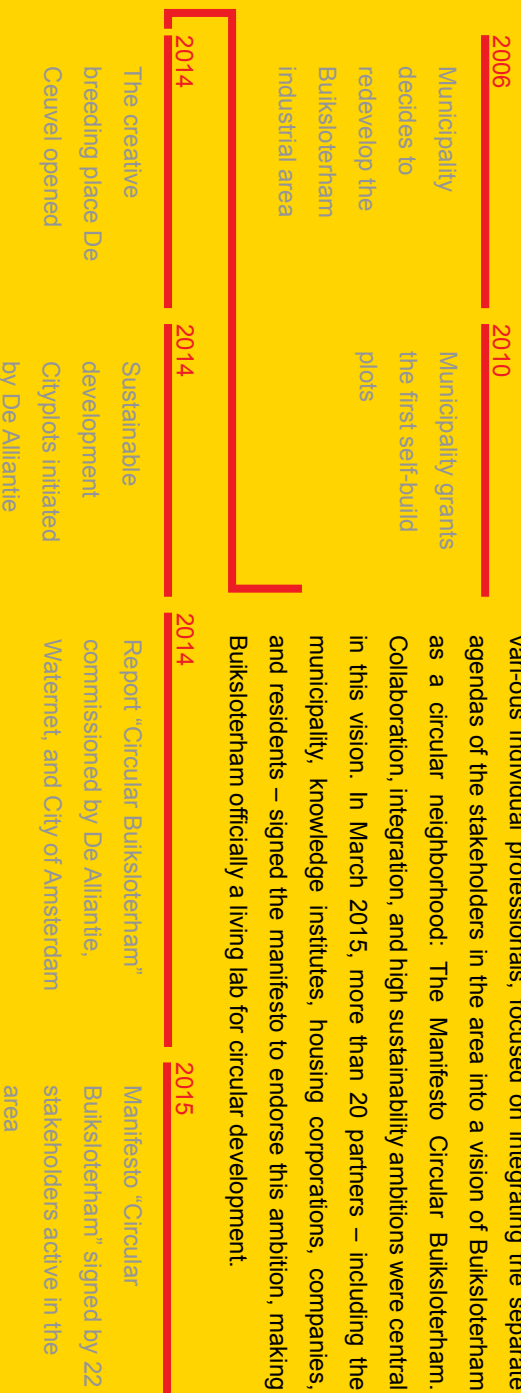


Manifesto Circular BSH

Buikslooterham is an industrial area on the north shore of the river IJ in Amsterdam. The large-scale mixed-use redevelopment of the area was put on hold due to the 2008 financial crisis. In the absence of large investments, bottom-up experiments, research, culture, and innovation were actively encouraged.

The ambition for a “circular” Buikslooterham was first expressed in the aftermath of the development of sustainable self-build homes and the circular creative workplace De Ceuve!, which is also situated in the area. Amongst the group of active citizens and local entrepreneurs, the awareness grew that in order to deliver truly sustainable solutions, more integration, more relaxed regulations, and a mandate for sustainable intervention and experimentation in the area were necessary.

Commissioned by De Alliantie housing corporation and the water company of Amsterdam, Watermet, an extensive research was conducted by Metabolic, DELVA Landscape Architects, STUDIOINEDOTS, and various individual professionals, focused on integrating the separate agendas of the stakeholders in the area into a vision of Buikslooterham as a circular neighborhood: The Manifesto Circular Buikslooterham. Collaboration, integration, and high sustainability ambitions were central in this vision. In March 2015, more than 20 partners – including the municipality, knowledge institutes, housing corporations, companies, and residents – signed the manifesto to endorse this ambition, making Buikslooterham officially a living lab for circular development.





"Buiksloterham has become THE place for research and experiment on circularity in a real-life context; an example for the Netherlands, and beyond. [...] The process still has many rough edges, but it is very special that we work together to implement new and integrated sustainable solutions on such a scale."

- Saskia Müller, Quartermaker Foundation Stadslab Buiksloterham

LESSONS LEARNED

- Stakeholder engagement is a task of its own and should be managed as such
- Formalization of collaboration can act as a barrier by challenging the private sense of ownership and responsibility of participants
- High ambitions are often weakened by requirements motivated by the status quo
- Alignment with the culture of the community is crucial for supported products and processes
- Follow-up assignments are often reasons for evaluation and dissemination of former projects

The Knowledge Mile

Hemelswater CODE BLOND

Joris Hoebe was at home brewing beer with a small do-it-yourself kit, when he got the idea to produce beer from rainwater. Being connected to the University of Applied Sciences of Amsterdam (HvA) as a coach at the MediaLAB, he was involved in the Amsterdam Rainproof program. His students were to develop products that would make people more aware of the city's water storage problems. The beer brewing idea resulted in a project with Rainproof. Through the Amsterdam living lab platform "The Knowledge Mile," he found the necessary partners: the Volkshotel, for the collection of rainwater, and De Prael, a local brewery. The first product was a bitter blond beer called CODE BLOND, which was soon awarded the ASN Bank World Prize in the category sustainable energy, nature, and environment. Meanwhile, Hoebe and partners founded the start-up Hemelswater ("Heavenly water"), to further commercialize and spread the concept of collecting rainwater for beer production, and to increase awareness of the need to reuse rainwater and to increase the storage capacity for rainwater in the city.

03 / 2016

Joris Hoebe had the idea of using rainwater for beer production during a home-brew experiment

03 / 2016

Coupling of idea to a project on increasing rainwater awareness at the MediaLAB HvA

04 / 2016

Collaboration with Brewery De Prael for brewing

05 / 2016

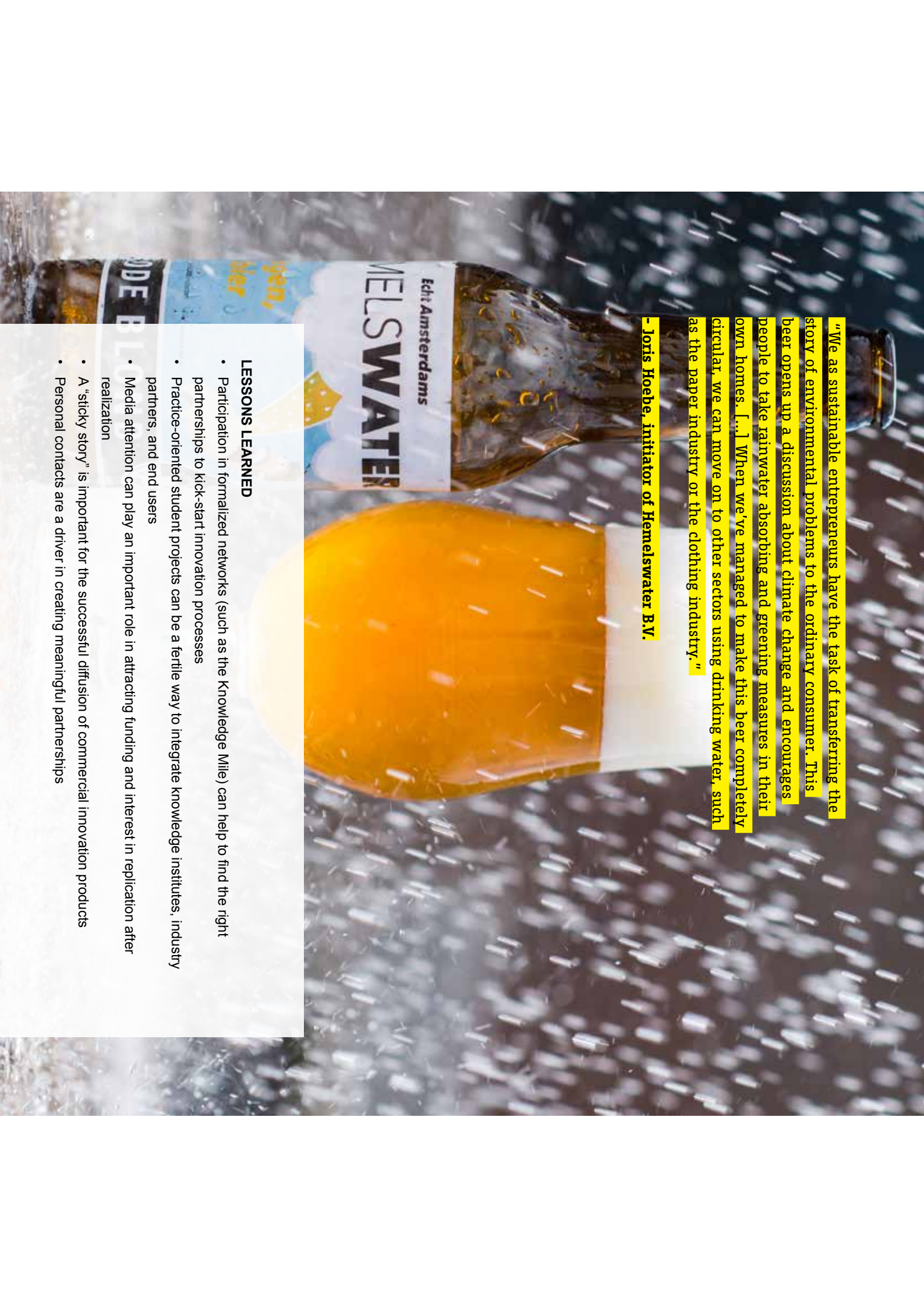
Presentation of idea at a gathering of the Knowledge Mile

05 / 2016

Collaboration with Volkshotel for rainwater collection

06 / 2016

Public tasting of Hemelswater: CODE BLOND at Brewery de Prael



"We as sustainable entrepreneurs have the task of transferring the story of environmental problems to the ordinary consumer. This beer opens up a discussion about climate change and encourages people to take rainwater absorbing and greening measures in their own homes. [...] When we've managed to make this beer completely circular, we can move on to other sectors using drinking water, such as the paper industry or the clothing industry."

- Joris Hoebe, initiator of Hemelwater B.V.

LESSONS LEARNED

- Participation in formalized networks (such as the Knowledge Mile) can help to find the right partnerships to kick-start innovation processes
- Practice-oriented student projects can be a fertile way to integrate knowledge institutes, industry partners, and end users
- Media attention can play an important role in attracting funding and interest in replication after realization
- A "sticky story" is important for the successful diffusion of commercial innovation products
- Personal contacts are a driver in creating meaningful partnerships

Urban Solution Sloterdijk III

In 2012, the city of Amsterdam decided to redevelop the Westpoort-Sloterdijk area. It commissioned the development of an integrated sustainability strategy for the area to program manager Olga Van de Ven. Based on the sustainable activity already present in the area, it was decided to use a pilot period of one year to set up a living lab in which entrepreneurs, the municipality, and knowledge institutes would work together to produce a formula in which sustainable production and commercial profit naturally go together.

Amongst others, a solution was sought for the sustainable use of temporarily vacant plots. Inspired by a presentation about urban agriculture, Van de Ven got in touch with the Bio-Based Connections program of the Amsterdam Economic Board. Watermet, agricultural wage and rental company RVR Hooftdorp, Schiphol ES2020 (a Schiphol program with mobile container labs for testing energy solutions) and processing companies such as the paint factory Rigo developed a collaboration model for cultivating various crops on the vacant land and for processing these into bio-based products. The business case was successful, proving the solution suitable for replication.

2012

Redevelopment decision Westpoort-Sloterdijk

2013

Assignment for the sustainability pilot Sloterdijk III

2013

Emergence of urban agriculture concept during brainstorm with designers

2013

Connection with the Bio-Based Connections project

2013

Development of a business case with experts and local actors

2014

First harvest of hemp and flax on three vacant plots in Sloterdijk III

"The parties we needed for all the steps of the chain were all in the Bio-Based Connections project. Together we developed the business model. We forgot about the contracts, because that would have implied the whole juridical shebang, costing a lot of time, etc. Our collaboration was completely based on trust, the people involved, their attitude, and our common membership of the Bio-Based Connections network."

- Olga van de Ven, program manager Sustainability Westpoort-Sloterdijk, Municipality of Amsterdam



LESSONS LEARNED

- A decision to redevelop an area or product is an opportunity to formulate or reformulate a sustainability strategy and experiment
- Organizational changes can obstruct innovation by estranging connections and knowledge, which are often person bound
- Presenting projects as temporary pilot projects or experiments reduces the perceived risk and lowers the threshold for actors to become partners in such projects
- The Bio-Based Connections project was an instant way to get in touch with experts and partners

Chapter 2

A living lab Way of Working



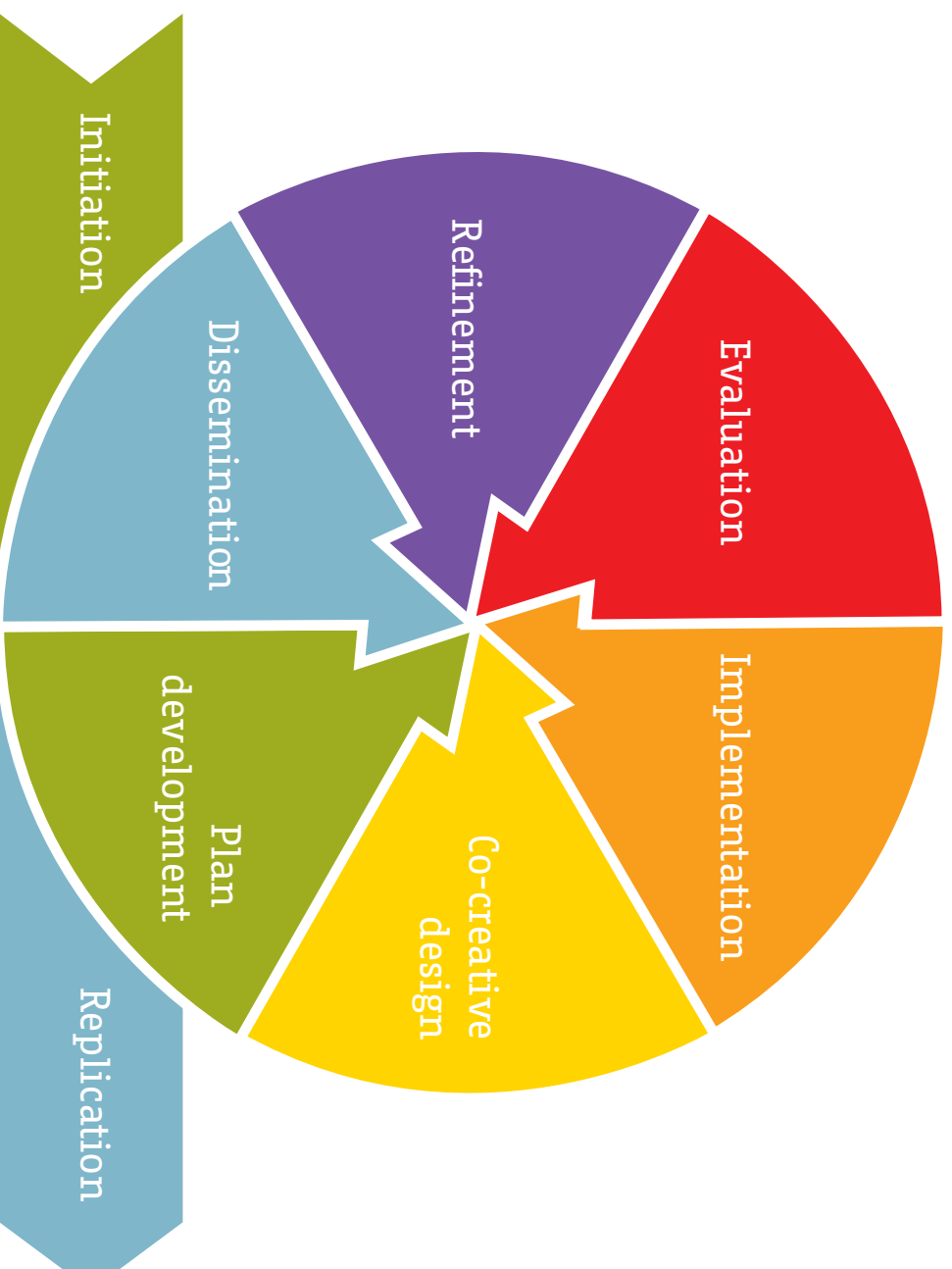


This chapter presents the living lab way of working, based on the theoretical recommendations for living lab methodology and lessons learned from the in-depth analysis of living labs and innovation processes in Amsterdam.

