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Deliverable 3.1

Practical guidelines for establishing and running a city logistics living laboratory

Disclaimer

This document reflects the views of the author(s) and does not necessarily reflect the views or policy of the European Commission. Whilst efforts have been made to ensure the accuracy and completeness of this document, the CITYLAB consortium shall not be liable for any errors or omissions, however caused.

The practical guidelines for establishing and running a city logistics living laboratory created for CITYLAB is based on a generic Living Labs methodology and adapted for the specific context and objectives of this project. The text on the Living Labs approach and main methodological steps is re-used. The methodology and instructions have been further customised for this project. To date, TNO has developed dedicated Living Labs Handbooks for the following projects: CORE (2014), Logicon (2015) and Smart Rail (2015).

Document Control Sheet

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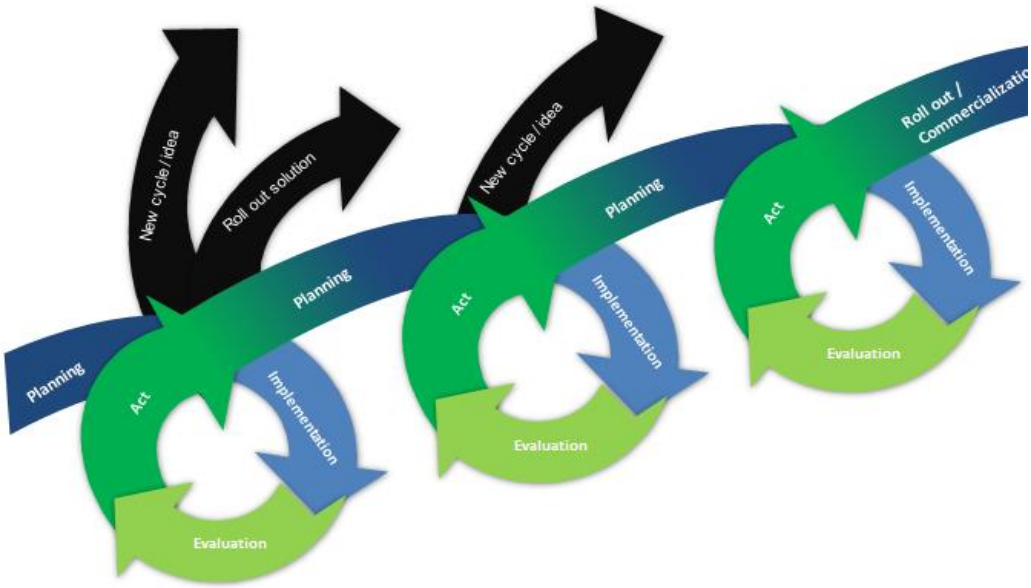
Executive summary

These guidelines present an overall methodological approach to be used in the city logistics Living Labs within the CITYLAB project. A Living Lab is defined as a dynamic test environment where complex innovations can be implemented. The methodology follows a cyclical approach, where several solutions can be tested and readjusted/improved to fit the changing real-life environment. One cycle within a Living Lab usually consists of the following phases:

- **Planning** where the Living Lab vision, ambitions, objectives, main users and stakeholders are identified and where conceptual designs of implementation cases to be tested in the Living Lab are made.
- **Real life implementation** where concrete Living Lab solutions are prepared for execution and implemented in real life environment.
- **Evaluation** where the results of the implementation are analysed based on more extended data collection and on feedback from the users.
- **Act/Decision** where, based on the lessons learned from the evaluation phase, a decision is made on the continuation of the Living Lab into a new cycle and on what amendments will be made in this new cycle.

The following figure presents a schematic overview of the different steps and the iterative approach within the Living Lab.



This document introduces the overall Living Lab methodology and which specific urban logistics characteristics have to be taken into account (chapter 2), presents an overview of different roles and responsibilities within the Living Lab and explains how to facilitate involvement in the process of users and stakeholders (chapter 3). It provides a guidance of actions and considerations to be taken into account in the different phases of the Living Lab process (the annexes).

1 Introduction

1.1 Background CITYLAB

The objective of the CITYLAB project is to develop knowledge and solutions that result in roll-out, up-scaling and further implementation of cost-effective strategies, measures and tools for emission-free city logistics. In a set of living laboratories, promising logistics concepts will be tested and evaluated, and the fundament for further roll-out of the solutions will be developed.

The project consists of seven interrelated working packages. The overall objective of WP3 is to establish Living Labs in the seven CITYLAB cities as a co-creation of the local CITYLAB research partner, city partner and industry partner. The figure below presents the structure of the project.

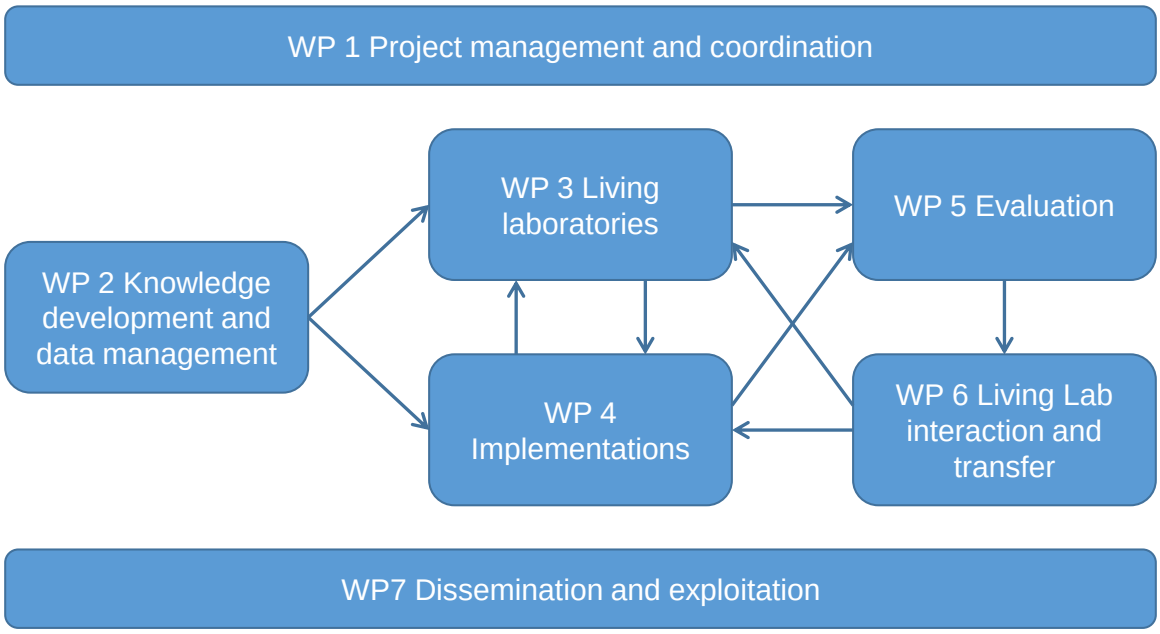


Figure 1-1 PERT diagram CITYLAB

Work package 3 consists of four subtasks where task 3.1 aims to develop necessary preparations for the establishment of CITYLAB's city logistics living laboratories. In this task a methodology is developed that enables local authorities, in collaboration with both research and industry partners, to set up a city logistics Living Lab.

1.2 Introduction to the Living Lab methodology

This deliverable presents guidelines for the Living Lab methodology that will be used as guidance for the Living Labs that will be set up within the CITYLAB project. These Living Labs will be used to implement measures and concepts in real-world situations aiming to establish effective solutions for improvement of urban freight logistics practices.

A Living Lab can be defined as a dynamic test environment where complex innovations can be tested. A Living Lab shows many similarities to a pilot or a field test, but following the methodology can be of added value in case of complex situations, such as a multi-stakeholder field, or a highly dynamic environment.

The Living Lab methodology distinguishes from a pilot approach by systematically implementing various cycles, in which solutions are either adapted or where new solutions are tested. The methodology presents a clear assessment and decision framework to go from one cycle to another.

These guidelines are aimed to be used by the Living Labs within the CITYLAB project. The document considers particular cases for the city logistics sector and has been tailored for the

urban freight cases. The indicated steps proposed in the document are exemplary and are to be further adapted to each particular Living Lab case by the Living Lab participants. Therefore this document should be considered as a helpful tool and not as a pre-defined approach. This document provides guidance on the process of conducting a Living Lab and not on the concrete tools/methods to follow within each step. Providing the first insights for the concrete CITYLAB cases, this deliverable is an input for WP4 to organise and perform implementations, WP5 to perform evaluation and WP6 to transfer the best practices.

The methodology presented in this document builds on the existing frameworks from previous and existing Living Labs (such as ENoLL network, CORE, Cassandra, LogiCon), the FESTA methodology and Deming circle. TNO created customised Living Lab handbooks for a set of projects, which are all derived from a common, generic Living Lab methodology. The customisation of the Living Lab handbooks improves the applicability to the domain of the individual projects and adapts the approach to the nature and industry of the Living Labs in these projects. Nevertheless, these documents have a lot in common, including main text in methodological chapters. Therefore, the Living Lab approach presented in this document is reproduced within the following Living Lab handbooks:

- CORE Living Lab Handbook, First Edition [no official CORE deliverable]; TNO; 2014
- CORE Living Lab Handbook, Second Edition [no official CORE deliverable]; TNO; 2015
- LogiCon Living Lab Handbook, Deliverable 3.1, WP3, LogiCon project; 2014
- Guidelines for Living Labs, Deliverable 2.3, Smart Rail project; 2015.