A living lab way of working: a step by step method

This recommendation for a “living lab way of working” synthesizes the methodological living lab recommendations from theory and the identified conditions for successful living lab outcomes retrieved from in-depth case studies in practice. All too often, the dynamics and blur of the moment distract actors’ attention from some of the steps and conditions needed, leading to local lessons that are not materialized and disseminated.

The proposed living lab way of working consists of eight steps, visualized in the figure on the right. For each of these steps, the main actions and conditions needed are presented, supplemented with general recommendations and tips on how to successfully complete these steps. The zigzagged lines between the steps emphasize that there are different pathways to come to successful living lab outcomes. Yet, this living lab way of working helps actors involved in urban living labs to keep on track with the innovation process as intended, and provides a step-by-step plan that permits a constructive and efficient process towards the achievement of living lab results.



STEP 1. Initiation

First step in establishing a living lab way of working is initiation.

A. An idea and a problem

Living labs are aimed at generating innovations: fitting a new solution to an existing or new problem. Therefore, either a problem or an idea that may solve a problem lie at the core of actors' ambitions to initiate a living lab.

Option 1: Problem > Idea

When starting from a problem, the actions lie in making the problem explicit and finding partners that agree with you on the relevance of solving this problem to initiate a lab. An idea for a possible solution can follow later, for example, following a research phase or a brainstorm.

Option 2: Idea > Problem

An idea can also serve as a starting point for a lab, emerging from your private search for a solution to a problem, or popping up serendipitously. New experiences are often carriers for the latter. Making the connection between the idea and a relevant problem is key. Based on an idea, a living lab with other interested stakeholders can be set up.

TIP – Similar thinkers as carriers of ideas

Encounters, facilitated by meeting places and events, have been shown to play a role in the emergence of ideas and initiatives in many of the studied innovation processes in Amsterdam. Especially encounters between similar thinkers, for example at conferences and thematic sessions, prove to be important in eliciting energy and inspiring action, creating momentum for further development. Facilitating these encounters by attending or organizing them can foster innovation.

B. Partners

It is up to the person or actor coming up with the idea – a user, private actor, public actor, or knowledge institute – to find partners who are interested in collaborating on elaborating the topic problem or idea.

Get in touch

The initiator has to contact potential partners, which can be users, public actors, private actors, or knowledge institutes. The final aim is to form a partnership with the capacity to set up a project.

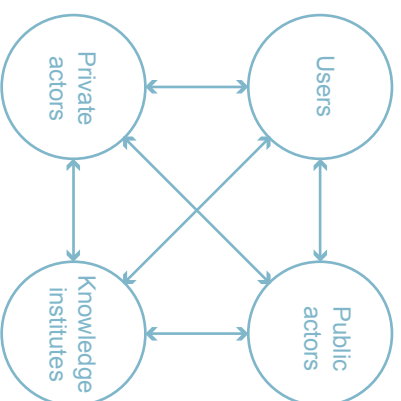


Figure 6. A first-contact communication infrastructure between the living lab stakeholders

TIP – A first-contact communication infrastructure or platform

As the first step toward making contact with potential partners is so important, a platform should exist through which actors can get in touch with each other. This first-contact infrastructure is currently often only arranged for or usable by companies or organizations, leaving, for example, un-institutionalized user initiatives in the dark. An accessible first-contact communication infrastructure through which users, public parties, knowledge institutes, and private parties can reach the right person or department with a low threshold to talk about their initiatives or ideas and be informed about potentially further procedures, is an important link in the chain of events leading to innovation.

Persuade

When in contact, it is the task of the initiator to persuade the potential partners to collaborate on the topic of the suggested idea or problem. Intrinsic motivation is necessary for commitment. Build on the private interests of the actors you are approaching by explaining how the particular innovation process will advance their interests while contributing to sustainable innovation in general. Note that collaborations often fail because propositions are too vague. Therefore, make sure your problem is specific and/or your idea is concrete.

Reduce the risk

Actors tend to refrain from investing in living labs because experimentation involves risk taking. A clearly limited scope in terms of location (e.g., working within a constrained geographical area, which can range from a building to a district) or time (e.g., for one year) reduces this risk and may convince actors to take the leap. Referring to the initiative as a “pilot project,” “experiment,” or “living lab” can stimulate this.

Be open!

Whereas the initiating actors have the task of contacting other actors to start collaborating on a joint problem, other actors need to be open to these initiatives and collaborations to allow living labs to emerge and be successful. For many actors, this is contrary to their traditional way of working. If the suggested idea makes sense, municipalities, knowledge institutes, companies, and users should be prepared to give initiatives driven by non-traditional actors and spontaneous leaders space, preferably including regulatory space, and support them where necessary.

C. A project

After determining the topic of the living lab and finding partners willing to collaborate on this topic, it is necessary to translate this abstract aspiration into a concrete project in which all interested partners participate and can constructively work on the problem.

Choice for the living lab way

The experiences with living labs demonstrate the need to explicitly choose for the living lab approach. This implies working in user-public actor-private actor-knowledge institute constellations and an area-based approach, and being aware of its implications from the outset of the project. To make this choice, the partners should consider the living lab advantages and disadvantages and see whether a living lab matches their project goals.

+	-
+ High potential for innovation (thanks to the multidisciplinary and multi-stakeholder approach) + High potential for systematic learning and replication of innovations + More sustainable solutions thanks to the integration of all stakeholders' requirements + Closed gap between product production and uptake + Reduced risk of policy and business failure + Better match with local, cultural, and institutional contexts and creativity potentials + Better utilization of existing knowledge and inventions	- Not a direct path to a short-term solution - Experimentation entails failures - Needs large investments in terms of coordination, organization, management, and supportive tools - Successful stakeholder participation requires particular expertise - Successful co-creation requires a particular mindset - Working according to the living lab approach may require actors to abandon their usual culture and/or way of working

Figure 7. Advantages and disadvantages of the living lab approach

Creating a project

Having made the decision to develop the solution to the selected collective problem in a living lab, the partners have to take the action of creating a project. This can be done either by coupling the initiative to an existing project (finding an existing project and following the recommendations for partnership formation once more) or by setting up a new project with the partners. A project can also originate as an independent project for a part of the plan development phase, and later connect to an existing project that matches the plans.

TIP – Connect to an existing, subsidized project

Connecting to an existing project to organize the development of the selected problem or idea can lead to many benefits. By linking to an existing project that has already received funding through, for example, subsidies, a relevant network of people, organizations, and organizing capacity (including facilities and resources) can be engaged. Many conditions for the further development of the innovation (introduced later in this booklet) can be settled at one fell swoop. Fulfilling these conditions by starting up an independent project is also possible, but will be much more difficult and labor intensive.



Inclusion of all living lab stakeholders

Whether a project is set up or connected to an existing project, it is important that all living lab stakeholders are included from the start of the project, in order to arrive at the co-created and integrated solutions that living labs propagate. This requires the initiating partners of the lab to actively invite public, private, civic, and knowledge stakeholders to participate in the lab. Note that end user engagement often requires special attention, as these actors typically do not have a professional motive to participate in innovation processes and participate on voluntary basis. It should be ensured that all stakeholders relevant in the context of the envisioned problem or solution are involved, regardless of the existing networks that might be embedded in the location or collaboration structures.

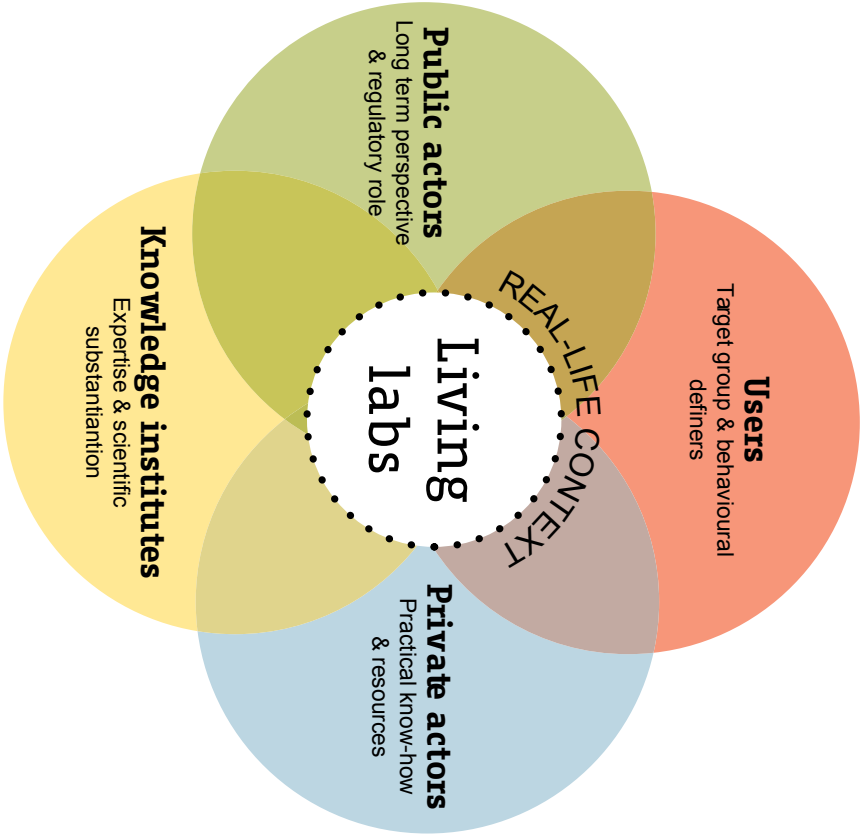


Figure 8. The living lab stakeholders

TIP – Working with an existing community

End user involvement in the development process is often dependent on invitation by other actors. This requires attention and organization, since end users generally do not have a professional motive to participate in the development of societal solutions. In many of the urban innovation projects studied, experiences reveal that voluntary participation rarely produces users who are interested in participating in the development process. Since participation cannot be enforced, working with an existing community that is interested in working on a solution might be preferred. Following the bottom-up movements in a city can probably lead you to these communities.

A location

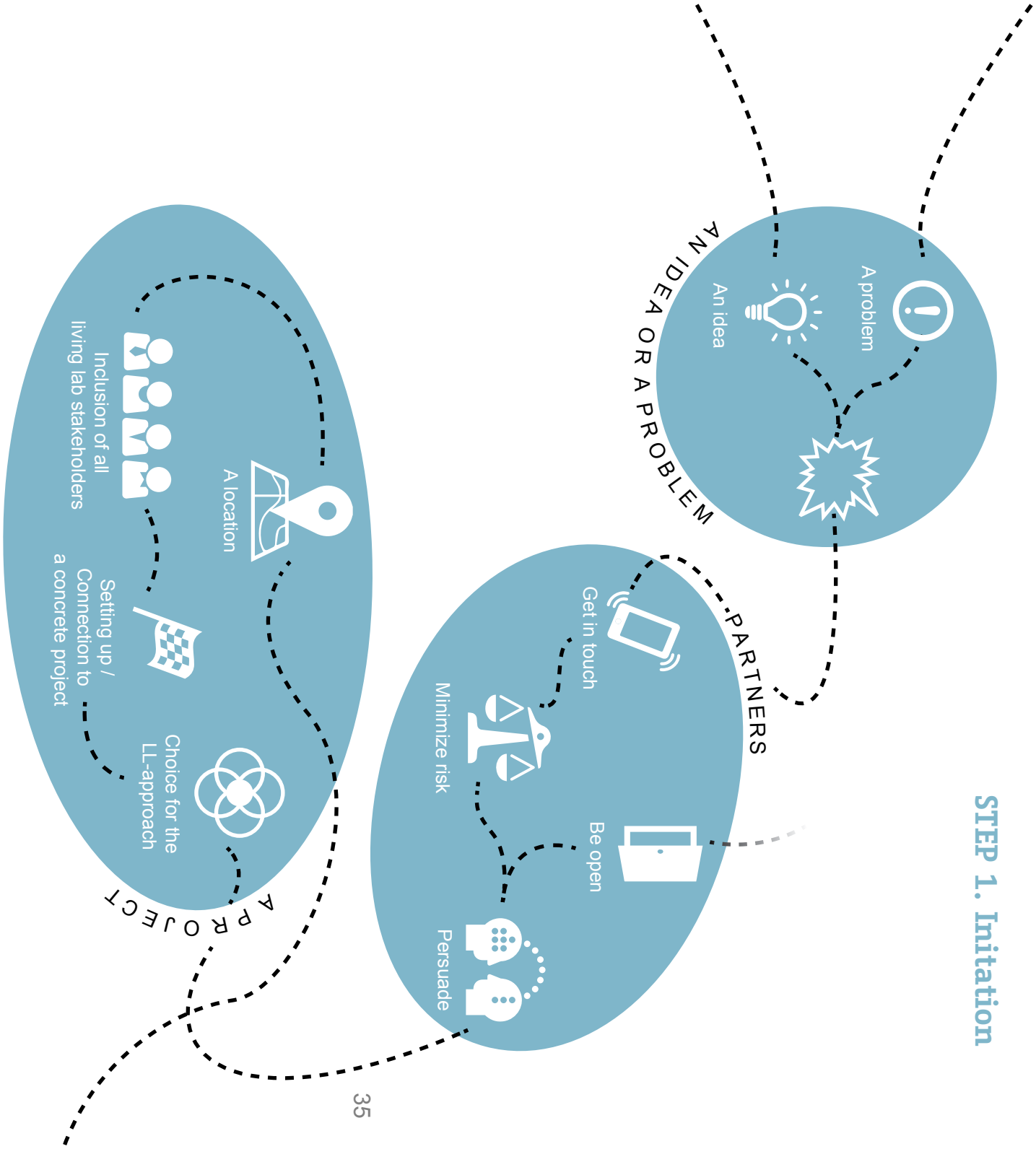
Finally, the project should be connected to a location. Specific characteristic of a living lab is the setting of its activities in a real-life context, often a geographically defined area. This location can be provided by one of the project partners; for example, the municipality might grant a piece of land, or a company or knowledge institute might offer an operational space as implementation arena for the living lab. A location can also be provided by working with an existing, delimited urban area, selected on the basis of its users being interested in participating in the living lab project.