1.3 Document structure and reading guide

These guidelines consist of five chapters and annexes. In Chapter 2 main trends and problems within urban freight transport system are introduced. Living Lab approach is introduced as a possible umbrella approach to address the urban freight transport activities on the city level and within CITYLAB project. Chapter 3 introduces the Living Lab approach more in detail, describing Living Lab framework, environment, approach, roles and concrete methodological steps. Chapter 3 provides only a short summary of main methodological steps referring extensively to the Annexes where more detailed information per each step is provided. Chapter 4 goes deeper into how to manage the Living Lab process and Chapter 5 concludes on next steps.

The document is not meant to be read in one sitting. Chapter 3 provides reader information on the overall methodology and different stages of the Living Lab process. The annexes are should be used as a reference book over the duration of the Living Lab as they contain an overview of activities needed to be taken into account in each Living Lab step.

2 Towards Living Labs in city logistics

2.1 Urban freight logistics context

The shape and characteristics of a city, the transportation and logistics industry and therefore also the urban freight logistics system are specific for each individual city

The shape and characteristics of a city and its logistics industry influence what will be the urban freight logistics system of a city, its characteristics and problems. At the same time, some general macro-economic trends that impact the overall development of city logistics in Europe can be identified as well. First, this chapter provides a short overview of these global trends. Next, the range of solutions to address these problems is shortly presented.

2.1.1 Development trends

Urban freight transport in Europe

An overview of current position of the urban freight transport in the European transport system is provided in Box 1. This section summarizes the major development trends that are relevant for urban logistics in the coming years, Verlinde (2015, page 5 and 6) provides a more detailed description of trends.

Box 1. Urban freight transport in the EU transport system

Urban freight traffic accounts for about 10-15% of kilometres travelled[1] and emit approximately 6% of all transport-related GHG emissions[2]. It accounts for between 2% and 5%[3] of the total workforce employed in urban areas and it is estimated that between 3% and 5%[4] of urban land is reserved to logistics activities [5].

Some 20-25% of freight vehicle kilometres is related to goods leaving urban areas, and 40-50% is related to incoming goods. The remaining percentage relates to internal exchange (i.e. goods having both their origin and destination within the city)[6].

The following estimates of goods generated in an urban context have been deduced from studies and analyses conducted for several urban areas:

- 0.1 delivery/pick-up per person per day;
- 1 delivery/pick-up per economic activity per week;
- between 300 and 400 freight vehicle trips per 1,000 persons per day; and
- between 30 and 50 tonnes per person per year[7].

Source: CIVITAS WIKI Policy note n5 (2015)

Different on-going trends further impact the developments of the urban freight transport and might significantly change its shape and characteristics in the near future. In the following

[1] http://www.ppiaf.org/freighttoolkit/knowledge-map/urban
[2] White Paper, 2011
[3] Macario R., 2012
[4] Macario R., 2012
[5] http://www.ppiaf.org/freighttoolkit/knowledge-map/urban
[6] http://www.ppiaf.org/freighttoolkit/knowledge-map/urban
[7] Dablanc, 2009

sections we discuss trends on urbanisation and logistics markets in urban areas as well as the future possibilities to act on the urban logistics issues.

Population/urbanisation trends

In the next years some reshaping of the EU urbanisation profile is forecasted. Even though there is no high population growth expected, the proportion of older adults will increase and they might tend to move from suburbs to city centres, closer to the professional, medical and other facilities. Next, when in the past people left cities to live in suburbs, nowadays and in the future, it is increasingly urban culture (shops, restaurants, museums, theatres and events) that attracts people to stay and live in cities – even with families and kids. As a result, the demand for a higher quality of life in the cities increases. By 2025, more than 75% of Europe's population is forecasted to live in urban areas and by 2050 the proportion is expected to increase to 84% (Verlinde, 2015).

This will have additional pressure and require for a reorganisation of the urban freight system that supports this urban culture, becoming more efficient and integrating new services into the traditional businesses.

Trends in the major market sectors of urban freight transport

Being a service, the development of the urban freight transport is highly dependent on developments in the major market sectors which it is servicing. Those are, mainly: retail; express, courier and post services; hotel, restaurant and catering; construction and waste.

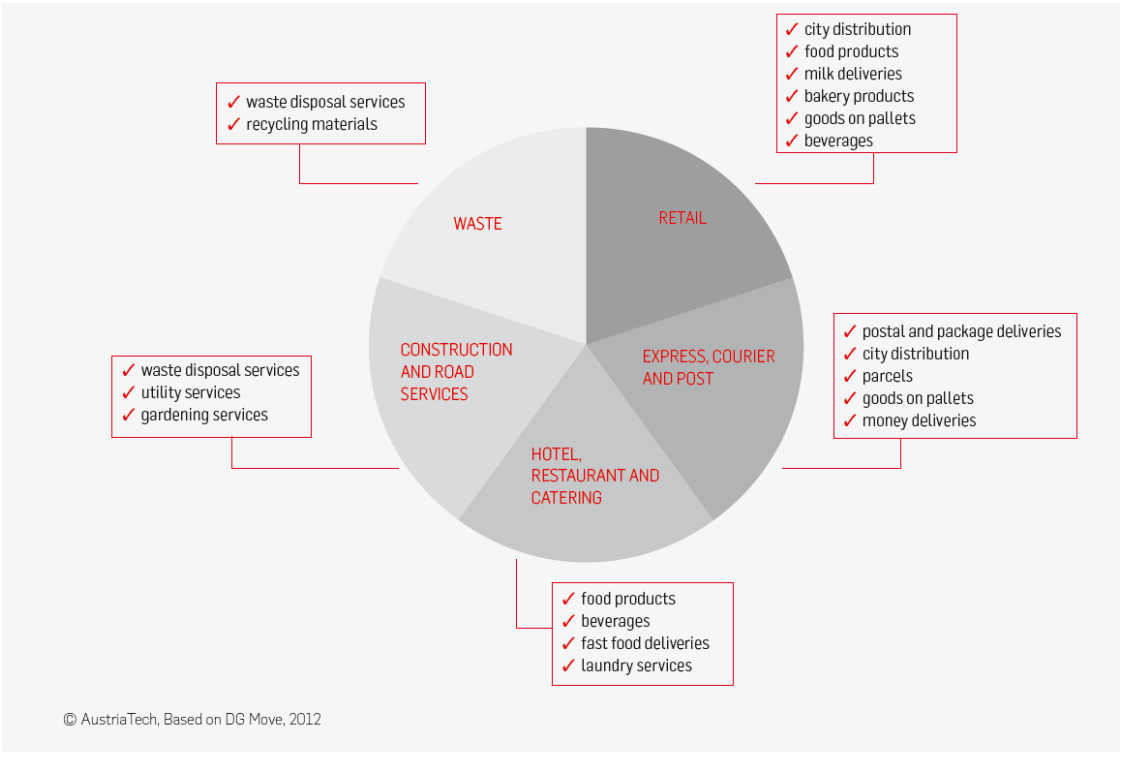


Figure 2-1 Market sector of urban freight transport

[1]Source: Austria Tech (2012)

Therefore, specific trends within these sectors determine the nature of the challenges to be dealt with for the urban freight transport in the future.

Currently, the growth of e-commerce and home deliveries is one of those trends that is slowly reshaping the urban freight logistics market. Just in 2014, over half of the Europeans bought goods or services over the internet, and the overall value of business-to-consumer e-commerce represents almost 2%[8] of the EU's GDP already. Verlinde (2015) states that by 2025%, 20% of retail will happen through online channels, highlighting that this will change the urban freight flow patterns and urban freight transport, though the impact of these changes remains uncertain. For example, the function of the city centre itself might change, from a retail area to an experience area. In any case, new solutions to efficiently manage deliveries and services in urban areas as well as new knowledge and collaboration are greatly needed. This results in opportunities for traditional service providers or city logistics specialists, who are facing increasing competition in their traditional core business (e.g. parcel delivery and warehousing services) and are searching for smarter solutions and new markets to penetrate.

2.1.2 Urban freight transport characteristics

Multi-stakeholder environment

Urban freight transport involves many different stakeholders. Some of these stakeholders are directly involved in the supply chain processes. Others are not directly involved in the freight transport but are part of the urban area and experience the impacts from the urban freight traffic (more on different categories of urban freight transport stakeholders and their interests in chapter 3). Aggregating, those are (CIVITAS WIKI Policy note 5, 2015):

- Supply chain actors: shippers, receivers, transport operators;
- Public authorities;
- Resource supply stakeholders: infrastructure providers, infrastructure operators and landowners;
- Those affected by freight: other traffic participants, city residents and users, visitors and tourists;
- Other stakeholders like: providers of vehicles, IT support systems, etc.

The presence of these many stakeholders inevitably brings in the problem of the conflicting interests. As summarised in MDS Transmodal Limited (2012), "this is particularly the case because logistics decisions are usually taken on the basis of commercial and operational factors rather than considering wider sustainability issues that are of concern to city authorities acting on behalf of residents and tourists/visitors. Logistics decisions are typically taken on the basis of commercial and operational factors, without any specific consideration for the local environment". They identify the following most common conflicts of interest:

- Between the commercial efficiency objective pursued by the stakeholders in the supply chain and the wider sustainability objectives pursued by city authorities;
- Between residents and transport operators in urban areas;
- Between residents, tourists/visitors as consumers, which want goods to be available in shops, and the same stakeholders who regard road freight movements in urban areas as a "nuisance" because they create traffic congestion, noise and environmental pollution and are also regarded as intimidating.

Summarising these conflicts, we identify:

- The competition for (the limited available) city space between logistics and other activities / functions in cities;

[8] http://www.ecommerce-europe.eu/facts-figures/infographics

- The difference in scope between logistics operations and city issues, such as large (supra) national/ regional scale versus city or neighbourhood scale;
- Conflicts between logistics efficiency and costs on the one-hand and minimal nuisance on the other hand.