TIP – Temporary or permanently vacant plots or industrial areas as living lab locations

Time and again, vacant plots within cities prove to be great options for use as the location for a living lab. They are often embedded within an operating urban area, with local residents and users, while providing room for new development. Also the permanent or temporary use of vacant industrial plots or buildings can be a good pathway, as these locations often enjoy relaxed regulation, which benefits the living lab activities (as will be explained later in this booklet).

Figure 9. Process visualization of the recommended **Initiation** steps and building blocks in the living lab way of working >>

STEP 1. Initiation



STEP 2. Plan development

After initiation, a stage of plan development comes into play, in which the direction of development of the product as well as the process are determined.

A. A shared vision

A living lab approach implies that also the plan development process is one of co-creation. In the first step, stakeholders jointly work toward a shared vision for the project. A shared vision, being an integrated result of the joint effort of all stakeholders, fosters satisfaction and commitment among the participants.

Embedding all stakeholders' interests

A precondition for this commitment is that all actors are intrinsically motivated to participate in the living lab. If one of the stakeholders cannot be convinced that the project is in their interest, the project will not yield integrated solutions and long-term social, economic, and environmental sustainability. This intrinsic motivation to participate should be consolidated in the shared project vision, be it by providing added value in terms of the strategic or commercial objectives of stakeholders, or by building on an internal passion.

Jointly defining the problem statement, goals, and ambitions

The best chance of reaching agreement and making optimal use of the means and strengths of the various actors, is created when both interests and solutions are aligned in the development plan. This implies that, if necessary, the aims should be reformulated until all the stakeholders' interests are included, which should be part of the plan development process and to which the initiator should be open. Together, the stakeholders should form an integrated vision of the goals and ambitions for the innovation.

TIP – A sticky message

Many contributors to living labs point to the importance of a “sticky message.” A project mission that sticks and lingers in the minds of the people who hear it. A sticky message, making the goal of the project communicative, tangible, and appealing, can form a continued incentive for stakeholders to support and join the innovation project. Also, the marketing team will thank you later.

Commitment to a different way of working

Part of the shared vision underlying the innovation and the living lab process should be the commitment of the participants to be open to adopting an attitude that might be different from their traditional way of working. First of all, a communicative and transparent attitude of the actors in the development process is needed with regards to their knowledge, interests, and objectives. This may require a change in culture, especially by those participants who are used to concealing their objectives for strategic reasons. Participants should realize that they all have interests to be served in order to produce a solution that is sustainable. Furthermore, participants need to be open-minded and realize that other participants may help them find new and perhaps better solutions to problems they have struggled with for a long time.

B. Capacity

Once a shared vision for the innovation has been developed, capacity for the required activities should be organized.

Search for inclusion of the right capabilities

To organize capacity requires one to actively seek inclusion of useful resources and skills. This usually involves interaction with the people who have, or have access to, these skills and resources. These interactions often take place through a recurring pattern of awareness, action, and interest (demonstrated in the figure on the left), leading to the connection of these people to the project.

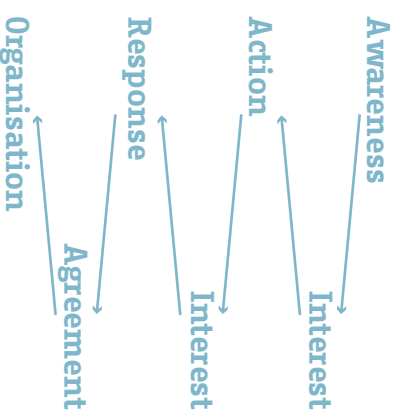


Figure 10. The awareness–interest cycle that represents the pattern of people interactions leading to partnerships

Smartly facilitating the events in this sequence by, for example, inducing encounters or through persuasion, can help in the formation of collaborations. The aim is to ensure that all the capabilities and resources necessary for the development process, and all the corresponding actors, are included in the development process.

TIP – Look for a connection with organizations with a sustainable cause

Organizations with sustainable causes or long-term perspectives – such as banks, municipal departments, or companies with sustainability missions, innovation departments, or subsidy programs – played a role in all the studied innovation projects, be it at the start or at the end of the process. These organizations can provide the capacity that can significantly help a project become successful.

TIP – Join a formalized network

There are many networks connecting a number of local, national, or even global stakeholders who wish to discuss specific sustainability topics. The World Business Council for Sustainable Development, the Dutch Watertorenberaad, and Amsterdam Rainproof are only a few examples. Not only have these networks been important for the later diffusion of innovations, they are also useful for providing inspiration, knowledge, and partnerships that can help the development process of the innovation. Therefore, connecting to one or more of these networks early in the process is highly recommended.

TIP – Make use of your personal network and find win–win arrangements

The goodwill factor and low-investment win–win arrangements underlay a large share of the organization of capabilities and resources in the studied urban innovation processes. For example, an old friend offered his empty hangar for construction activities, and a company donated materials in return for exposure. Use this to your advantage and try to think from the perspective of your potential partners to discover win–wins.



C. A process design

When the vision is set and the capabilities and actors are included, it is time to formulate a working plan for the development process, again a process of co-creation. Whereas product design is self-evident in innovation processes, the design of the process is often forgotten, even though this activity proved crucial for the living lab activities later in the project.

Involve expertise on the living lab way of working

In addition to the design of the workflow, equipment needs, methods, and planning necessary for organizing the development process of the innovation in question, it is recommended to get expertise on the living lab approach on board. Achieving innovation in co-creation requires specific activities, interactions, and conditions, which need to be addressed and included in the process design. To ensure a systematic and coherent co-creative innovation process, it is highly recommendable to anchor attention for the needs of the living lab approach in terms of steps to take and conditions needed in a living lab. Especially knowledge institutes are logical candidates to fulfill this role, supported by methods such as the one presented in this booklet; however, also other actors or procedural safeguards might fulfill this role.

Division of roles & responsibilities

The process design implies a division of roles and responsibilities amongst the living lab participants across the innovation lifecycle. It should be clear that not all partners can contribute to an equal extent. Participants should on their own initiative indicate where they can contribute, and jointly work toward the allocation of all required roles and responsibilities.

Addressing the conditions for developing the innovation - During the formulation and allocation of responsibilities, attention should be paid to ensure that all conditions for the development of the innovation are met (visualized in the conditions map on the right). If any of these

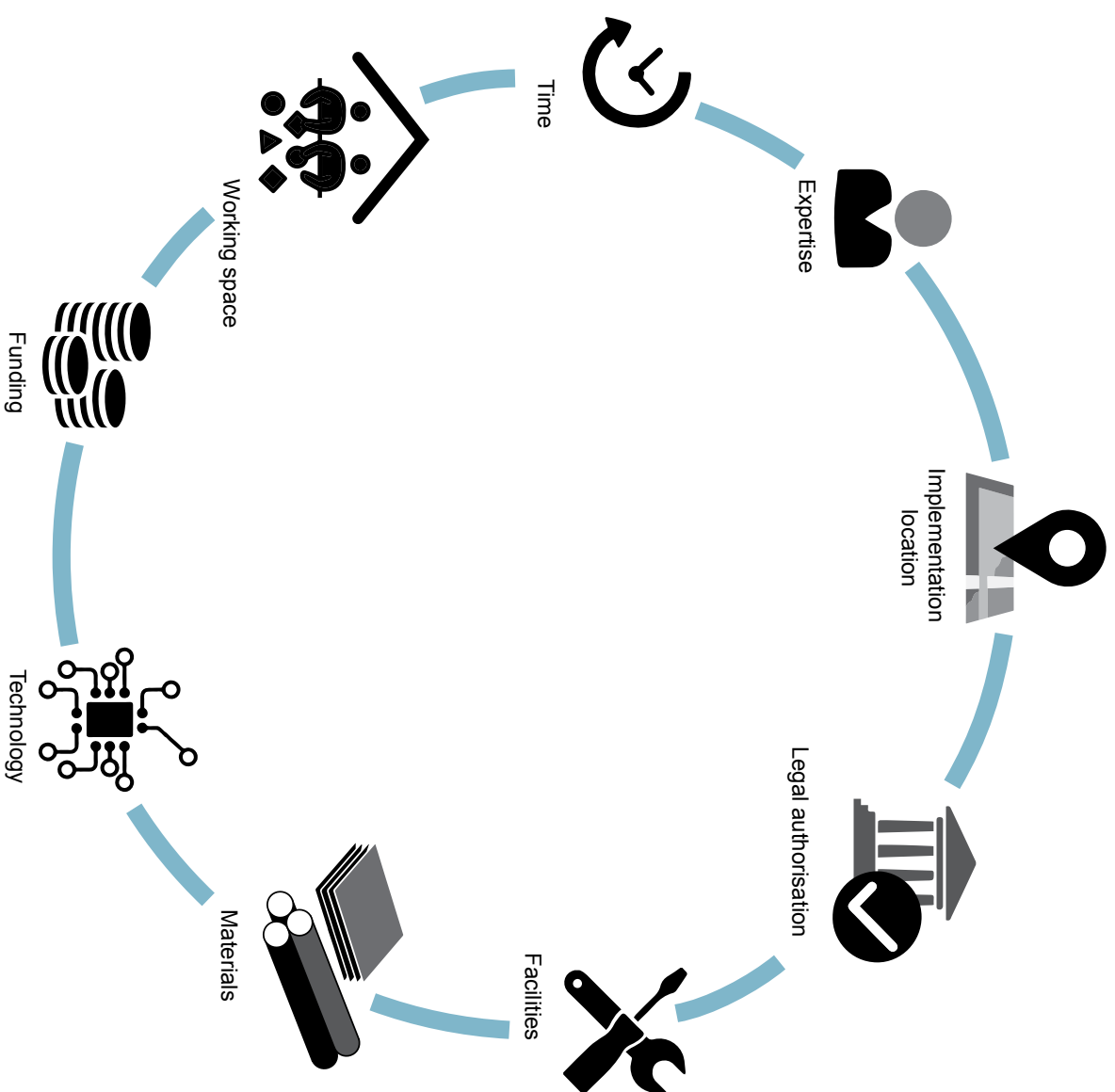


Figure 11. Map of recurring conditions for the development, implementation, and replication of innovations

conditions are not met, an effort should be made to connect to additional actors or to make an alternative arrangement to fulfill the conditions. This also applies over the course of the living lab process when additional requirements come up or participants change. Furthermore, multiple participants can join forces and combine their efforts to deliver a condition.

TIP - Use the “conditions map” as a tool to see where you can contribute

AMS Institute has developed a map of the conditions needed to support the development and implementation of innovations within the living lab and to support replication. Stakeholders involved in a living lab can use this map to decide on the division of tasks and responsibilities. The map shows them in which fields they can contribute, while making explicit which tasks will eventually have to be completed. The conditions map is visualized on page 39.

Funding – The sharing of costs is always a challenging issue when dividing tasks and responsibilities. Don't fall back on traditional role patterns, trying to shift the bill and risks to others. Instead, discuss the possible solutions together. Pay if it is reasonable for you to pay. Actors can also decide to share the costs or to contribute in kind.

TIP – Start looking and applying for subsidies early in the process

Subsidies can be a huge help in solving funding issues. Ever since living labs have become a funding requirement for specific (EU) research and innovation subsidies, there has been an enormous growth in the number of living labs. Also other innovative plans can qualify for subsidies. However, to receive funding through this pathway, you have to be proactive and well in time. Look and apply for subsidies and subsidized calls right from the outset of the living lab process.

Awareness and agreement on commitments and implications

During the process design, it should be made clear what the planned tasks, activities, and methods imply, and what exactly is expected of each actor. Actors usually need to contribute to the tasks of others as well. For example, even though evaluation may be the responsibility of actor A, it can imply the completion of a survey by actor B. Creating awareness of and agreement on the commitments and implications of tasks up front increases the chance that actors will stick to their commitments. At the same time, however, processes in living labs are dynamic, which calls for agility and for forgiveness if processes take unexpected turns.

Friendly formalization

While many actors are used to having these commitments and collaboration agreements formalized in a contract or a letter of intent, living lab experiences have shown that these strong formalizations can also work counterproductively, by discouraging actors from committing in the first place, or by decreasing their commitment after signing by taking away the sense of personal responsibility. Starting complicated discussions about everything that could go wrong also saps energy. Instead, try to rely on trust and formalize as little as possible. If formalization is necessary, keep the initial agreement brief and simple and address problems as they occur.

43

D. Management

Despite the dynamic and unpredictable character of living labs processes, some management is needed to ensure progress, to monitor the performance of the scheduled activities, and to organize the people and resources to actually achieve results.

Establishment of appropriate management

In the plan development stage, a management structure should be established to guide the living lab process and its inseparable activities of co-creative design, evaluation, refinement, and dissemination, which tend to not get much priority. This development process manager does not necessarily have to be the same as the manager who might eventually manage the innovation during its operation phase.

Participants in a living lab cannot be managed in a traditional way, as they often join the innovative co-creation work on a voluntary basis, while making a considerable contribution. Rather than forming a hierarchical authority, the development process manager should motivate and inspire the living lab participants, and build relationships and trust. These activities are essential, in addition to safeguarding progress and managing (and, where necessary, seeking advice on) the living lab activities.