Urban freight transport issues are complex to solve as there is usually no single problem-owner and the many different stakeholders have different objectives and stakes. As a result, simple solutions that can be implemented by one stakeholder are not sufficient to deal with urban freight transport's grand challenges (Quak et al, 2015).

Growing negative impacts

Being a part of the larger freight transport system, urban freight transport has economic, environmental and social impacts on the liveability of people and functioning of the economy within cities. Verlinde (2015) provides a comprehensive summary of observed negative impacts of freight urban transport, highlighting that they are of a real problem to a local policy makers. These negative impacts include:

- Economic impacts:
    - Increased traffic congestion which lead to:
        - Time losses and inefficiencies for the person or company doing the transport
        - Unreliable deliveries for the receiver
    - Use of resources
    - Cost of governmental regulation and planning of urban freight transport
- Social impacts:
    - Health impacts
        - Local air pollution
        - Traffic accidents
        - Noise nuisance
    - Contribution to traffic congestion
    - Damage to buildings and infrastructure
        - Vibration
        - Traffic accidents
        - Damage to the road surface because of the weight of goods vehicles
    - Other quality of life issues
        - Loss of greenfield sites and open spaces in urban areas as a results of transport infrastructure developments
        - Visual intrusion
        - Physical hindrance
        - Stench
        - Vibration
- Environmental impacts:

- Emission of global pollutants contributing to global climate change (CO_2)
- Emission of local pollutants (CO, NOx, PM, VOCs)
- Use of non-renewable resources
  - Fossil fuel
  - Aggregates
  - Land
- Waste products such as tyres, oil and other materials
- The loss of wildlife habitats and associated threat to wild species

Although these problems are not solely caused by urban freight transport, urban freight transport is a major contributor to them.

Other problems within a sector

Urban freight transport is a highly competitive sector. Last mile logistics in the majority of cities can still be described as inefficient – especially considered from a city perspective. This is due to several factors, such as: low load factors, empty running (partly) due to narrow effective time windows for urban deliveries. Additionally, there exists a lot of urban freight movements which are relatively unorganised, not optimised and are independent from any existing logistics network. These unorganised logistics activities are often own-account transport activities and performed in vans, such as delivery of fresh products, service related trips (where next to transporting goods service men are required as well). On a high level (based on traffic counts in for example London, Amsterdam, Rotterdam and Utrecht, see for example TNO, 2015), one could more or less say that the majority of the goods in cities are transported very efficiently via large retail chains or logistics service providers using large trucks (where possible), which accounts for a relative small part of the urban logistics vehicle movements. The majority of the vehicle movement by vans, that carry only limited volumes, like, for example service vans, delivery services (medicines, food, etc.), private waste collection, construction services, cleaning services, etc. This large group of unorganised small urban logistics operators is very diverse and difficult to reach and organise in most cities. According to MDS Transmodal Limited (2012), this "inefficiency in distribution leads to additional costs for transport operators, which would normally be passed on to receivers/shippers (in the case of third party operators) or absorbed as costs for own account operators. These costs are ultimately borne by the wider economy".

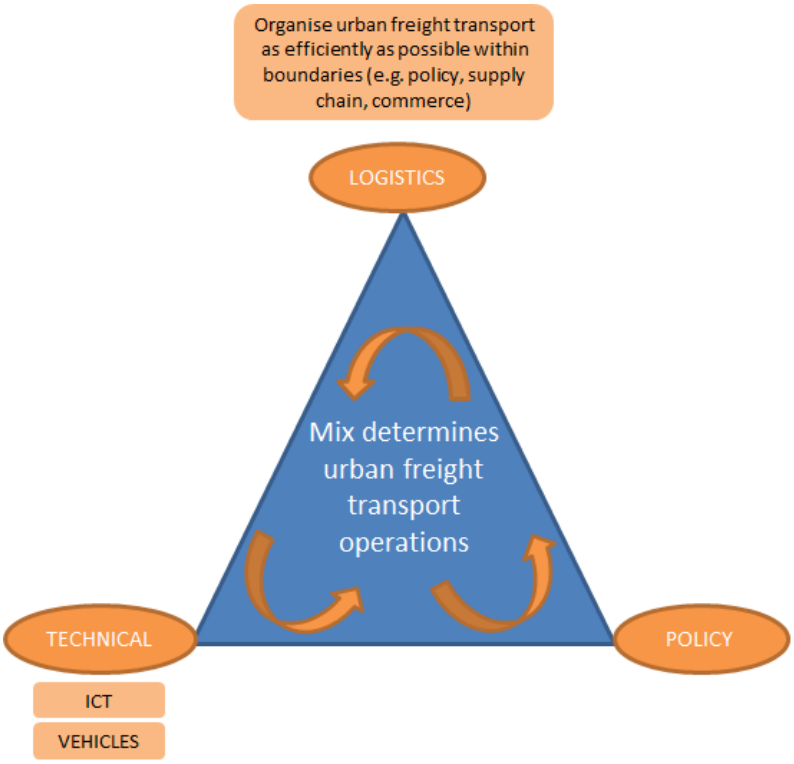
2.1.3 Solution directions

One of the issues in urban freight transport, as discussed in the previous section, is the complex environment, with multiple stakeholders involved. Therefore, it is also difficult to speak of a solution – as experience shows, a solution for one issue results in a problem for someone else (e.g. time windows to reduce nuisance result in higher costs for operators due to time restrictions and limited options for efficient planning). So, making changes in complex systems, such as the urban freight transport system, is difficult: there are many different stakeholders with different and sometimes conflicting objectives. No single stakeholder has a complete overview of the system or what the effects and rebound-effects of actions, policy measures or other interference are or will be (Quak et al, 2015).

CIVITAS Policy note 5 (2015) identifies three different solutions to make changes to an urban freight transport system as a whole or its specific part. These directions are:

- Policy: determines the urban conditions in which urban freight transport operations can take place (time, location, etc.).

- Technical: determines on the one hand the available means (e.g. vehicles) involved in urban freight transport and on the other hand the means to plan trips and communicate (e.g. ICT).
- Logistics: determines the operational conditions for urban freight transport trips, e.g. exact location, delivery hours, delivery frequency, means used, etc.



Source: CIVITAS WIKI Policy note 5 (2015)

Figure 2-2 The organisation of urban freight transport operations

Figure 2-2 illustrates that if we want to introduce changes in the urban freight transport system we have to consider all directions and not just one. This requires that for solving issues in urban freight transport cooperation between logistics (private sector), policy (public sector) and technics (again private sector) is required.

Urban freight measures

MDS Transmodal Limited (2012) provides and extensive review of most common measures and practices that are employed in order to make changes in the urban freight transport system. Usually these measures are not performed in isolation and are used as a mix of measures. Though, experiences from demonstration and trial projects show that very often the measures/technologies/innovations do give a very positive result, but only within limited period of time and are not widely picked up by the big urban freight transport community improving an urban freight transport system in a long term. According to Quak et al (2015), “in order to actually make a considerable change in the urban freight transport system, it is necessary to align the stakeholders, their objectives, their abilities to act, and their perceptions on the problems that have to be tackled”. One best practice that is currently used to do this in cities

is to setup a freight partnership (a public private partnership that deals with urban freight transport issues). We will discuss these freight partnerships in the next section.

Table 2-1 provides and indicative summary. Usually these measures are not performed in isolation and are used as a mix of measures. Though, experiences from demonstration and trial projects show that very often the measures/technologies/innovations do give a very positive result, but only within limited period of time and are not widely picked up by the big urban freight transport community improving an urban freight transport system in a long term. According to Quak et al (2015), “in order to actually make a considerable change in the urban freight transport system, it is necessary to align the stakeholders, their objectives, their abilities to act, and their perceptions on the problems that have to be tackled”. One best practice that is currently used to do this in cities is to setup a freight partnership (a public private partnership that deals with urban freight transport issues). We will discuss these freight partnerships in the next section.

Table 2-1 Overview of urban freight transport measures

Category	Description	Measure examples
Regulatory	Essentially rules and prohibitions, supported by a control/enforcement system and that are designed to control private activity for the wider benefit of society	Time windows Vehicle weight and size restrictions Low emission zones
Market based	Fiscal measures such as taxes and tolls aim to “modify” the market prices of the goods whose production generates negative effects.	Congestion charging Mobility credit schemes Indirect subsidies
Land use planning	Land use planning measures taking into account the demand for urban freight transport as well as needs of freight industry	Zoning of retail & logistics activities to secure critical mass New developments with off-street loading/unloading facilities Safeguarding of rail-connected & water-connected sites for future use Requiring large-scale distribution sites to be rail and water connected
Infrastructure	Measures that focus on creation/upgrade of related to the urban freight transport infrastructure	Network of on-street designated loading and unloading bays Development of rail and/or waterborne connected logistics zones
New technologies	Application of ICT and ITS for the improvement of urban freight transport	
Management and other	Measures implemented directly by private actors to secure sustainable urban distribution and measures implemented both by public and private actors	Developing Urban Logistics plans Developing freight quality partnerships, involving effective consultation

	that did not fall into any other category	On-line one stop shops for freight Indirect subsidies to support urban consolidation centres Planning permission requirements for construction consolidation centres for major construction sites Developing network of e-commerce pick up points

[1] Source: adapted from MDS Transmodal Limited (2012)

Freight partnerships/Private public partnerships

Local public-private partnerships (PPP) in urban freight transport do occur in the form of freight partnerships (also called freight networks, freight charters and peer to peer exchange etc.). Freight partnerships can be defined as “a long-term partnership between freight stakeholders concerned with urban freight, that on a formal or informal basis meet regularly to discuss (and sometimes find solutions to) problems and issues that occur in the urban area” (Lindholm and Browne, 2014). They differ from the traditional PPP by also involving private stakeholders for consultation and dialogue in public decision-making (Browne et al., 2003).

Freight partnerships are of a high interest when addressing urban freight transport problems because they lead to increasing of shared situational awareness of all of the participants and bring in joined knowledge production for innovation. Quak et al (2015) also states they could be an attractive approach to stakeholders’ involvement, since it is a way of achieving valuable results with a relatively low budget. However, freight partnerships are usually not really action driven, and as a result, these often do increase the understanding between actors and might solve some of the urgent stakeholders’ discomforts, but a joint action to really improve the system on the longer term does not happen.

Towards Living Laboratories for city logistics

Where freight partnerships bring together the various stakeholders, collaborative and joined innovative actions and ambitions are often not the direct result of these partnerships (Quak et al, 2015). Creation of the Living Laboratories provides a new way to develop an action driven form of freight partnerships, fostering innovation deployment and improving communication and cooperation between different stakeholders of the urban freight transport system. In this deliverable, the Living Laboratory (Living Lab) is defined as a “test environment for cyclical development and evaluation of complex, innovative concepts and technology, as part of a real-world, operational system, in which multiple stakeholders with different background and interests work together towards a common goal, as part of medium to long-term study” (Lucassen et al, 2014).

This way to develop a more action-driven form of freight partnerships follows from a solution approach, which has proved successful worldwide in fostering innovation deployment, but has not yet been applied explicitly in the domain of City Logistics: Living Labs. The concept of Living Labs is credited to William J Mitchell of MIT in early 2003. Mainly owing to insights into the potentials of information technology, he proposed to move R&D to in vivo settings—in other words, to ‘wired’ living settings such as in a building or part of a city—thereby enabling to monitor and respond to users’ responses and interactions, with the ultimate aim to speed up development and deployment of innovations. In Europe, the concept of living labs was already recognized by the European Commission in 2006 as a key tool for open innovation. Since then, living labs have spread over Europe in various waves, first focusing on new ICT tools but later extending to other fields, such as sustainable energy, health care, and safety. The achievements of the living lab movement went beyond fostering the development of demos, pilots, experiments and test beds: it changed the emphasis from the solution as an isolated object to the process of integration with its environment. It allowed the creation of experimentation environments that were sufficiently connected with real world stakeholders and their business models, to allow near-simultaneous development and deployment (Quak et al., 2015)

The Living Lab approach distinguished form the freight partnerships as the Living Labs are more action driven, and focus on the entire experimental arena. Next, the Living Lab approach is also different from the traditional field tests and demonstrations that are often undertaken in the urban logistics field. Table 2-2 summarises the distinction between these traditional field test, demonstrations and Living Labs. Together this provides a first overview of what Living Lab is and how it discerns from the freight partnerships and demonstrations.

Table 2-2 Distinction between field tests, demonstrations and Living Labs

Field tests and demonstrations	Living Labs
Characteristics	
Simple	Complex
Linear development	Iterative, cyclical development
Predetermined	Learning effects and improvements during activities
Isolated environment	System in system, real-life environment
Individual values	Shared values
Mainly operational goals	Grand challenges
Single actor as driver and owner	Multi-stakeholder and collaborative governance (incl. public-private partnerships)
Little uncertainty	Deep uncertainty
Short to medium term orientation	Medium to long term orientation
Re-active planning and steering	Adaptive and pro-active planning and steering
Purpose	
Closed research & development	Open innovation and live analytics
Expert design	Co-creation of multi-stakeholders
Closed system evaluation	System in system evaluation
Analysis for single department / actor	Analysis for multi-department / multiple actors

Source: Quak et al, 2015

Although there are several initiatives that carry the Living Labs title and there is interest in City Logistics from the Living Labs communities of practice (see e.g. www.openlivinglabs.eu), we are not aware of any discussion in the literature about the operationalization of the concept within city logistics. In this paper, we explore some main characteristics that Living Labs should have within cities. For city logistics, we argue that the set-up of a Living Lab has to fulfil three important conditions:

- Inclusiveness: connection of all relevant stakeholders and business models within a city, with a joint recognition of a problem and solution spaces.

- Anticipatory capability: means to (collectively) make predictions of the effects, based on simulations, gaming or more simplified means of analysis.

- Responsiveness: measuring of impacts and agreements to respond to this with the aim to ultimately deploy a solution.

The Living Lab approach ensures that all main stakeholder groups, and, especially users, are regularly involved throughout all phases of the trial process (planning, implementation, evaluation, feedback) and that the proposed measure or technological solution is revised and continuously improved to meet stakeholder needs and obtain maximum impact during the project. The Living Lab approach needs to have a common vision and start from a shared ambition bringing all kind of stakeholders around one table. There is no need to have a clear roadmap of ready to implement solution from the beginning. One of the main strengths of the Living Lab is that solutions are born in a close dialogue between key stakeholders and users

and are continuously adjusted to the user needs and requirements. As will follow from the (in this deliverable developed) guidelines, the activities undertaken in a Living Lab contribute to achieving the ambition, but, in time, new, adjusted or other activities might become necessary. This implies that there is no full planning of all activities in a Living Lab in advance, and maybe not even full budget. But the stakeholders commit to finding activities and funding in this process so that the objectives are met in the end.

2.2 Living Labs for CITYLAB project

In general, as reported within previously conducted projects (e.g. LogiCon, CORE), Living Lab set-up is mostly beneficial in the context where complex topics need to be addressed. Those are multi-stakeholder problems that address big challenges and where shared values are difficult to find, but have to be found. Usually these kind of problems are characterised with highly dynamic external environments and deep uncertainty in the outcomes of the solutions. They require a medium or long term approach, adaptive and pro-active planning and steering instead of a reactive attitude.

Therefore, the Living Lab approach is a suitable methodology for testing new solutions in the urban freight transport sector. First, solutions in urban freight transport often ask for a multi-stakeholder approach, bringing together the Living Lab participants, stakeholders, users and customers within one Living Lab environment (see the example in the Figure 2-3). As mentioned above, the goals and barriers faced by the different users are often not aligned to each other. The Living Lab methodology focuses heavily on stakeholder involvement and on communication between different types of stakeholders. Furthermore, the short cycle approach in a controlled environment makes it easier for stakeholders to try new ideas for which they do not immediately see advantages.

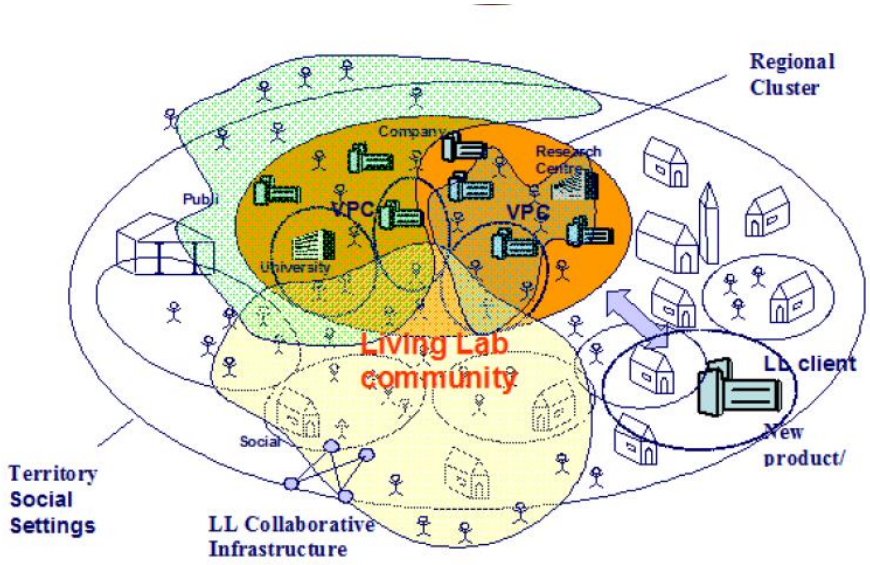


Figure 2-3 A graphical example of a Living Lab in a city (i.e. living lab as functional region) Source: Innovation Alcotra, Deliverable 2.3

Second, due to the organisational, operational and regulatory complexity of the sector, it is unsure in advance what type of solution will best fit with problems faced. However, many solutions for the city logistics have high investment costs. The Living Lab methodology allows for a quick testing of multiple types of solutions within a limited, controlled scope. This can help to identify the best practice cases for further implementation.

Therefore, the Living Lab setting is beneficial for the urban freight transport setting. Still, as any approach, it carries a set of specific risks that need to be taken care carefully.

General Living Lab risks

Living Labs are not a new phenomenon and there are already a lot of examples of setting up a Living Lab in the urban context. ENoLL database presents a good overview of existing European Living Labs. Though, the research, recently performed by Nesti (2015), identifies that from 354 Living Labs registered in this database only 47 are currently in operation. She explains this phenomenon with several factors:

- After the initial popularity of the Living Labs and the diffusion of successful stories, interest has declined and people have simply realised that they do not need Living Labs.
- Living Labs have high organisation costs due to staffing, selection of users, selection of real settings, etc. and public funding is essential for their operation;
- Living Labs do not produce 'disruptive innovation', they do not produce outputs that alter significantly the market, so enterprises do not perceive Living Labs as a real tool to improve their products.

These considerations need to be addressed carefully within each particular Living Lab and integrated in the risks mitigation plans where necessary.