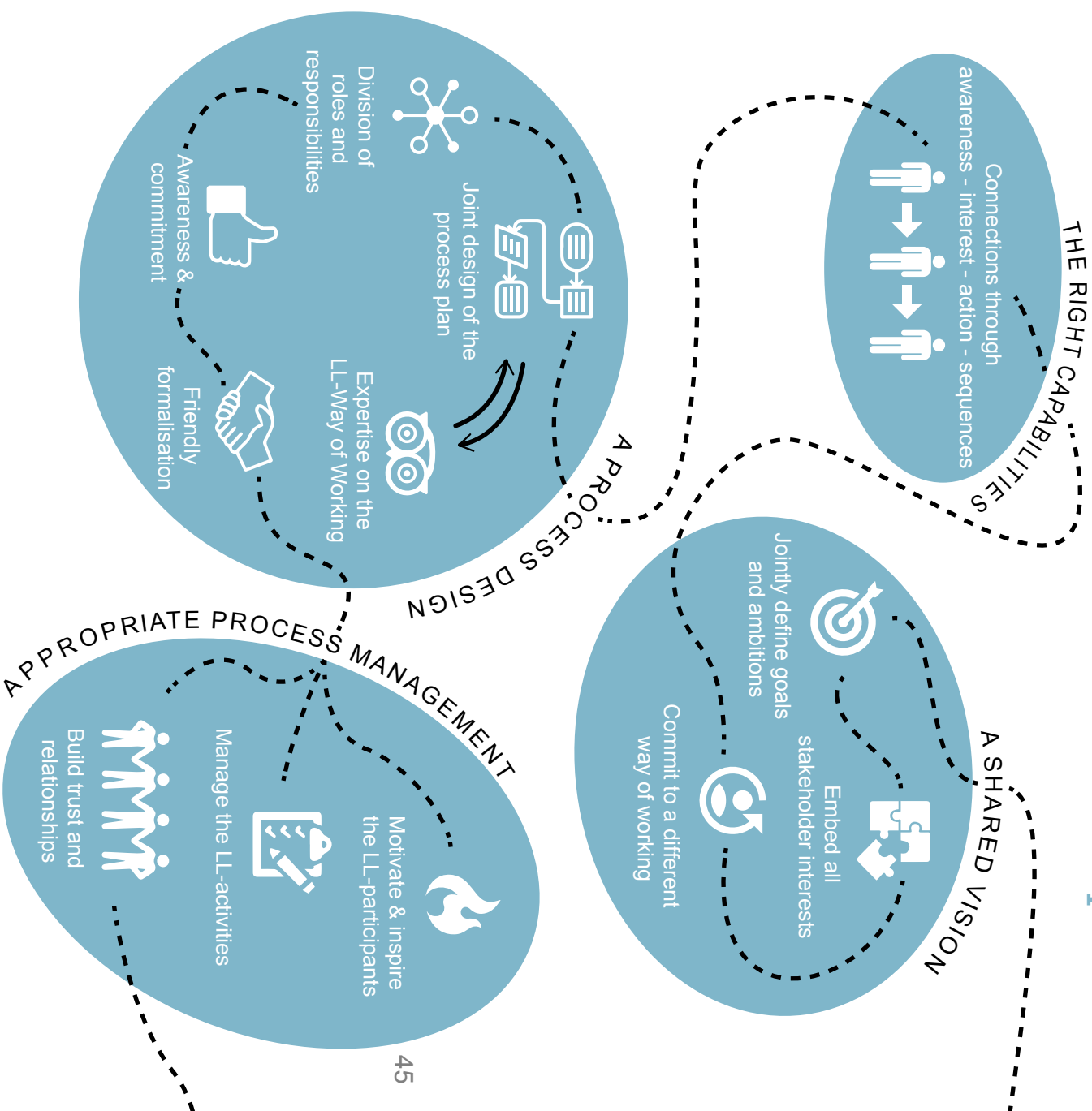
To achieve such a management structure, living labs need a special kind of person to take the lead: a person who is emotionally involved, persuasive, entrepreneurial, persevering, and creative. It does not matter to which actor group (public, private, or civic) such a leader or group of leaders belong; the capacities are leading. An independent manager, for example a freelancer, is also an option.

TIP – A visionary Leader

Visionary leaders have been shown to have a large positive impact on innovation processes. These visionary leaders are intrinsically motivated persons with a strong vision who can captivate and drag along others with their enthusiasm, ready to pull, lug, and fight to realize a shared vision. These leaders usually emerge spontaneously, often because of their strong personal commitment to the idea to be developed. Such a personal commitment is crucial, also when recruiting such a leader from outside.

Figure 12. Process visualization of the recommended **plan development** steps and building blocks in the living lab way of working >>

STEP 2. Plan development



STEP 3. Co-creative design

When a shared vision has been formulated concerning the goals of the project, the direction of development of the solution, and the course of the innovation process, it is time to move on to the co-creative design process. In this phase, the specifics of the product are gradually elaborated though the development of a concept, the design of the product based on this concept, and the production of the designed product (prototyping). Just as in the other phases, co-creation implies that the stakeholders make decisions together, respecting each other's input. This requires stakeholders to actively participate, to state their opinions, and to listen to each other. This way of working calls for attention in some particular areas.

A. Network-collaboration in a setting of equal interests

First of all, actors will have to collaborate in a network setting in which interests and actors are juxtaposed.

Acknowledge and build horizontal relationships

The first step that needs to be taken to facilitate this network collaboration structure is to minimize potential traditional hierarchical actor dominances in the development process. For an urban living lab approach, the participants in the lab must let go of their potentially traditional dominance or steering role, and position their demands as one of the many interests in the deliberation process, to which an integrated solution should be found.

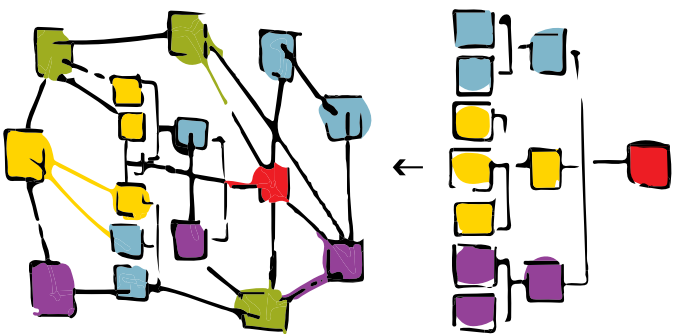


Figure 13. The transition from a hierarchical to a network collaboration structure necessary for co-creative development in living labs

Do not fall back on traditional role patterns

For many actors, it is difficult to not fall back on traditional role patterns.

A living lab can be considered a niche to which the usual rules and roles do not apply, or do so only to a limited extent, which means that enforcing the usual rules and roles will frustrate the process. Design decisions should be based on what might be beneficial for this particular innovation, and arguments referring to the inability to deviate from traditional behavior or role patterns should not be accepted during the development process.

An open and transparent attitude

As mentioned in the "commitment to a different way of working," the participants in a living lab will have to adopt a communicative and transparent attitude in the development process, and be open to potentially new perspectives introduced by other actors.

B. A flexible institutional framework

To facilitate co-creation and prevent a large part of the design of the product and process being determined by public plans and procedures and private norms and standards, it is necessary that the living lab process is facilitated by a flexible institutional framework. Especially for public actors, who are used to acting upon the existing institutions, it is often difficult to let go of the authorize, control, and enforce mode. This mode is understandable from the point of view of democratic accountability, but it does not support innovation. Likewise, citizens and private actors should stop turning to the government for problem solving. Within a living lab, it is important to devote time to discussing the changing roles and role expectations amongst the participants involved, as well as within the participating organizations. Backup from the management board and government in office is crucial for exploring new grounds and crossing institutional boundaries.

Identify regulations that hinder, experiment with those that support

Urban living labs, which operate within existing institutional frameworks from which they are partly exempted, serve very well to identify regulations that are a barrier to innovation. They also offer room to experiment with new regulations. This often requires the involvement of multiple levels of government, thus including the state in local innovation processes. Performance-based regulations are known to better serve innovation: it is up to actors how to comply. Living labs can experiment with formulating performance requirements.

Provide clarity on the living lab status

Many cities now have living labs, and often the living labs are formally acknowledged by city councils. However, it is highly opaque which rights this status brings along. The eventual willingness of actors to allow experimentation and exemption from rules and co-creation is difficult to uphold when permits have to be granted, land use and zoning plans have to be formally approved or subsidies have to be granted. This often involves the participation of other municipal departments, units and civil servants than the one(s) already involved, less willing to jointly discuss the relaxation of regulations and allow significant stakeholder participation. Participating actors should aim to get clarity on the living lab status as soon as possible. The relaxation of regulations and opportunities for co-creation should be made explicit to all stakeholders, also to those not directly involved, as early in the process as possible. Clarity on the status also reduces the risks for (local) government. The experimental status prevents that others demand similar conditions. Also, regulatory experiments are allowed to fail, allowing regulatory authorities to simply end regulatory experiments when they turn out not to work.

TIP – Appoint a “municipal guide”

In IJburg, a new Amsterdam district, a coalition between the municipality and large stakeholders with development rights (property developers and housing associations) in the area involved in the planned development of the district appointed a marketeer (a “market master”). An official in the neighborhood specifically charged with thinking along with and facilitating bottom-up initiatives, while providing guidance on the applicability of the municipal regulations and procedures, and functioning as a spokesperson when adjusting these municipal regulations and procedures was desirable. An accessible expert who is familiar with the public planning system can help open up municipal processes to the living lab actors by providing the appropriate information and advice.

Local relaxation, generic replication

The good news is that whereas regulations should be relaxed for the sake of innovation development and innovative regulations supporting the innovation are being reformulated and tested, the living lab experiences will help to change regulation and formulate citywide or nationwide regulations supporting the replication of the innovation in other urban areas.

TIP – Formulate a selective municipal deregulation policy

The living lab approach requires room in the municipal regulations to allow co-creative plan development. The municipality could support this by selecting zones where its efforts are aimed at creating room in the public regulations allowing bottom-up initiatives and innovation. Living labs could then be concentrated in these deregulated zones, where actors are already accustomed to a different way of working and where some expertise and communication networks already exist.

C. Constructive, inspiring co-creation sessions

A co-creative design process is built on constructive, positive and inspiring co-creation sessions, in which the actors can engage in development activities in a setting that provides energy, enthusiasm, and productivity.

Keep gatherings informal and low threshold

Many of the cases studied show that low threshold, informal meetings requiring no obligatory attendance yield a higher rate of attendance and more development decisions than formal meetings. For example, they can be held during lunchtime, after work hours with drinks, or even during breakfast. They offer safe environments for the various actor groups to freely exchange ideas and brainstorm. Together with the low threshold character of these meetings, this allows the participants to firmly focus on the innovation and the content, offering a breeding ground for creative thinking.

Use appropriate language

Knowledge institutes, private actors, public actors, and, especially, users and citizens are known for speaking their own languages. For example, whereas a municipality may speak of a “dwelling,” a user speaks of a “house.” To allow good communication, the use of jargon should be minimized and actors should ensure that they speak in terms that are accessible to all participants. Avoiding jargon will also make actors aware of the hidden assumptions that are often embedded in these specialized terms.

Nourish intrinsic motivation

Actors’ enthusiasm, perseverance, and intrinsic motivation have been shown to be crucial in successful innovation processes. Therefore, the intrinsic motivation of partners should be nourished during the co-creation sessions. This can be done by demonstrating the relevance of the project to each of the actors, by reconfirming the shared interests,

and by promoting a sense of ownership and responsibility among the actors. In every session, co-created decisions should be clearly documented and monitored in the following sessions.

Maintain the momentum

The positive mindset and active participation of actors in the living lab process is fed by their sense of accomplishment. Holding on to the positive energy resulting from events and maintaining the momentum has been shown to be a recurring success factor in the studied innovation processes in Amsterdam.

Result-oriented sessions with tangible results – The actors in the living lab should not be allowed to slack off. Interactions may be short but they must be frequent, in order to keep the discussion about the innovation up and running. Sessions should be result-oriented, with a focus on doing rather than talking. Tangible results will help in making progress. This can be strengthened by directly sharing these results after each session. Deadlines often drive big steps forward.

TIP – A toolbox of brainstorm- and co-creation methods

We wish we could tell you which methods to employ in the co-creation sessions to co-create, but unfortunately there is no one-size-fits-all mode. Be creative in developing your personal co-creation and brainstorm methods, and take a look at other projects to see what has worked for them. The cases in this booklet provide some great examples of co-creation methods employed in the innovation processes. Determine what you need, look around, and find the tools and methods that can help you shape *your* development journey.

Celebrate successes – Celebrating successes and affirming these achievements with a publication, covenant, or a cake helps to consolidate this feeling of momentum in the participants' minds.

Keep things simple – To make meetings positive and productive, it is vital to avoid complexity and to keep things simple. Discussing legislative, juridical, and financial side issues with all actors together can lead to frustration. Focus on the connection with the higher aim and target the vision and dream, instead of diving too deep into these

technicalities. Even though co-creation in principal assumes equal influence of all participants on decision-making, it does not mean that participants have to be involved in all decisions. Ask participants if they want to participate in those matters that don't directly relate to the content of the innovation, and if they don't, don't force them. Instead, sort out these technicalities with a team of experts, of course feeding the outcomes back to all stakeholders, putting them up for discussion, and requesting input and feedback whenever appropriate. Furthermore, be pragmatic and solve problems as they occur, instead of wasting energy on anticipating potentially difficult problems.

Develop a suitable infrastructure for communication and sharing

It will not always be possible for all living lab participants to attend every development session, especially in the case of low-threshold, informal meetings. Nonetheless, it is important that even the stakeholders who are not present at a development session stay connected to the development of the innovation and the decisions made. To facilitate this, a suitable communication and information sharing infrastructure should be established through which all participants can be updated on the steps taken, and through which relevant files and information can be shared. Additionally, the process manager can inform absent stakeholders orally. Potentially relevant points discussed outside of the co-creative sessions should still be taken into account and be put on the agenda for the next session.

Co-create the process and the product

During these co-creation sessions, not only the product – the innovation – but also the process should be subject to development. The process can and should change over the course of the development process, as the shape of the innovation and the associated actions and working methods become clearer. It is important that also these decisions are made in collaboration with all the actors in the process, so that there is consensus and the responsibilities are clear. Commitment to the process will also lead to more commitment to the outcome, thus improving the chances of successful implementation.

D. The right mindset

Finally, the success of the co-creative design process depends of the participants approaching the development deliberations with the right mindset.

Develop trust

First of all, it is impossible to work together in the collaborative, enterprising, and creative way that co-creative innovation processes require when there is no trust between the living lab participants.

Trust is mentioned in theory and by practitioners as a precondition for actors to dare to invest and take action in living labs, which inherently imply experimentation and innovation – two risky undertakings. A way to promote this trust is to focus on propagating relationships through team building activities and enjoyable sessions. This, as well as conflict management where needed, should be part of the responsibilities of the process manager. Furthermore, trust should be confirmed by sticking to the shared values and ambitions. To do this, ambitions should be adjusted when necessary (which is a natural process as the innovation is gradually specified) and guarded during the development process. Mutual respect for these shared values creates a bond between the participants, which lies at the basis of trust.

Accept uncertainty

Breaking new ground always implies uncertainty, and this is no different in living labs. Apart from the uncertainty associated with experimentation, living labs have to cope with uncertainty regarding the institutional context and the behavior of the other actors on whom the innovation depends. Partners can change their minds regarding authorization or investment, jeopardizing the viability of the innovation. In the initiation phase, risk can already be reduced by delimiting the experiment in geographical scope and time. In the co-creative design phase, uncertainty can be further reduced by ensuring involvement of the participating actors by including multiple persons from multiple departments and ranks of

the participating organizations. Rather than trying to transform these uncertainties into certainties and demanding unrealistic promises from the living lab partners, however, the actors in the living lab should learn to accept this uncertainty and be daring, learning to act and make decisions regardless of the absence of guarantees.

TIP – Contractless collaboration

There are some examples of innovation processes where the project partners have decided to skip the contracts altogether, as far as reasonably possible. This has been shown to accelerate the process significantly, and, above all, has produced more than satisfactory results. In this scenario, the collaboration between the participants of the living lab is built entirely on trust. This produces a low degree of formalized certainty, while also producing a high degree of flexibility for the individual actors and a limited degree of risk, by taking away the potential of partners to start legal procedures. The shared membership of a professional (or social, for that matter) network is often reason enough to not violate the bond of trust.