Urban freight transport and city context specific Living Lab risks

There are some specific risks that need to be taken into consideration during the Living Lab process in urban logistics. These are: stakeholder complexity, legal complexity, heavy financial load for private operators, limited visibility of positive impacts, restricted data availability, available technology.

The urban freight transport sector consists of a high amount of public and private stakeholders performing different roles and acting according to their own needs and goals. These needs and goals are often conflicting. In the process of the Living Lab stakeholder involvement, alignment and agreement on ambitions, scope, plan of the Living Lab is of crucial importance since stakeholders in the end need to implement and embrace the innovation.

Very often local regulations play an important role in city logistics operations; e.g. low emission zones, congestion charging, vehicle restrictions or time access windows. Normally it is not easy for local authorities to change existing regulations (both due to a risk increase in nuisance, and as it also requires political support or support of other authorities' departments. The living lab could result in an experimental area, where local authorities can also actually experiment with for example specific policy exemptions for stakeholders that behave in a way that helps reaching the living lab ambitions. However, this is often not an easy thing to do.

Usually the nature of the innovative solutions proposed in the urban freight transport is such that high initial investments are required from the private supply chain operators (e.g. purchase of the electric freight vehicles; installation of the IT systems), creating a heavy financial load for them. These necessary investments create additional heavy burden for the Living Lab coordinators and participants. As one of the main ideas of the Living Lab approach is that it works within Private Public Partnership setting and becomes self-sustainable, dealing with financially heavy solutions is even more of a challenge.

Urban freight transport is only a part of the bigger freight transport system, as well as of a larger urban traffic system. And, even if positive results are achieved, the impacts from them are not directly and easily visible.

Real-time data on urban freight transport processes in the city are barely available and are very hard to collect. The data exchange between partners in the supply chain is very restricted too which does not lead to the most efficient logistics solutions. Data exchange and

transparency are very important for the Living Lab process if high adoption rates for innovations are to be achieved. Decision makers and public are better informed about the innovative solution that is offered. Open discussion helps to increase general acceptance level.

Experimenting with dynamic traffic management to specifically steer or provide privileges for specific groups would be an interesting part of a city logistics Living Lab. These can be, for example, possibilities to provide individual information to vehicles via apps. The risk here is that research partners might be more advanced in proposed technological solutions than it is actually feasible in cities and for logistics operations. A good example is the physical internet (see for example: http://physicalinternetinitiative.org/), which is a very appealing vision on logistics in the future. However it might not yet be far enough to start experimenting with it in the city. Another example is the availability of low emission vehicle technology such as electric freight vehicles. On-going FREVUE project has illustrated that these are currently hardly available for a feasible purchasing price, especially for the vans and trucks larger than 7.5 tonnes. In the Living Lab ambition, the availability of technology should therefore be considered carefully. Not available, very expensive, or not (yet) reliable technology reduces the success chances of any implementation as well as the enthusiasm of stakeholders to further experiment in the area (Quak et al, 2015).

Making a successful CITYLAB Living Lab: addressing the risks

The mentioned general Living Lab risks as well as the risks specific to the urban context need to be carefully addressed in order to make a successful experience from the Living Lab process in city logistics. The proposed Living Lab methodology and CITYLAB project settings address these risks and provide preconditions necessary for the successful implementation of the CITYLAB Living Labs.

First, Nesti (2015) states, that even if the number of Living Labs is declining, most of them are still publicly funded. She explains, that “these are often set up by public administrations or research institutions because of the experimental nature of their activities. Particularly in the European Union, where innovation is often costly and risky, the enterprises – in particular small and medium – are encouraged to participate in the innovation process transferring the costs for R&D to public institutions and allowing them to test product or services before they have been launched in the market. This is precisely what happens in the case of urban Living Labs where municipalities become testing environment for enterprises in exchange for future investments in the smart city project”. In this framework, the CITYLAB Living Labs are well positioned, combining initially three main actors: local authorities, research partners and industry stakeholders. This combination of different participants will give a good start for individual Living Labs. Further in the Living Lab process this initial group of participants will be further extended by the involvement of external users in different steps of the Living Lab process.

Second, the Living Lab methodology, proposed in section 2.2, specifically highlights the necessity of continuous monitoring of legal issues as well as importance of ensuring continuous user/customer/stakeholder commitment. Following the repetitive cycles suggested in the methodology will allow tackling of any emerging issues at an early stage and act accordingly, therefore addressing the issues of legal and stakeholder complexity.

Third, available technology can be dealt with in a city logistics living lab by making sure the right partners with knowledge on available technology are involved, as well as by creating an environment where stakeholders can discuss their experiences with new technology.

Fourth, WP2 of CITYLAB aims at creating an observatory on city logistics processes, which will also merge existing datasets that will be available for all the Living Lab research partners, improving data availability on the urban freight transport processes.

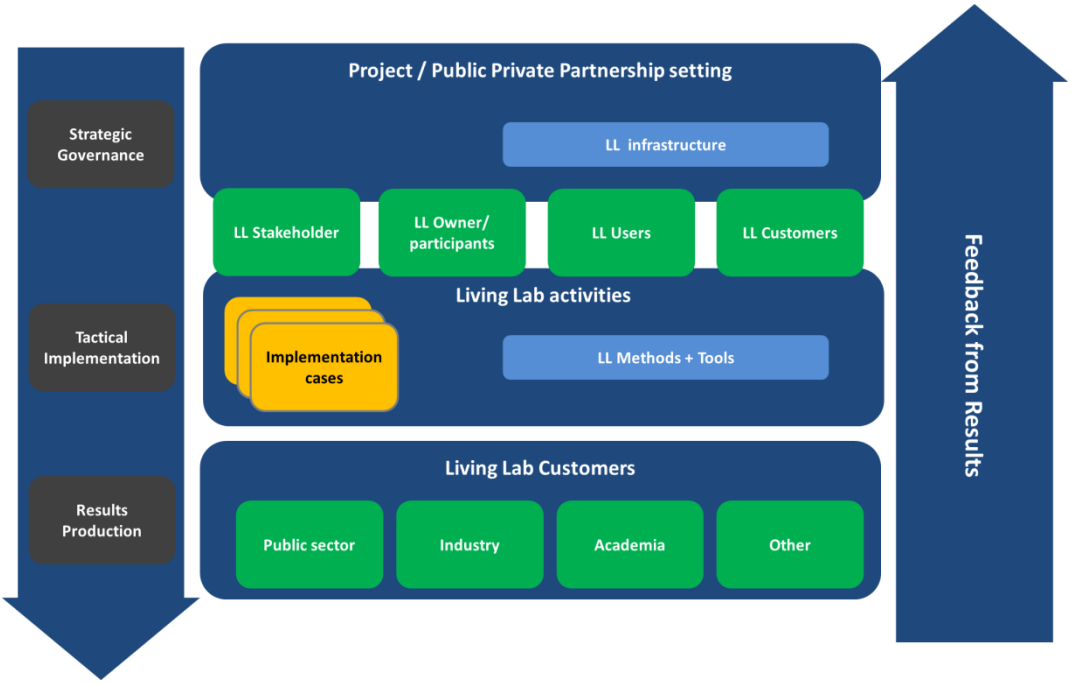
Finally, an extensive evaluation process will facilitate the identification of impacts from concrete measures implemented within the Living Labs and will make it public through the dissemination channels foreseen.

3 Living Lab framework

As stated above, in this deliverable, the Living Laboratory (Living Lab) is defined as a "test environment for cyclical development and evaluation of complex, innovative concepts and technology, as part of a real-world, operational system, in which multiple stakeholders with different background and interests work together towards a common goal, as part of medium to long-term study" (Lucassen et al, 2014).

3.1 Living Lab environment

A Living Lab framework or architecture (Figure 3-1) consists of three levels. On the **strategic** level, different Living Lab participants (see chapter 3) are interacting with each other providing actual governance of the Living Lab. The next layer consists of the practical and tactical **implementation** of the solutions. Finally, the third layer deals with the **results**: final customers of the Living Lab are benefitting from the results and based on the evaluation 'feedback loop' decide on the new Living Lab cycle. Figure 3-1 shows the conceptual architecture of a living lab, the remaining of this sections provides a similar figure, only in a way that the cyclical approach (where different Living Lab cycles are depicted) is emphasised more – as a result some of the details that are depicted in Figure 3-1 are not depicted in later figures in this section.



[1]Source: Adapted from Innovation Alcotra (2011)

Figure 3-1 A Living Lab conceptual architecture

The Living Lab architecture brings together different Living Lab roles, activities, infrastructure and necessary methodological support in one framework.

Several implementation cases can run in parallel and focus on completely different or closely related subjects, all, nevertheless, falling into the scope and ambition of the specific Living Lab. These several implementation cases are than running within one same Living Lab environment. The city or city centre can typically be such a living lab environment where several implementations performed by different stakeholders run in parallel. They might than have in common different actors participating in it, share some parts of the infrastructure,

benefit from common analysis and, most important, from the cross-evaluation (Figure 3-2). Finally, that will be necessary to assess how the decision taken on one implementation case will impact the development of the solutions/measures from other implementation cases.

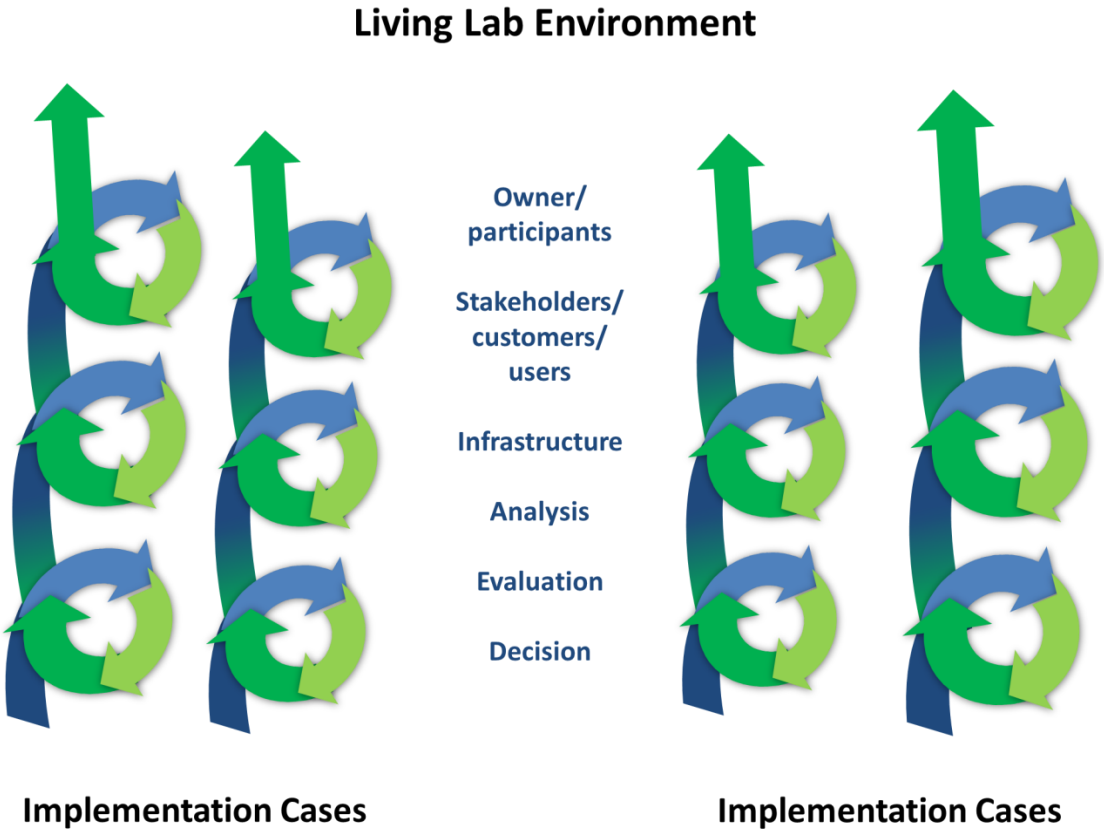


Figure 3-2 Living Lab environment

This deliverable further focuses on the description of the concrete Living Lab methodological steps and supporting tools that help to bring all the elements together in one cyclical approach.

3.2 Living Lab methodology

The Living Lab approach is introduced in this chapter. The main phases and activities of the Living Lab methodology are presented and further elaborated in the annexes. The activities presented are not novice and are usual in the process of implementing new solutions or technologies. The main difference in the Living Lab approach is on the process: high involvement of users/stakeholders, continuous monitoring of changes and direct considering of their impact on the implementation process as well as learning process from each cycle and continuation of the Living Lab with new cycles. Therefore, the guidance below is not aimed at teaching the reader on how to perform each activity, such as an impact assessment or setting up an implementation plan. Rather, it focusses on issues to pay attention to in order to create from the regular implementation/demonstration project a smooth running Living Lab environment.

3.2.1 Living Lab approach

A cyclical approach is the foundation of the Living Lab methodology. Following this approach, several solutions can be tested and readjusted/improved to fit the needs of the real-life environment. One cycle within a Living Lab usually consists of the following phases (named differently according to different Living Lab methodologies):

- **Planning** (sometimes called: Preparation of the Living Lab; Definition of the Living Lab; contextualisation; Co-creation; Co-design; Plan) where Living Lab vision, ambitions, objectives, main users and stakeholders are identified and where implementation cases to be tested in the Living Lab are conceptually designed.
- **Real life implementation** (or Concept design; Do; Limited and extensive scale field experimentations; Technical prototype development and deployment; Concretization, exploration and experimentation; Implementation; Use) where concrete Living Lab solutions are prepared for execution and implemented in real life environment.
- **Evaluation** (or Check; Feedback; Analysis) where the results of the implementation are analysed based on more extended data collection and on feedback from the external parties.
- **Act/Decision** (or Conclusion; Technology recommendations) where, based on the lessons learned from the evaluation phase, a decision is made on continuation of the Living Lab into a new cycle and on what amendments will be made in this new cycle.

The following figure presents a schematic overview of the different steps and the iterative approach within the Living Lab cycle.

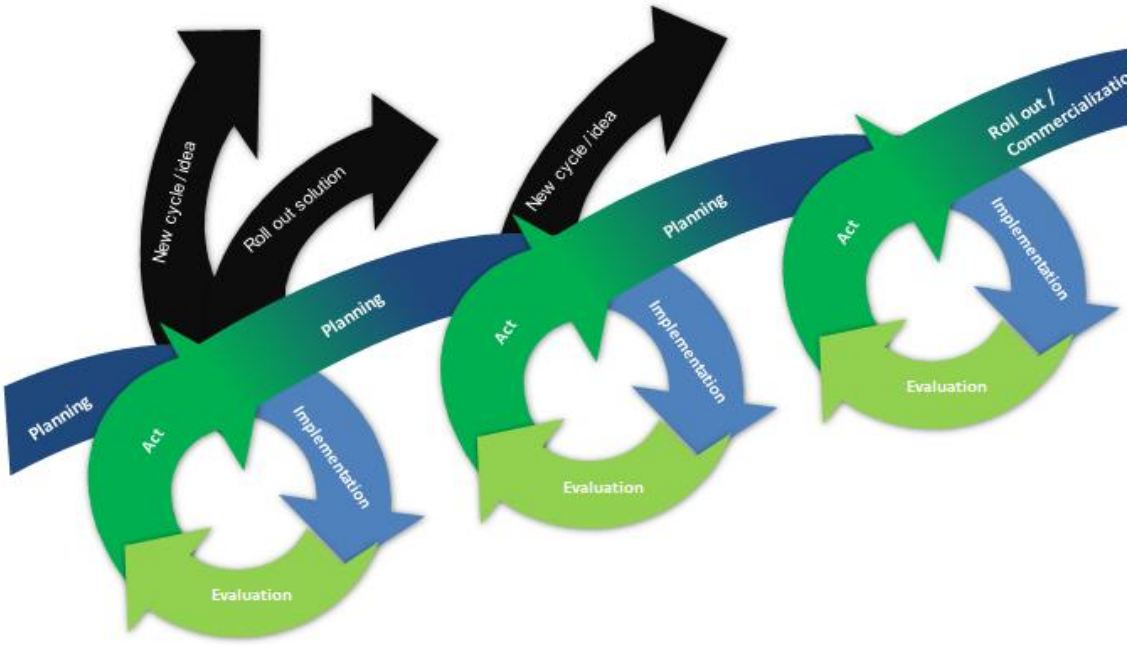


Figure 3-3 Schematic overview of the Living Lab cycle

Different phases consist of activities. These activities are 'advisory', but are not necessarily applicable (or large-scale implemented) in each Living Lab cycle. For instance, the planning phase will involve more activities in the first Living Lab cycle than in subsequent ones. Therefore these activities need to be considered helpful guidance blocks instead of mandatory steps.

The goals of the ***Planning phase*** are to agree on the Living Lab approach and way of working, to build knowledge and define the exact goals and requirements for both the Implementation and Evaluation phases (see Annex A for more detailed information). In order to achieve these goals the following activity blocks are suggested:

- **Set-up**: the overall goal and ambition for the Living Lab are defined; crucial partners are identified, consulted and involved. The scope of the Living Lab system, as sub-system of the real-world logistics environment is determined.

- **System analysis:** depending on the Living Lab ambition and scope a set of analyses is performed in order to get a clear overview of the outside elements that may influence the success of the Living Lab.
- **Design**: in the design block implementation cases (technological solutions or soft measures) to be tested are designed and described. The evaluation and monitoring system for the current cycle is developed.
- **Implementation plan**: the outcome of the planning phase is an implementation plan where all previous steps are summarised and timing, resources, milestones and other necessary information for the Living Lab cycle are defined.

The goal of the ***Implementation phase*** is to deploy Living Lab solutions in the real life environment and gather the actual results. In this phase all arrangements are to be made in order to start and perform field experimentations (see Annex B for more detailed information). This phase is composed from two activity blocks:

- **Preparation**: the Living Lab system and concrete implementation case(s) are prepared for actual execution. For example the functionalities needs to be developed, staff needs to be trained and fall back procedures and escalation protocols need to be put in place. Also a baseline measurement needs to be performed.
- **Execution**: execution refers to real-life implementation of the specific implementation case (new technology or concept) of the Living Lab. The input for the evaluation is gathered.

The goal of the ***Evaluation phase*** is to evaluate the results and to compare them to original ambitions and targets as well as to the 'business as usual' situation. Depending on the tested concept or technology, a number of Key Performance Indicators is evaluated as well as feedback from external parties is collected (see Annex C for more detailed information). The phase consists of:

- **Data collection**: data collected during the previous phases is to be evaluated and checked for gaps. Where missing data are identified, solutions are to be found to fill in missing data.
- **Data analysis**: data analysis is to be performed and conclusions need to be drawn about KPIs, process and stakeholder evaluation, technological maturity of the solution/technology as well as business case feasibility.

The ***Act/decision phase*** takes the results of the evaluation phase and use these to decide on the continuation or not of the implementation case and Living Lab (see Annex D for more detailed information).