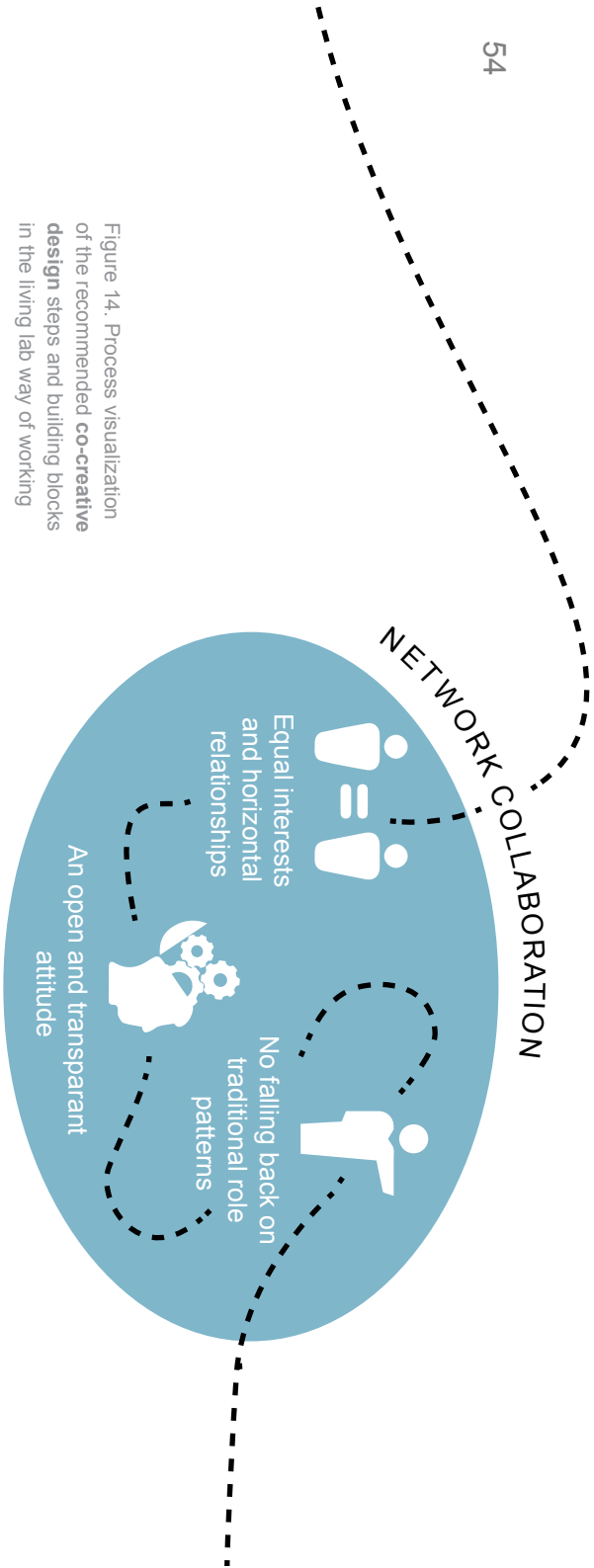
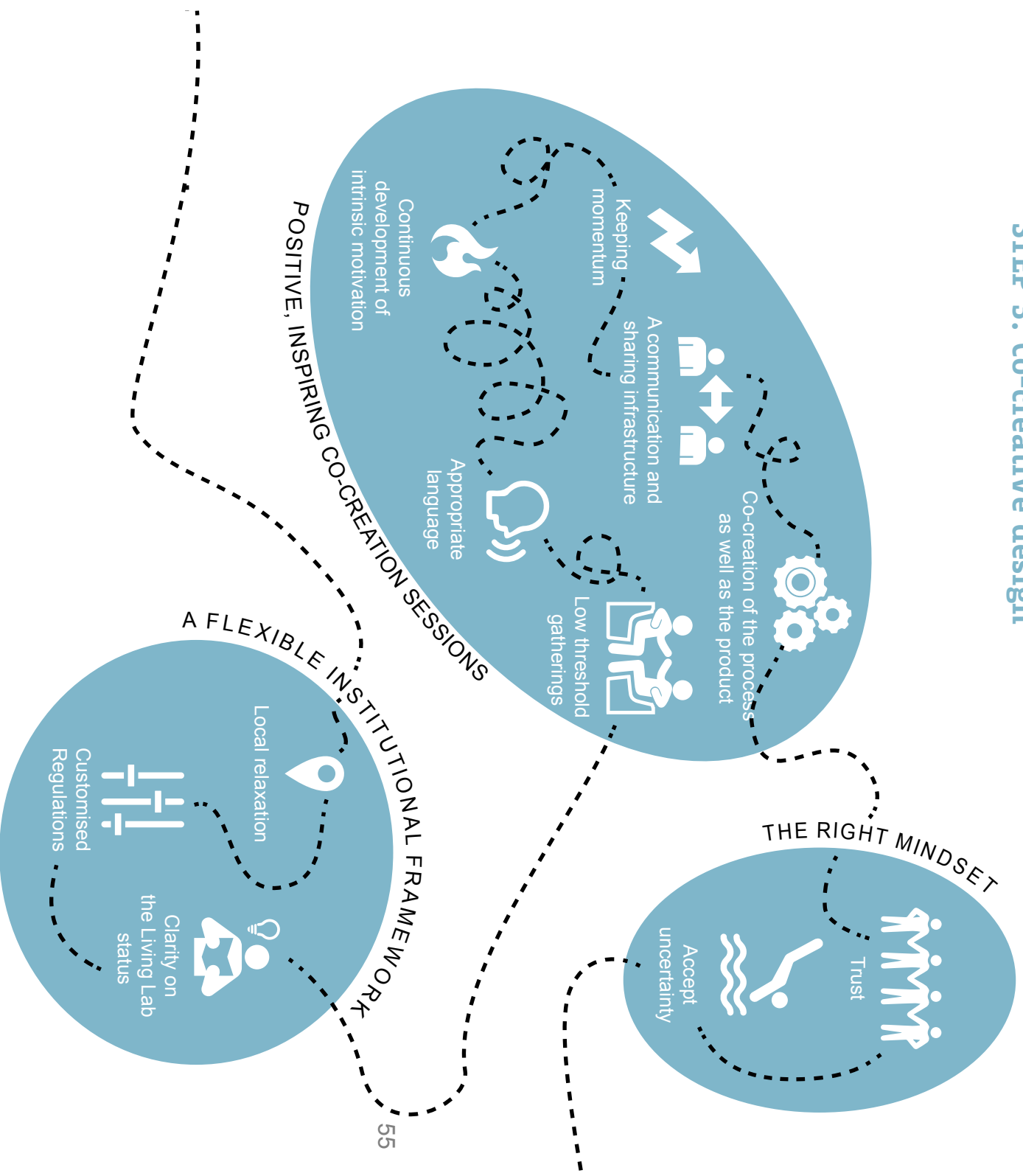


Figure 14. Process visualization of the recommended **co-creative design** steps and building blocks in the living lab way of working

STEP 3. Co-creative design



Cross Chain Control Centre

In 2013, the city of Amsterdam joined the subsidized European project TRANSFORM with the project Energetic South-East (Energiek Zuid-Oost). The project aimed at creating low carbon cities through energy-focused interventions in a particular area, preferably with the cooperation of local companies.

Energetic South-East has led to impressive results and numerous new partnerships. After the project, some partners decided to continue the sustainable efforts without subsidies. They entered an informal partnership called Circular South-East (Zuid-Oost Circulair). In 2016, the partnership sought cooperation with the knowledge institute TNO to manage the program, which became rather big. Solving the waste problem was an important focus of this program. Together, the actors in Energetic South-East started to work on the development of a more efficient logistic cooperation system for waste collection and new circular concepts. They decided to respond to the call of the Dutch "Top Sector Logistics" for a proposal for a "Cross Chain Control Centre" (4C), integrating multiple supply chains in an overarching transportation system. They won the competition. In March 2018, a new logistics pilot model should be operating in Amsterdam South-East.

2013

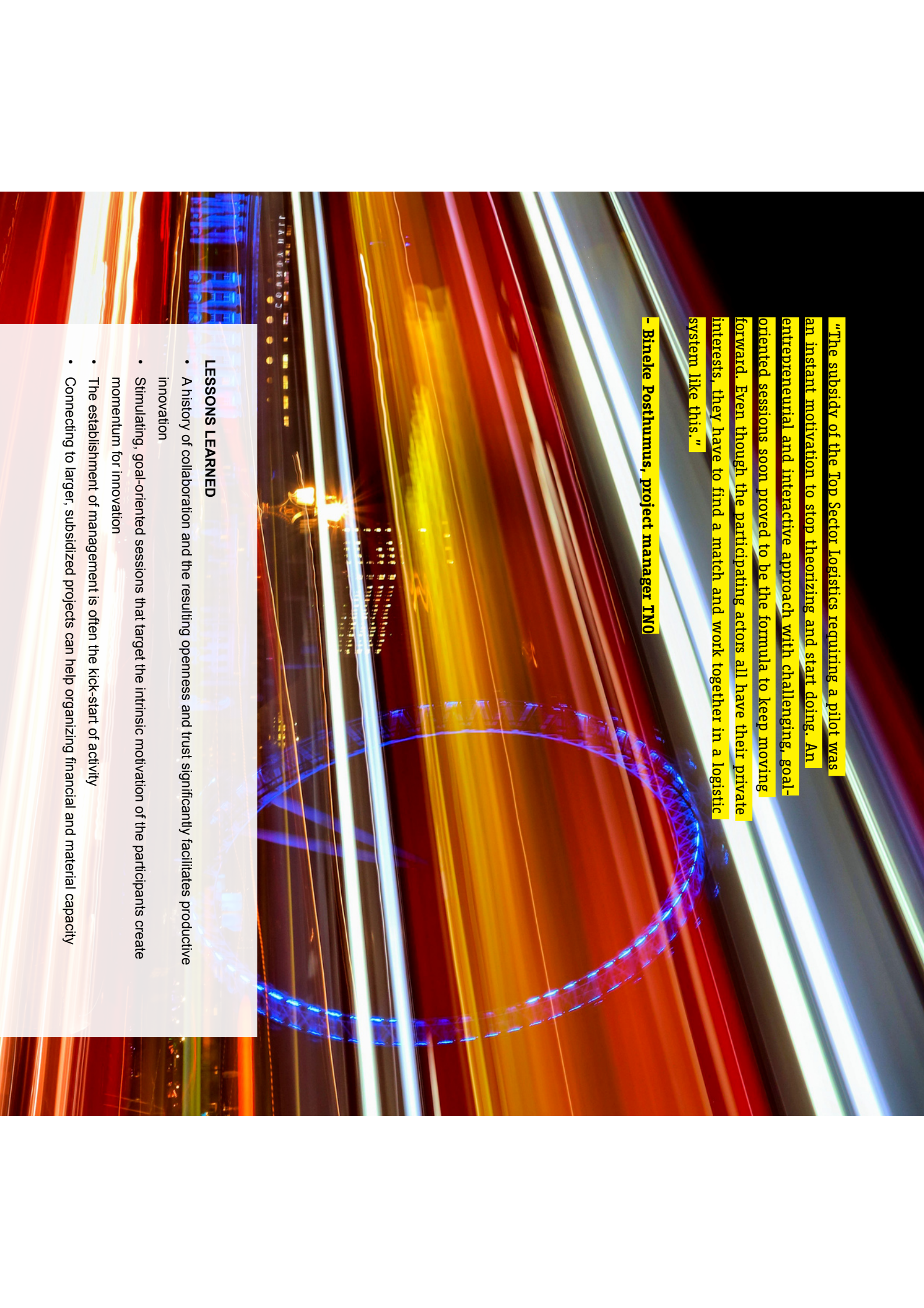
2014

2015

2016

2017

Amsterdam South-East joins the European project TRANSFORM	End of project TRANSFORM, start of the informal collaboration	Two-day "Waste in the City" challenge with local actors to raise awareness and gather ideas	Consortium wins Top Sector Logistics call with 4C proposal	4C pilot project in Amsterdam South-East
South-East Circular				



"The subsidy of the Top Sector Logistics requiring a pilot was an instant motivation to stop theorizing and start doing. An entrepreneurial and interactive approach with challenging, goal-oriented sessions soon proved to be the formula to keep moving forward. Even though the participating actors all have their private interests, they have to find a match and work together in a logistic system like this."

- Bineke Posthumus, project manager TNO

LESSONS LEARNED

- A history of collaboration and the resulting openness and trust significantly facilitates productive innovation
- Stimulating, goal-oriented sessions that target the intrinsic motivation of the participants create momentum for innovation
- The establishment of management is often the kick-start of activity
- Connecting to larger, subsidized projects can help organizing financial and material capacity

Online platform Gebied-online

After a meeting on social innovation at The Hub (a workspace rental office for engaged people), IJburg residents Paul Engel and Linda Vosjan got the idea for an experiment. If one meeting can open up such interesting discussions and create so much energy for action, would this also work with residents? Soon the first network meeting of what would later become the organization "IJburg Dreams, IJburg Does" (IJburg Droomt, IJburg Doet; (IJDIJD)) was a fact. IJDIJD informed residents about what is going on in the neighborhood, connecting needs to ideas and people in the area. The wish for an online platform to facilitate the activities of IJDIJD emerged, which resident and IT entrepreneur Michel Vogler volunteered to build. With the support of residents, entrepreneurs, the municipality, and the IJburg Coalition, the HalloIJburg.nl platform went online in May 2012. More functionalities were gradually added to the platform, generating interest in the platform outside IJburg. In 2016, the Gebiedonline ("Neighborhood online") cooperative was founded. The cooperative ownership made it possible to make the technology available to others. The co-operative currently has 22 members, presented by different networks in various cities in the Netherlands. The platform supports these bottom-up initiatives through information exchange, by connecting and activating people, and by giving them the possibility to self-organize, allowing them to create more impact.



"While making halloiburg.nl and the Gebiedonline cooperative, we investigated how online platforms can reinforce bottom-up networks as engines for societal and democratic innovation. The members of the coop-erative, which are the users of the platform, make the decisions about the further development of the platform, following our philosophy of a completely flat network collaboration."

- Ruurd Priester, Quartiermaker Gebiedonline cooperative



LESSONS LEARNED

- Local culture and demography can influence the emergence of innovation. A highly educated population can cause societal involvement, a local identity can cause commitment, and the presence of entrepre-neurs can propagate initiative and know-how
- General thematic gatherings on specific urban problems, such as the sessions at the meeting places The Hub and Pakhuis De Zwijger, often lay at the basis of ideas and initiatives
- A "cooperative in formation" (Coöperatie in Oprichting) is a very elementary legal form to formalize the collaborative management of an innovation without specifying too much.
- Continuous development of an innovation, allowing it to grow together with its users, is important for the survival of the innovation.

STEP 4. Implementation

In the living lab approach, design activities are alternated with implementation of the product in its real-life environment. The following recommendations have been formulated for this step.

A. Sustaining the implemented innovation

From the case studies of innovation processes in practice, a number of conditions for the successful implementation of an innovation have been identified.

Presence of the development conditions to sustain the innovation

For a successful operation phase of an innovation, the innovation must be sustainable in its real-life context. All too often, participants focus most of their attention on delivering the innovation, and much less on making sure that the innovation delivers a successful solution also over a longer period of time.

To achieve this, the conditions for development, presented in the conditions map on page 39, still apply – but this time for a longer time span.

Presence of the development conditions to further develop the innovation

Next to simple sustainment, the ongoing development of the innovation, to a greater or lesser extent, has come forward as being crucial for the survival and replication of an innovation in an urban context. This implies that the development conditions (see page 39) should also be fulfilled to allow action to further develop the innovation.

Formalise an implementation organisation

All too often innovations are left unused after their initial launch, simply because not enough attention has been paid to ensuring their continued use. For prolonged implementation, the organization of the tasks associated with the sustainment of the innovation becomes

a requirement to ensure that the innovation is successfully and continuously maintained. This organization is often formalized in one of many possible legal forms.