- **Making decision**: this activity block focuses on taking decisions on the future development of the implementation case and consequently on the future of the Living Lab as a whole.
- **Acting on decision:** the decision taken falls into one of the following categories which than represents the second activity block in this phase:
    - **New cycle entry:** a new cycle can start whether with introducing adjustments to the existing implementation case, whether with completely new idea that came out from one of the previous phases. In case the Living Lab implementation results need to be readjusted, some activities in the Planning and Implementation phases will need to be reviewed or rebuild by going into the new Living Lab cycle. This phase is crucial as it provides a cyclical turn of the Living Lab.
    - **Roll out of solution:** the technology or solution is ready for rolling out. Impact assessment and scaling up can be performed in order to decide on the utility of the rolling out. Further rolling out or commercialisation can be done outside of the Living Lab.
    - **Disruption of Living Lab:** the decision is made to stop the Living Lab. All the arrangements necessary to finalise implementation case and to stop the Living Lab environment and report on its outcomes are to be performed.

- **Analysis of the Living Lab cycle:** at the end of each cycle it is important to evaluate whether Living Lab environment corresponds to ambitions, goals and means of the concrete project and is the best environment to achieve project results and to decide what kind of improvements can be introduced into the process of the next Living Lab cycle.

3.2.2 Living Lab roles and process

A clear understanding and acceptance of different roles, especially within a setting of the city logistics sector which is characterised by its stakeholder complexity, is crucial for the Living Lab success. There are at least four main roles that need to be managed within the Living Lab framework.

Living Lab owner is a real or virtual organisation appointed to lead the whole Living Lab process and to act on behalf of the Living Lab. It is suggested to have one or two people appointed to this role. The Living Lab owner will take the lead in setting up, organising, conducting and monitoring the process of the Living Lab. Ideally this role should be undertaken by city authorities.

Living Lab stakeholders contains a group of organisations that need to be involved in the organisation and implementation of the Living Lab. Stakeholders are usually involved in the strategic and practical governance and the actual implementation of the Living Lab. For example, in the case of the urban consolidation centre (UCC) implementation, the following organisations will fall into the category of the stakeholders: architecture / construction company that help with the preparation of the building, the organisation managing the UCC, , etc. The Living Lab stakeholders are – although it is easy to confuse – not the stakeholders in the urban logistics context, but the actors that are actually (physically) developing something for the living lab implementation. For example, in the case of the floating depot (a CITYLAB implementation in Amsterdam), the constructor of the depot can be considered to have to role of 'Living Lab stakeholder'.

Users are the organisations that are involved in testing the proposed innovation or solution in real life. Depending on the solution, users can be organisations as a whole, or a specific group within organisations. In the case of the consolidation center, transport operators and logistics providers will be the users. The Living Lab users are also stakeholders, but their role is slightly different from what was defined as 'Living Lab stakeholders', as these actors are actually using the developed solution. In some cases the 'Living Lab stakeholders' and the 'Living Lab users' are the same. For example, in the case of the floating depot (a CITYLAB implementation in Amsterdam), the logistics service provider using the depot can be considered to have to role of 'Living Lab user'.

Customers are actors that benefit from the results of the Living Lab, whether this is a generation of results from trials or implementation of concrete technology or solution. For example in the case of the floating depot (a CITYLAB implementation in Amsterdam), the local authorities can be considered as the 'Living Lab customer' as these have the benefits of the reduction in emissions and vehicle movements.

Very often, Living Labs are set up by a group of motivated people united together to reach the outset goal. This project team often includes representatives of the Living Labs stakeholders, users and customers. At the same time it does not provide a full necessary coverage of all inputs/competences. Therefore, if the Living Lab is set up within a framework of the project (like in the case of the CITYLAB), another group needs to be distinguished*:* **Living Lab participants**.

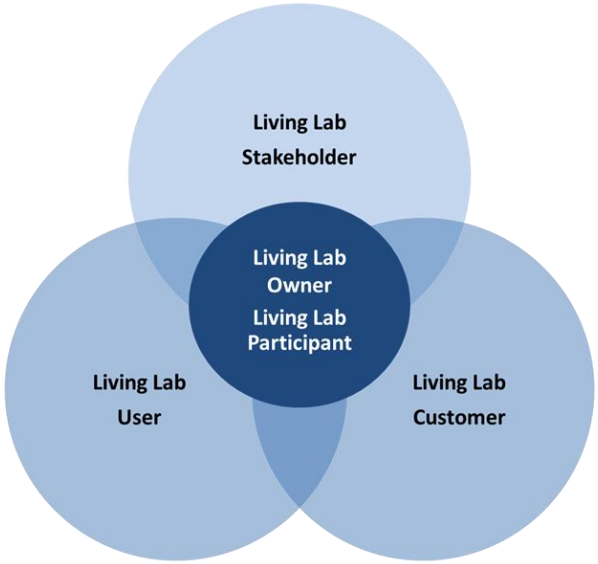


Figure 3-4 Overview of the Living Lab roles

As illustrated in Figure 3-1, Living Lab participants might play several different roles during the process of the Living Lab. That is why all project partner roles and responsibilities are to be clearly defined the earliest possible in the project, both from the point of view of the Living Lab process and from the point of view of the project in order to have a clear understanding who when and in which role need to provide an input into the Living Lab process. At the project level also attention need to be paid to include all relevant and important stakeholders, users and customers even though they are not part of the project team. Figure 2-3 clearly indicates during which activities it is advisable to involve stakeholders, users and customers in the Living Lab process. This involvement can vary from simple consultation process to the active design process.

Figure 3-2 illustrates Living lab process that combines distinctive methodological steps as well as several specific characteristics that define the difference of the Living Lab process from the regular demonstration or trial approach.

Continuous **monitoring of environment**, and, more precisely of the Living Lab ambition, scope, key factors from the external environment as well as potential risks is necessary in order to keep the Living Lab up to date with important developments in the environment and increase the final adoption rate of tested solution by the users. For example legislation changes could impact the chances of success for the Living Lab or make implementation easier or more difficult. These changes need to be incorporated in the other Living Lab blocks at any time if they influence the Living Lab results, which might request for reviewing of some previously done work. Figure 3-5 highlights that monitoring of environment should be in the responsibility of the Living Lab owner, which, in case of really big changes, communicates it straightforward to all the Living Lab participants. In some cases changes in the environment/ambition/scope might bring to reconsideration of the whole Living Lab cycle.

Second distinctive feature of the Living Lab methodology is a necessity to ensure continuous **stakeholder/user/customer commitment.** Ideally, results from all of the steps need to be checked/validated with external partners. As in practice it appears more difficult/impossible, Figure 3-5 identifies the steps where involvement of the external parties is of the most importance. In general, stakeholder commitment can be reinforced, for example, by disseminating and validating designs and results.