Ensuring users throughout implementation

In addition to the conditions of organization and the fulfillment of the conditions necessary for the sustainment and ongoing development of the innovation, the presence of users provides a final condition necessary for a successful operational phase of the innovation. Users of the innovation give the innovation legitimacy. If there are no users using the innovation, a new, interested user base should be found, or the innovation should be adjusted in order to better meet user needs.

B. Role-true behavior

For short-term implementation periods for the sake of testing, attention should be paid to the fact that the roles necessary for the implementation of the innovation are taken up only by actors who would also take up these roles in the long term. This is the stage at which to explore the opportunities to create a viable business model for executing all activities surrounding the implementation of the product, such as production, management, etc., which should be achieved in order to deliver a sustainable product.

C. For the long term: A management structure

Implementation can be oriented to both the short term – for the sake of testing and the initial launch – and the medium to long term, in the case of the final implementation of the product. For the latter, a management structure is required to manage the operation and potential replication processes of the innovation in other urban areas. It will also ensure that the activities associated with the sustainment of the innovation are executed. Short-term implementations without this formalized structure are possible, if the intention is to remove the product from circulation soon.

Find a legal organizational form that suits you

Formalization of the implementation organization can take many shapes: a foundation, a cooperation, an association, a private company, or another form. The developers of the innovation should formulate a role division for the long-term implementation phase of the innovation, and find a juridical organizational form that suits this vision. Whether all stakeholders participate in this management structure, or whether the future management of the innovation is left to one party, in the form of for example a private company, is up to the stakeholders to decide.

In case of collective management: include all stakeholders

Stakeholders can also decide to remain involved during the operation phase. When a collective form of juridical organizational is chosen, some additional challenges will be encountered.

Shared motivations – First, as we are talking about a long-term organization, members representing each stakeholder can change and/or new stakeholders can enter the organization as the innovation evolves. It is important to immediately familiarize these new members with the motivation behind the organization and the innovation, so that they understand its function and do not regard the organization as, for example, just a supplier. Sharing the motivations is also crucial for the members, when they want to collectively strengthen the innovation.

TIP – The cooperative as a useful management form

When there is a desire for collective management of an innovation, the cooperative has proven to be a useful juridical form to formalize the management structure.

Especially a *Coöperatie In Oprichting* ("Cooperative in formation") can open up opportunities in the Netherlands. In such a cooperative, the articles of association can be elementary, allowing the shared interest to be put central. Additional agreements can be documented by the members in the internal rules of operation, which can be amended without the intervention of a notary.



Expertise – A formal management structure requires a certain degree of professionalism. The inclusion of people with entrepreneurial or self-employed experiences can offer expertise regarding the organizational aspects of the organization, allowing others to focus on the innovation.

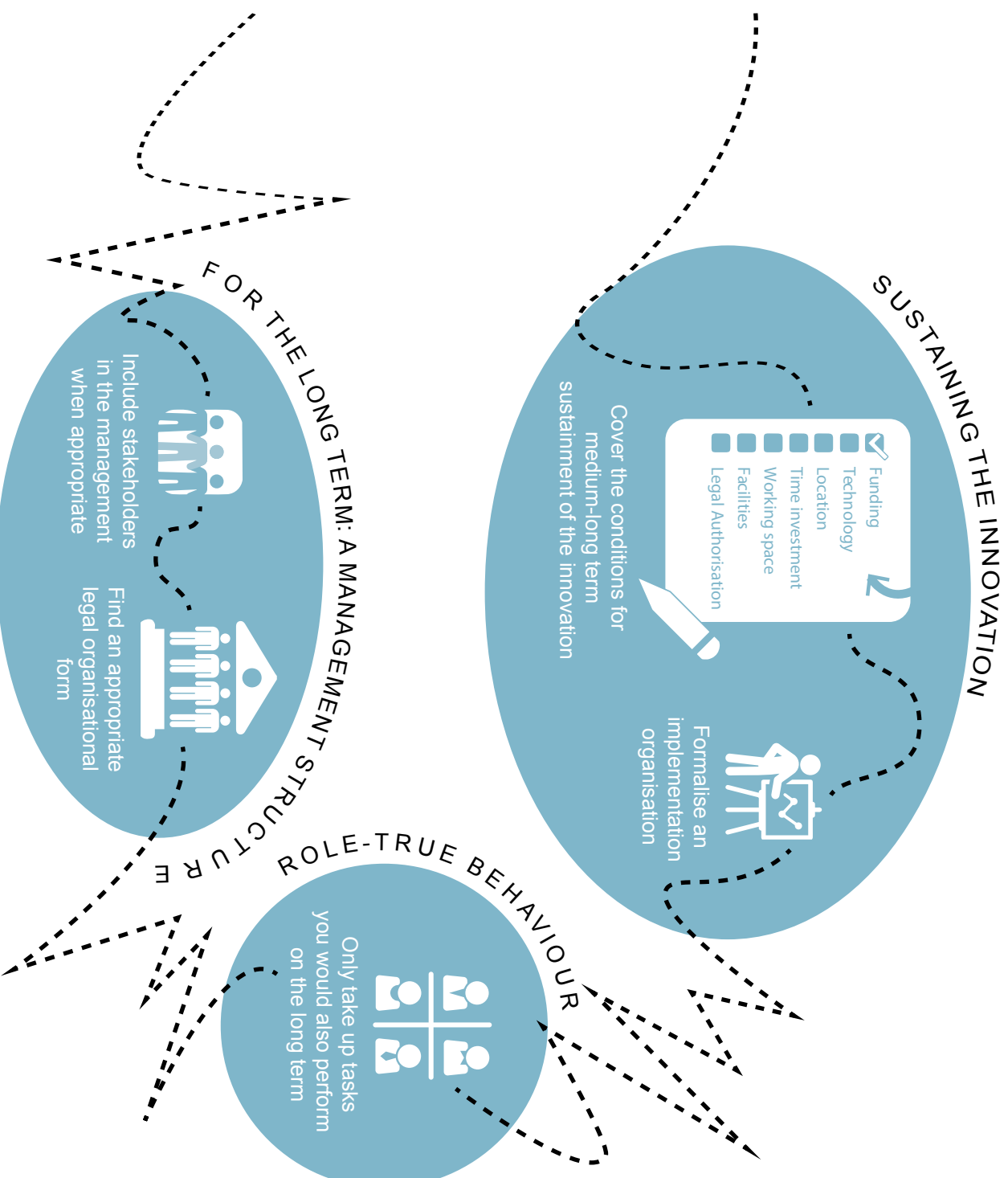
Keep things simple – As said, the administrative aspects of a formal management structure can be complicated. The managerial meetings with all stakeholders can soon evolve into difficult discussions on financial or juridical issues, leaving little time to address the core issue: the implementation of the innovation. Keeping things simple is key to effective collective management. Don't dive too deep into the numbers, and when things become too complicated, stick to one-size-fits-all decisions that are acceptable to everyone. Be pragmatic, and tackle problems as they occur, maintaining to the positive momentum of the development phase.

▪

♦

Figure 15. Process visualization of the recommended **implementation** steps and building blocks in the living lab way of working >>

STEP 4. Implementation



STEP 5. Evaluation

Evaluation is a core component of the living lab approach. During the evaluation phase, the product and the process are evaluated to check whether the goals and ambitions have been achieved. This evaluation is to take place at two levels. The technical level is concerned with the functioning of the innovation itself and asks questions, such as: Does it work, can people operate it, do people use it? At the conceptual level, evaluation is concerned with questioning the innovation itself or the aim of the innovation, leading to questions, such as: Is this the right innovation given the aim or the problem it intends to solve? Does it have many, perhaps unexpected side effects? Will it be replicable? If so, under which conditions and at which scale?

A. Management

Evaluation, together with iteration and dissemination activities, has been shown to be the most vulnerable part of the living lab approach. As urban living labs are about innovation, the phases of development, production, and implementation of the innovation often receive most attention. However, given the aim of living labs to learn from the innovation in its use context and to use the innovation and/or the lessons learned in other places, evaluation is a crucial stage. Without evaluation, living labs will lead to one-off, local innovations.

Include monitoring and evaluation activities

Just like the plan development and design activities in the living lab process, the monitoring and evaluation activities need to be specifically formulated and steered by the management of the living lab, which can consist of representatives of various stakeholders or constellations thereof. Public stakeholders, such as local authorities or subsidizing organizations, should make their participation conditional on a well-formulated monitoring and evaluation plan.

Knowledge institutes in charge of monitoring and evaluation

In order to keep an overview of the gathered information and allow integrated formulation and documentation of lessons, it is best to have one party in charge of the whole learning process in living labs. The Amsterdam cases show that the close involvement of knowledge institutes in living labs ensure that attention is paid to monitoring and evaluation. Knowledge institutes do not only have knowledge on the innovation being developed; they also have knowledge and experience of monitoring and evaluation. This makes them ideal candidates for preparing and supervising these activities.

Evaluate the innovation and the innovation process

Monitoring and evaluation should be concerned with the product, the innovation, and the innovation process. Especially on the process, important lessons could be learned that could already benefit the living lab itself; after all, the process evolves in an iterative way. In addition, the process lessons can be of high value to other living labs, or to stakeholders contemplating starting or becoming engaged in a living lab. Without evaluation, living labs could never have such an impact.

B. Stakeholder commitment to evaluation

As the goals and ambitions, as well as the innovation and the innovation process, are the outcome of active stakeholder participation and influence, stakeholders should also be part of the monitoring and evaluation. In this process, stakeholders should be involved in formulating the indicators to be monitored and the criteria to be evaluated. In addition, the evaluation should consider the different stakeholders' perspectives on the process and outcome.

Remind the stakeholders of their interests and relevance

Even when it has been made clear to the participants that monitoring and evaluation is a crucial part of the living lab approach, the priorities of stakeholders might shift over time. Remind the stakeholders of the agreement, and demonstrate the importance of evaluation once more, by relating its benefits to the private interests and objectives of the stakeholders.

Make evaluation easy by good preparation

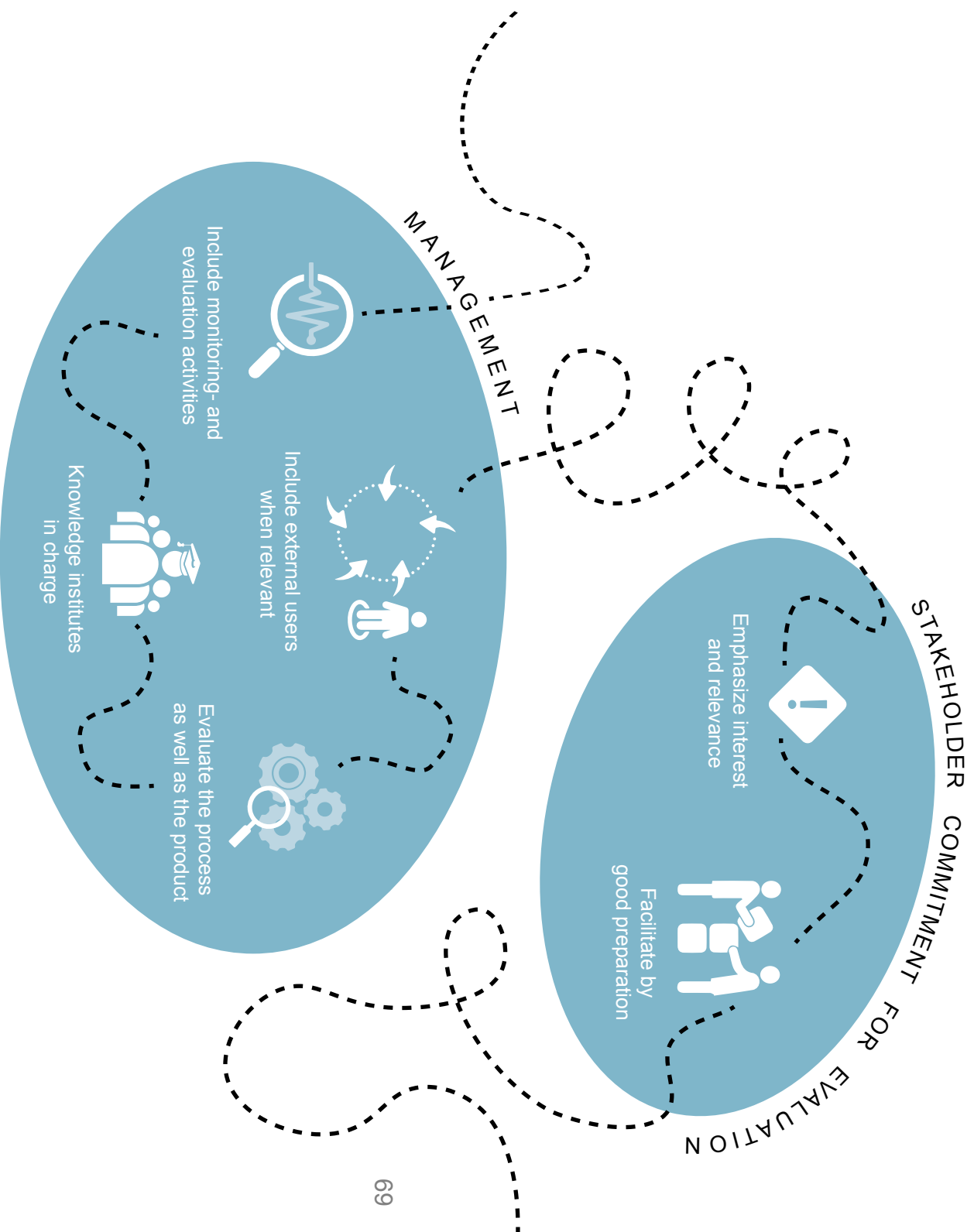
The manager of the evaluation process can facilitate the engagement of the stakeholders in evaluation by thoroughly and thoughtfully preparing the evaluation tools, such as clear and brief online surveys or well-prepared interviews, making it easy and quick for stakeholders to collaborate and share the knowledge and experiences gained. Also, participants should prioritize their own monitoring and evaluation activities. The popularity of living labs makes them a hot topic for research by many institutes and students, and jointly disseminating intermediate evaluation results could meet the information need of outsiders.

-

Don't forget to include external users in the evaluation when relevant

While in living labs users are participating in the product development process to ensure the developed innovation is in line with user requirements and user behavior, it is important to realize that the evaluation of the product by these users can be influenced by their having prior knowledge about the product. Also their involvement in the product development may influence perceptions. Therefore, external users should be included in the evaluation process, when appropriate. These “uninformed” users can teach the developing actors more about the functionality and appreciation of the product and provide fresh insights.

STEP 5. Evaluation



STEP 6. Refinement

Evaluation is followed by the refinement of the innovation, namely further improving and finetuning the product in line with the iterative character of the living lab approach.

A. Optimization

During refinement, the outcomes of the evaluation phase are used to go back to the appropriate development phase to solve the problems encountered and to refine the product to better fit the stakeholders' needs. The final aim is to develop an optimal product that meets the set goals for the innovation, and it can take several iterations of this process before this aim is achieved.

B. Co-creation

Adjustments to and refinement of the co-created outputs should also be addressed in a co-creative manner. This is an aspect of co-creation that is often forgotten in urban living labs in practice. During the implementation phase, there is a natural, operation-oriented division of tasks amongst the living lab participants. The focus on getting things done may cause the stakeholders in charge to feel legitimized to start optimizing the product from their own perspective. And quite often, stakeholders are not aware of this. Even though the improvements seem marginal, some stakeholders may regard them as a sea change. However, iterations should also be conducted in a process of co-creation, and the process, the tools, and the management can also be subject to review.

Again, there is tension between the time needed for co-creation and the progress and decision-making power need for implementation, especially since the implementation phase is one in which more traditional stakeholders might become involved, such as suppliers, shopkeepers, and housing associations. The participants managing the implementation process should be sensitive to assessing which changes should be discussed with the wider group of participants.

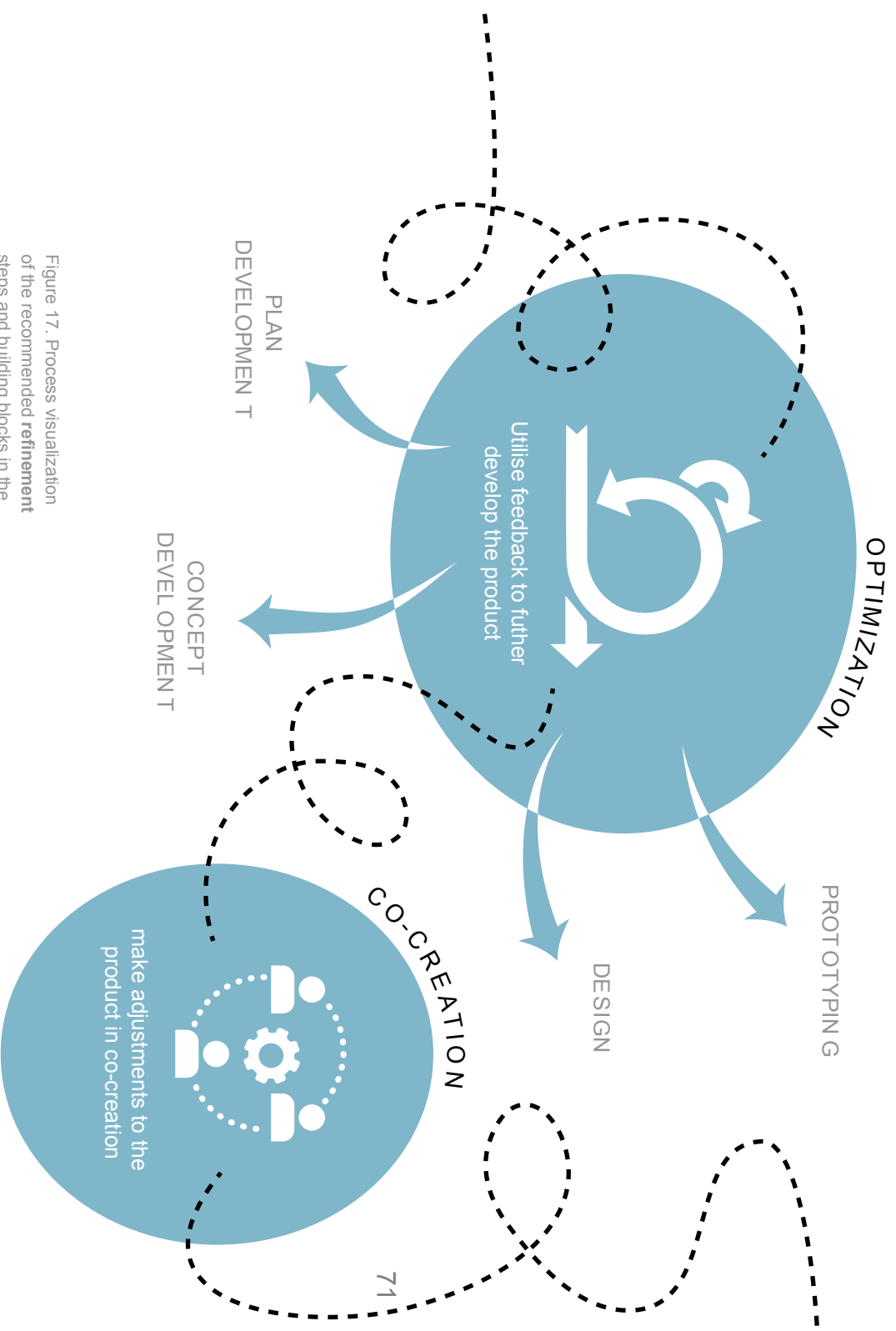


Figure 17. Process visualization of the recommended **refinement** steps and building blocks in the living lab way of working

The Arena Battery

The Amsterdam Arena stadium is home to the Ajax football club and also hosts many events. The stadium is a large energy consumer. In 2010, Amsterdam Arena launched a five-year strategic plan expressing its ambitions to lower the environmental impact of the stadium and the surrounding area and to become a platform for sustainable innovations. During the company's search for innovative sustainable solutions, its chief innovation officer, Henk van Raan, met the director of the The Mobility House. This company had just developed a renewable energy storage system made of car batteries with car manufacturer Daimler. A collaboration was born, and in 2016 The Mobility House, the Amsterdam Environment and Energy Fund, and Amsterdam Arena signed an agreement with Eaton and Nissan to realize a similar battery system for the stadium. The aim was to make the energy management more efficient, sustainable, and reliable. When put into service, the battery will be the largest energy storage system based on second-life car batteries used by a commercial company in Europe.

To increase the impact of the innovation, the Amsterdam Arena, The Mobility House, and the Amsterdam Environment and Energy Fund are setting up a private company, Amsterdam Energy Arena BV, to provide energy services to owners or grids, buildings, and housing, and to other event venues in the surroundings. This way, mega batteries like this can become a pivot in local smart energy grids, opening opportunities for more sustainable energy management systems in the future.

2010

Arena launches the five-year plan "Amsterdam Arena, Naturally sustainable"

2016

2016

2016

2016

Realization of a battery system based on car batteries by The Mobility House – Daimler

Directors of Amsterdam Arena and The Mobility House coincidentally meet

Amsterdam Arena and The Mobility House launch a tender for a battery system for the Arena

Amsterdam Arena, The Mobility House, Nissan and Eaton sign a contract for the delivery of an energy storage system based on second-life Nissan LEAF batteries

"As one of the largest commercial players in Amsterdam, Amsterdam Arena has the capacity to make a difference. Henk van Raan, our chief innovation officer, does a great job in convincing the other actors that now is the time to make this difference. To get everybody on board, you need to find smart solutions that are environmentally and economically attractive, like this battery."

- Reinout Huisman, project manager Amsterdam Arena



LESSONS LEARNED

- Unplanned encounters can play a big role in the origination of ideas and collaborations
- A visionary leader is a catalyst for collective action
- Large institutions with a sustainable cause often serve as major facilitators of innovation by creating awareness, initiating action and providing capacity
- Implementing an idea with the help of public funding can be difficult, because of the requirement for public tenders
- Connection with relevant technologies is necessary to realize certain ideas

Zuid-Oost Circular

Sustainability Company ZOEenergy

In mid 2016, the World Business Council For Sustainable Development (WBCSD), a global, CEO-led organization of over 200 leading businesses and partners, launched the Zero Emissions Cites (ZEC) project. The project is aimed at developing an approach to get cities to a zero emissions pathway together with local stakeholders.

Under the umbrella of this project, six member companies of the WBCSD joined forces with the municipality of Amsterdam and local partners to develop an implementation strategy for a selection of sustainable energy projects. The solution is sought in a district company or cooperation: Zuidoost Energy (ZOEenergy). This body would not only manage the development and implementation of tailored sustainable energy solutions in the involved areas, but would also be responsible for the organization of funding necessary for these interventions and their long-term return, reinvesting the revenues from these activities in the company.

After a dynamic process of specifying the collaboration, arranging a financing construction, and allocating responsibilities, on 8 February 2017 Arcadis, Allander, DNV GL, Engie, TNO, and the municipality of Amsterdam signed a letter of intent to work toward the establishment of the socially embedded sustainability company Zuid-Oost Energy, in an appropriate legal form, in September 2017.

1995

Foundation of the
World Business
Council for Sustainable
Development

2016

The WBCSD signs a memorandum
of understanding with the city of Amsterdam for a Zero Emission Cities
project in Amsterdam South-East

2016

Development of an implementation
strategy for sustainable energy
projects in Amsterdam South-East by
six WBCSD members, local partners,
and the city of Amsterdam

2017

Arcadis, Allander, DNV GL, Engie,
TNO, and the municipality of Amsterdam sign the letter of intent for the
realization of ZOEenergy



"The energy transition offers a big opportunity for companies. Yet, they experience no benefits in achieving a high sustainable energy performance. Participating in innovations like this really depends on individual corporations making it their interest to do better, and in the innovation to accommodate this interest."

- **Niels van Geenhuizen, program manager Sustainability Arcadis**

LESSONS LEARNED

- Large companies are discouraged from participating in sustainable innovation by institutional incentives that do not favor sustainability
- The uncertainty of the commitment of stakeholders to participate in an innovation proves to be a big barrier to innovation
- Opening up all potentially high-impact options means that actors need to be willing to deviate from their traditional mindset, way of working, and business model
- Deadlines help in encouraging the production of results and keeping momentum in the development process

STEP 7. Dissemination

Dissemination refers to the drawing of lessons from the experiences in the living lab in order to apply them in future contexts and thus permit an overarching learning process that goes beyond the individual living lab. Dissemination takes place after as well as during the development process, learning from interim experiences and evaluation outcomes as well as from the final results of the lab. It implies both reflection on the internal knowledge generated in the living lab and triangulation with existing external knowledge.

A. Drawing of lessons

Lessons should be drawn by reflecting on the interim and final experiences and findings of the living lab process, thus generating lessons on, amongst others, what works and what doesn't work. This reflection should be based on the input of all stakeholders, although it is recommended that one actor should be in charge of this process, in line with Step 5A. The lessons can be concerned with all aspects related to the innovation and the innovation process, and everything needed to support and organize this process.

B. Documentation of lessons

Documentation of the findings and reflections is crucial for the sharing of lessons. In this step, the findings and reflections are processed and documented. This can be done in various ways, ranging from traditional reports to websites, blogs, and videos. Without such documentation, it is very difficult to share the lessons and preserve them for other living labs, as well as for the living lab concerned. Without such documentation, lessons tend to remain personal experiences, which are lost when project members leave the group. Again, this should be centrally managed to ensure that lessons are drawn.

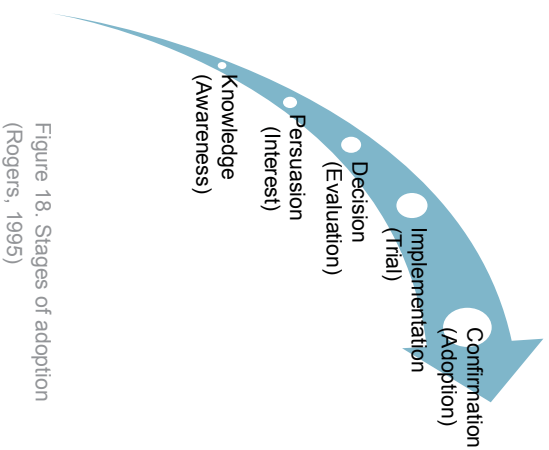


Figure 18. Stages of adoption (Rogers, 1995)

C. Contextualisation of lessons

Lessons also need contextualization to understand why some actions and activities succeeded or failed in the particular situation of the living lab, and to determine their broader meaning and applicability. During this step, the generated and documented lessons are triangulated with existing knowledge from theory and praxis.

The contextualization of lessons has proved to be of the utmost importance in facilitating an overarching learning structure that permits replication of solutions of the living lab in other urban contexts, which is the ultimate aim of living labs. The replication of solutions is nothing more than the adoption of lessons generated elsewhere. Actors adopt lessons on the basis of awareness, interest, evaluation, and trial. If lessons are not contextualized, the solution will not work in the context in which the potential adopter evaluates and tests the lesson, and adoption will be rejected.

D. Sharing of lessons

Finally, to facilitate overarching learning mechanisms that go beyond the individual lab, it is important to share the generated, documented, and contextualized lessons.

Make the lessons accessible

In practice, we often see the unconstructive development of a certain field of knowledge due to a lack of sharing of the knowledge generated in various places of experimentation. It is impossible to adopt lessons if they are not accessible. Making the documented and contextualized lessons available to a broader audience is indispensable for the sharing of lessons from a living lab process. This can be done through numerous outlets, such as a website, a documentary, or a scientific publication.

Generate exposure

Generating exposure can raise awareness of and invoke interest in the newly generated lessons of a living lab by potential replicators. This can

already be done during the development and implementation process, by looking for exposure through media coverage, presence at events, participation in competitions, etc., and by making sure that the living lab and the lessons learned are found when looked for (through well-spread contact information or a website). The impact of utilizing social and other media and employing marketing strategies to enlarge exposure and elicit interest should not be underestimated.

TIP – Join a network

Formalized networks in which a number of people and organizations are connected under the flag of a specific interest or cause have been mentioned before as playing a part in knowledge exchange, the provision of inspiration, the formation of partnerships, and the diffusion of innovations. These networks, in which specialized actors come together, are the places par excellence in which knowledge is collected for replication. Therefore, if you haven't already joined a network, now is the time to do it to share your lessons.

TIP – Attend events

Exposure of the lessons learned in the living lab can also be generated by sharing at events. Events typically provide a large audience that, in the case of specialized events such as congresses or thematic sessions, might even resonate with the topic of your lessons.

TIP – Participate in competitions

The studied innovations in Amsterdam have shown that prizes often imply media attention. This can generate a lot of exposure for the project, offer an organized platform to communicate the project, and yield funding because of the prize money often involved (which, although granted after the act, is always welcome to further improve and disseminate). However, to be able to grasp this opportunity, you need to participate in a competition. Make the move! Often, there is nothing to lose.

Mind the formulation

Finally, when sharing the lessons, attention should be paid to the form in which they are shared. The lessons should be relevant, understandable, operational, and complete, in order to evoke interest and facilitate evaluation and trial.

STEP 7. Dissemination

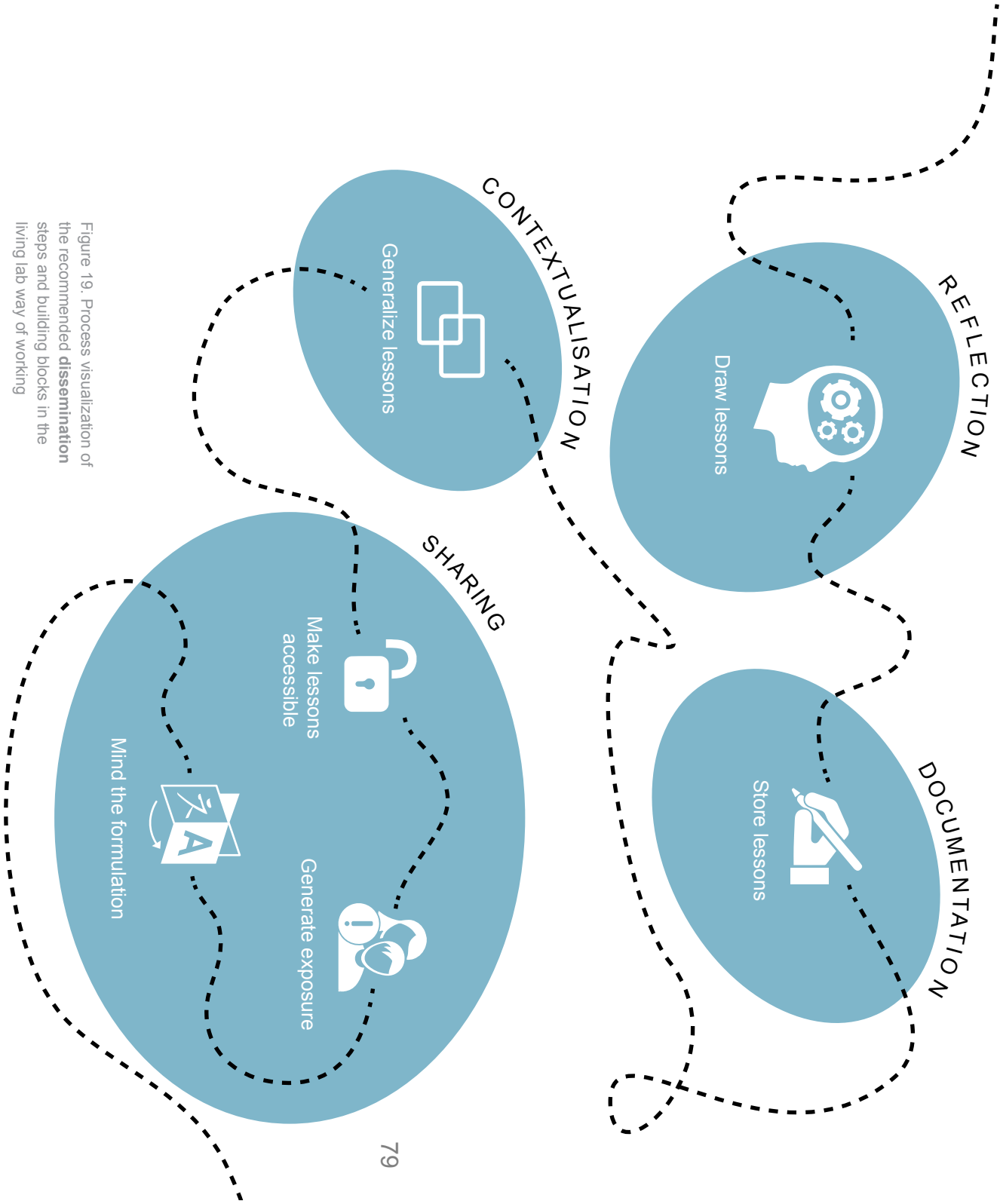


Figure 19. Process visualization of the recommended **dissemination** steps and building blocks in the living lab way of working

STEP 8. Replication

The final step in a successful living lab is replication, referring to the reproduction of the developed innovation in other urban contexts.

A. The decision for replicate

Replication does not occur unless somebody decides to do so. This decision can come from two sides: Either from the innovation-generating living lab wanting to scale up the innovation through enlargement or replication, or from external actors who are interested in the innovation and want to adopt the solution. In both cases, actors who are willing to replicate the innovation and the managers of the innovation in the implementation phase, will have to get in touch and arrange the replication process.

B. Implementation of the innovation in the context of replication

When replicating the innovation, part of the development process should be repeated. The development conditions (provided in the conditions map on page 39) have to be satisfied to support the development activities necessary to fit the innovation in the new context. This capacity has to be organized, and can be provided by the same actors as in the initial innovation, or by other actors.

C. Sustainment of the innovation in context of replication

Also the conditions for sustaining the innovation in the context of replication apply. The same recommendations as in the implementation phase of the living lab way of working apply, including the fulfillment of development conditions (page 39) for the medium-/long-term sustaining and further development of the innovation and the ensuring of the presence of users.

The successful replication of the innovative product of a living lab manifests adoption of the lessons of a living lab, indicating a retention of learning in the larger urban innovation system.

STEP 8. Replication

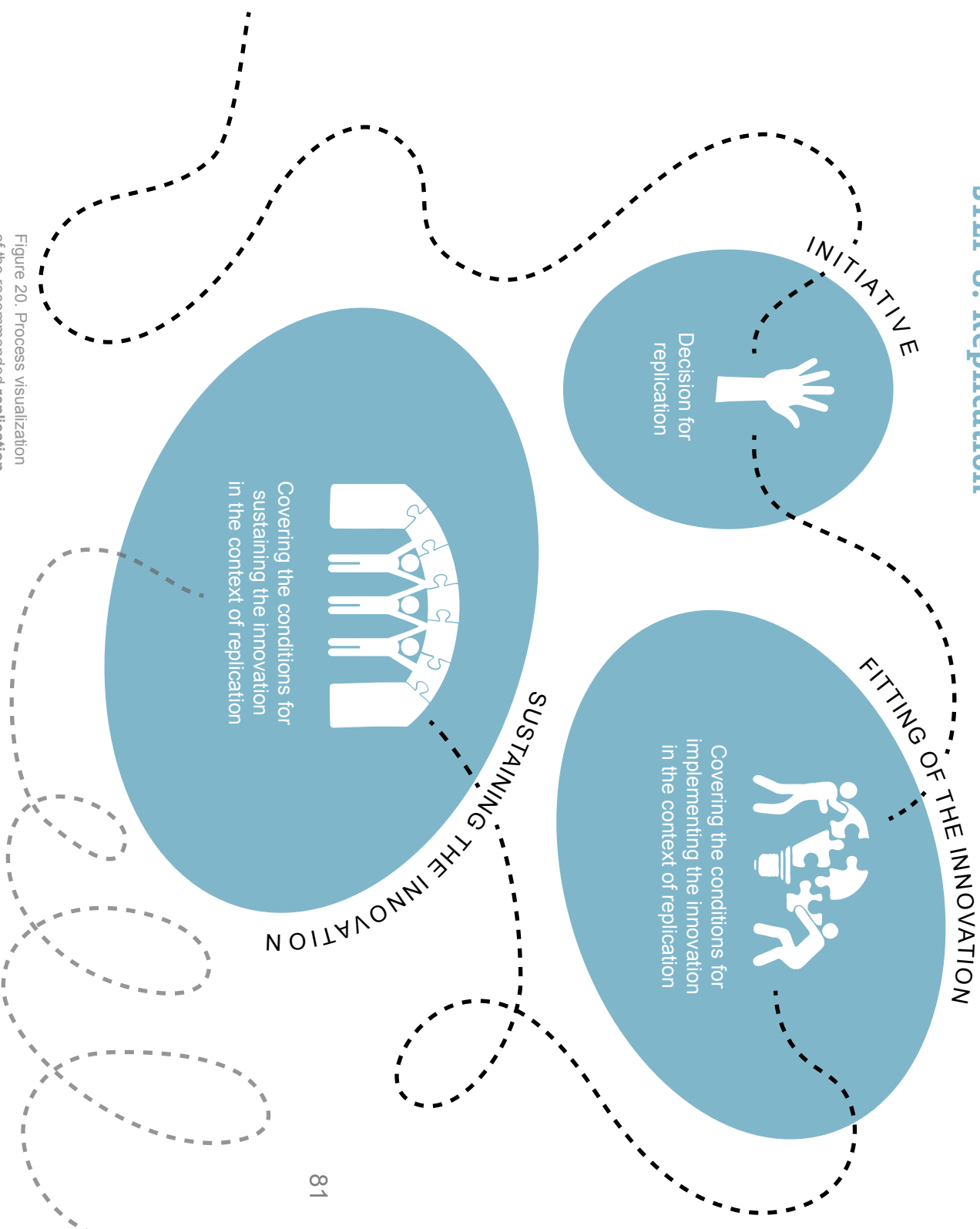


Figure 20. Process visualization of the recommended **replication** steps and building blocks in the living lab way of working

List of figures

- Figure 1.** The defining characteristics of urban living labs
- Figure 2.** The distinction between a living lab and a living lab platform
- Figure 3.** Division of 90 sustainable urban innovation projects in Amsterdam according to the innovation activities focused on in the project
- Figure 4.** Division of 90 sustainable urban innovation projects in Amsterdam according to the degree of user involvement intended in the project activities
- Figure 5.** The steps in the living lab way of working
- Figure 6.** A first-contact communication infrastructure between the living lab stakeholders
- Figure 7.** Advantages and disadvantages of the living lab approach
- Figure 8.** The living lab stakeholders
- Figure 9.** Process visualization of the recommended initiation steps and building blocks in the living lab way of working
- Figure 10.** The awareness–interest cycle that represents the pattern of people interactions leading up to partnerships
- Figure 11.** Map of recurring conditions for development, implementation and replication of innovations
- Figure 12.** Process visualization of the recommended plan development steps and building blocks in the living lab way of working
- Figure 13.** The transition from a hierarchical to a network collaboration structure necessary for co-creative development in living labs
- Figure 14.** Process visualization of the recommended co-creative design steps and building blocks in the living lab way of working
- Figure 15.** Process visualization of the recommended implementation steps and building blocks in the living lab way of working
- Figure 16.** Process visualization of the recommended evaluation steps and building blocks in the living lab way of working
- Figure 17.** Process visualization of the recommended refinement steps and building blocks in the living lab way of working

Figure 18. Stages of adoption (Rogers, 1995)

Figure 19. Process visualization of the recommended dissemination steps and building blocks in the living lab way of working

Figure 20. Process visualization of the recommended replication steps and building blocks in the living lab way of working

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Appendix I

List of 90 scanned sustainable innovation projects

1. **Amsterdam Rainproof**
<https://www.rainproof.nl/net-verhaal>
2. **Mediamatic Aquaponics**
<https://www.mediamatic.net/nl/page/46417/aquaponics-at-mediamatic-fabriek>
3. **Ship to Grid**
<https://amsterdamsmarcity.com/projects/ship-to-grid>
4. **Park 2020**
<http://www.park2020.com/nl/ons-team/>
5. **Houthaven 100% klimaatneutraal**
<https://www.nuon.com/activiteiten/producten-en-diensten/stadswarmteprojecten/houthaven-amsterdam/>
6. **Urban Solution Stoterdijk III**
<https://www.amsterdameconomicboard.com/n/en/nep>
7. **De Klimaatstraat**
<http://oud.amsterdamsmartcity.com/projects/detail/label/Klimaatstraat?lang=nl>
8. **Sustainable Neighborhood Geuzenveld**
<http://oud.amsterdamsmartcity.com/projects/detail/d/13/slug/sustainable-neighborhood-geuzenveld>
9. **Cargohopper**
<https://amsterdamsmartcity.com/products/cargohopper>
10. **Mokum Mariteam**
<http://www.mokummariteam.nl/>
11. **WeGo Fleet Mobility**
<https://fleet-mobility.nl/fleet/personenautos/3433-amsterdam-deelt-met-wego>
12. **Amsterdecks**
<http://www.amsterdecks.com/>
13. **Innovative Energy Contract E-harbors Zaanstad**
<http://oud.amsterdamsmartcity.com/projects/detail/d/50/slug/e-harbours-zaanstad>
14. **Rooftop Revolution**
<http://www.rooftoprevolution.nl/>
15. **City-zen Retrofitting**
<http://www.cityzen-smartcity.eu/resources/building-retrofitting/residentiair-retrofit-in-amsterdam/>
16. **Oosterlicht**
<http://oud.amsterdamsmartcity.com/projects/detail/d/125/slug/oosterlicht-project-of-zuiderlicht>
17. **Zonstation 1**
<https://amsterdamsmartcity.com/projects/zonstation-1>
18. **De Dakdokters**
<http://dakdokters.nl/#onzemissie>
19. **Aquatic plants transform into bench**
<https://amsterdamsmartcity.com/projects/aquatic-plants-transform-into-bench>
20. **Smart Light**
<https://amsterdamsmartcity.com/projects/smart-light>
21. **Sustainable symbiosis between Art and Greenhouse**
<https://amsterdamsmartcity.com/projects/duurzame-symbose-tussen-kunsten-kaas>
22. **City-zen: Comfort cooling residential buildings in Houthaven district**
<https://amsterdamsmartcity.com/projects/city-zen-comfort-cooling-residential-buildings-in-houthaven-district>
23. **Innovation Lab "Food Village"**
<http://www.creativitylab.nl/food-village-in-amsterdam-noord-het-lab-heeft-een-haaltbare-business-case-opgeleverd>
24. **City-zen Smart Grid – Vehicle2grid**
<https://amsterdamsmartcity.com/projects/city-zen-smart-grid-in-amsterdam-nieuw-west>

25. **City-zen Smart Grid – Virtual Power Plant**
<https://amsterdamsmacity.com/projects/city-zen-virtual-power-plant>
26. **Commercial Waste in the Winner City**
<https://amsterdamsmacity.com/projects/commercial-waste-in-the-inner-city>
27. **Smart street lighting powered by direct current at Port of Amsterdam**
<https://amsterdamsmacity.com/projects/smart-street-lighting-powered-by-direct-current-at-port-of-amsterdam-4f01ug3v>
28. **Wasted lab**
<https://wastedlab.nl/en/>
29. **Smart Sport Parks**
<https://amsterdamsmacity.com/projects/smart-sport-parks>
30. **Smart City Experience Lab**
<https://amsterdamsmacity.com/projects/smart-city-experience-lab>
31. **Metabolic Lab**
<http://www.metaboliclab.nl/>
32. **City-zen Test Living Lab**
<http://oud.amsterdamsmacity.com/projects/detail/id/85/slug/city-zen-test-living-lab>
33. **Digital Mile**
<http://www.innovatie-esiateite.nl/article/11061/High-Five-Marlie-de-Vreeze->
34. **Beacon Living Lab**
<http://oud.amsterdamsmacity.com/projects/detail/id/104/slug/beacon-living-lab>
35. **IoT Living Lab**
<http://iollivnglab.com/>
36. **Implementation of Fuel cell technology in De Groene Bocht in Amsterdam**
<http://oud.amsterdamsmacity.com/projects/detail/id/16/slug/fuel-cell-technology>
37. **Flexible street lighting**
<https://amsterdamsmacity.com/projects/flexible-street-lighting>
38. **RELOADIT**
<http://www.smart-circle.org/smacity/uncategorized/smart-energy-system-zaansland-reloadit/>
39. **Self-sufficient Pampus**
<https://amsterdamsmacity.com/projects/self-sufficient-pampus>
40. **Smart Wasting in Amsterdam**
<http://www.ams-institute.org/solution/smart-wasting-in-amsterdam/>
41. **Waterbestendig Westpoort**
<http://www.must.nl/projecten/waterbestendige-westpoort/>
42. **Rain Sense**
<http://www.ams-institute.org/solution/rain-sense/>
43. **De Praktijkproef**
<https://www.praktijkproefamsterdam.nl/over-ppa>
44. **Smart Students**
<https://amsterdamsmacity.com/projects/smart-students>
45. **Smart Electric Energy Boat**
<https://amsterdamsmacity.com/projects/smart-electric-energy-boat>
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Colophon

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Urban Living Labs

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