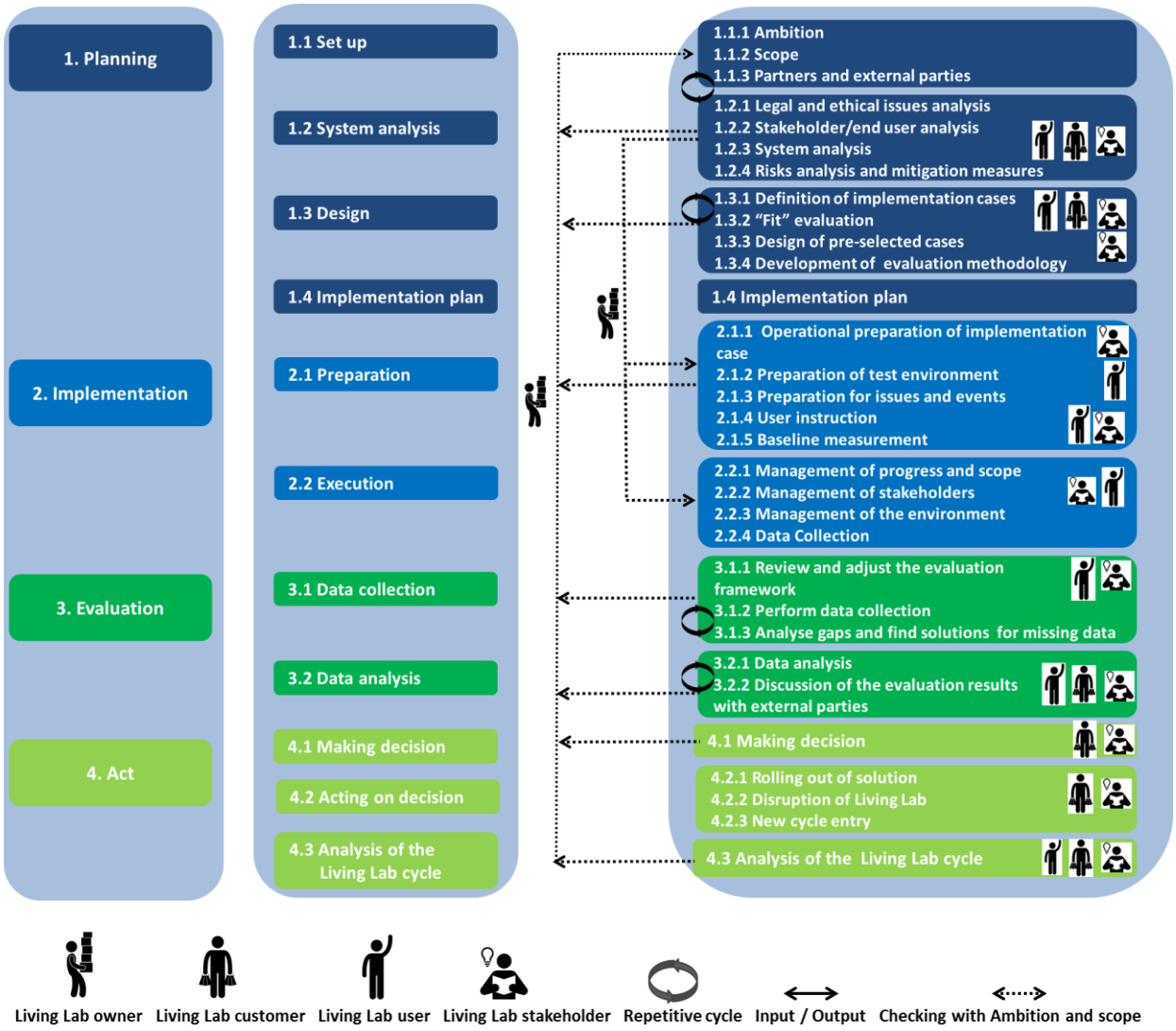


Figure 3-5 Living Lab methodology steps and main characteristics

Finally, the figure illustrates **small repetitive cycles** within Living Lab methodology that are needed in order to have satisfying final results. For example, there is a strong linkage between set up (1.1) and system analysis (1.2) activities, where results of the system analysis might define the necessity to reconsider the scope, ambition and number of external parties to be involved in the Living Lab. This reconsideration in its term may result in the necessity of additional system analysis to be performed. The same occurs in Definition of implementation cases (1.3.1), where a long list of possible implementation cases have to go through 'fit evaluation' (1.3.2). In case if 'fit evaluation' did not result in the definition of the concrete implementation case, this step needs to be repeated as long as satisfying all participants implementation case is defined.

This chapter will subsequently discuss the four Living Lab phases. Each phase will first present an overview of the main activities, roles and process involved. Subsequently the different activity blocks of the phase are further elaborated. In the sections, the objective, main approach and results are described. For some steps we suggest a set of tools that can be used in order to facilitate the process. More detailed description of each of the suggested tool can be found in Annex E.

4 Managing the Living Lab process

4.1 City logistics stakeholders

Paragraph 1.1.2 gave a first overview of the multi stakeholder environment that urban freight transport system is characterised. Looking into more detail, MDS Transmodal Limited (2012) provides quite a detail categorisation of the city logistics actors:

- Supply chain stakeholders
  - Shippers
  - Transport operators (own account and third party providers)
  - Receivers (major retailers, shop owners, etc.)
- Resource supply stakeholders
  - Infrastructure providers
  - Infrastructure operators
  - Landowners
- Public authorities
  - Local government
  - National governments
- Other stakeholders
  - Other economic actors located in the urban area
  - Residents
  - Visitors/tourists.

It is clear that all these actors have different needs, requirements and priorities and that is difficult to organise urban freight transport in a way that meets the interest of all these stakeholders. The following table presents a first overview of city logistics stakeholders indicating their main interests in the context of the urban freight transport. This overview can be used as a start of the stakeholder/user analysis of the Living Labs.

Table 4-1 Overview of urban freight transport stakeholders

Category of stakeholder	Stakeholders	Main interest in context of urban freight transport
Supply chain stakeholders	Shippers	Delivery and collection of goods at the lowest cost while meeting the needs of their customers.
	Transport operators (own account, third party providers)	Low cost but high quality transport operations and satisfaction of the interests of the shippers and receivers.
	Receivers (major retailers, shop owners, etc.)	On time delivery of products, with a short lead-time.
	Consumers	Availability of a variety of goods in shops in the city centre.
Resource supply stakeholders	Infrastructure providers	Cost recovery and infrastructure performance.

	Infrastructure operators (managers)	Accessibility and use of infrastructure
	Landowners	Profitability of local areas
Public authorities	Local government	Attractive city for inhabitants and visitors, with minimum inconvenience from freight transport, while also having an effective and efficient transport operation.
	National government	Minimum externalities from freight transport, while maximising economic efficiency and effectiveness.
Other stakeholders	Other economic actors located in the urban area (manufacturers, service providers, etc.)	Site accessibility and on-time deliveries.
	Residents	Minimum inconvenience caused by UFT.
	Visitors/tourists	Minimum inconvenience from UFT and a wide variety of products in the shops.

Source: MDS Transmodal Limited (2012)

4.2 Roles and responsibilities

The roles and responsibilities need to be identified at the earliest stage of the Living Lab process. This is especially crucial for the urban freight transport sector which is characterised by the stakeholder complexity. As discussed in the previous chapter, the main roles that are distinguished in the Living Lab are **owner**, **stakeholders**, **users** and **customers**. When the organisation of the Living Lab is initiated in the framework of the project (financed by EU or local government), a core number of organisations from either of these roles can be involved in the project as a **participant.**

Actors can fall in several categories within the same Living Lab cycle: for example, stakeholder can also be a customer, consumer or user of the developed solution. This should be acknowledged in the beginning of the project in order to make sure actors are addressed for all of their competencies. The role of an organisation in the Living Lab might be changed too within each of iteration. Involvement of the Living Lab actors will differ between the four phases of the Living Lab process. Table 4-2 highlights the type of involvement different role groups might have at different stages of the Living Lab process.

Table 4-2 Involvement of different actors in Living Lab phases

Stakeholder group/Living Lab phase	Living Lab owner	Living Lab participants	Living Lab stakeholder	Living Lab user	Living Lab customer
Planning					
Set up	Organise the Living Lab set up Make sure stakeholders have good and constructive dialogue about ambitions, scope. Organise constructive sessions consultation to come to shared ambitions and goals	Are responsible to define ambition and scope of the Living Lab, define the roles within the project team, develop Living Lab implementation plan	If considered necessary, are consulted in a constructive dialogue on their needs and goals. Help come up with a shared vision and ambition for the project	If considered necessary, are consulted in a constructive dialogue on their needs and goals	Are consulted to get a clear overview of their needs and goals
System analysis	Makes sure users, customers, consumers are consulted during the process If any changes in scope, ambition, stakeholder participants, other important factors verify how that impacts the Living Lab and informs Living Lab participants about all potential changes Need to make sure there is a joint understanding of how the systems works and why, include processes, architecture and interaction between different partners where needed Verify whether results of the system analysis change ambition and scope and if the repetitive cycle with set up block is necessary	Living Lab participants define ambition, scope of the Living Lab and agree on the list of additional stakeholders, users, customers to be included in the Living Lab at different stages of the Living Lab Ambitions and scope are checked with external stakeholders, users, customers	Provide input for into the system analysis: • Main legal issues • Input stakeholder analysis from their own perspective • Identification of main external elements and	Are consulted for the input into the user requirements analysis	Are consulted for the input into the system analysis
Design	If any changes in scope, ambition, stakeholder participants, other important factors verify how that	All Living Lab participants need to be involved in the definition of implementation	Are involved at the “fit evaluation” stage	Are involved at the “fit evaluation” stage	Consulted to check if selected implementation

Stakeholder group/Living Lab phase	Living Lab owner	Living Lab participants	Living Lab stakeholder	Living Lab user	Living Lab customer
	impacts the Living Lab and informs Living Lab participants about all potential changes Makes sure all necessary external partners are involved in the design stage	cases as they reflect on the issue from different angles and have different solutions in mind Need to make sure implementation cases are well aligned with ambition and scope of the Living Lab			case fulfil their needs and expectations Might be involved in the selection of the implementation cases
Implementation plan	Coordinates the process of the implementation plan development	Develop implementation plan			
Implementation					
Preparation	Makes sure the Living Lab develops according to the implementation plan Regularly checks that Living Lab is running according to its ambitions and scope. If anything is changed in ambitions and scope or influential factors/risks, informs Living Lab participants	Take part in the activities they are responsible too	Are actively involved in preparation Are consulted for the baseline measurements	Are consulted for the baseline measurements	
Execution	Makes sure the Living Lab develops according to the implementation plan Regularly checks that Living Lab is running according to its ambitions and scope. If anything is changed in ambitions and scope or influential factors/risks, informs Living Lab participants	Take part in the activities they are responsible too	If necessary are actively involved in execution Are consulted for the data collection if necessary	Are actively involved in execution Testing Are consulted for data collection if necessary	
Evaluation					

Stakeholder group/Living Lab phase	Living Lab owner	Living Lab participants	Living Lab stakeholder	Living Lab user	Living Lab customer
Data collection	Together with Living Lab participants check if evaluation framework developed in Planning phase still corresponds ambitions and scope of the Living Lab Makes sure all necessary external partners are involved	Check if evaluation framework developed in Planning phase still corresponds ambitions and scope of the Living Lab Collect and organise available data Verify if repetitive cycle between data collection/gaps and missing data analysis is necessary	Are contacted for data collection purposes	Are contacted for data collection purposes	
Data analysis	Makes sure all necessary external partners are involved in discussion of the evaluation results Verify whether repetitive cycle in data analysis/discussion with external parties is necessary	Perform evaluation of the implementation cases Prepare and animate discussion of evaluation results with external partners	Involved in the discussion of the evaluation results	Involved in the discussion of evaluation results	Involved in the discussion of evaluation results
Act/ Decision					
Making decision	Coordinates the process of making decision	Actively participate in making a decision	If necessary are involved in making a decision		Are actively involved in making decision
Acting on decision	Facilitate the final steps of the Living Lab	Act according decision taken	Are involved according to decision taken		Are involved according to decision taken
Analysis of the Living Lab cycle	Is responsible to perform analysis of the Living Lab cycle together with Living Lab participants Makes sure all important external parties are involved and results of the analysis are picked up in next Living Lab cycle	Help Living Lab owner to perform analysis of the Living Lab cycle	Take part in the analysis of the Living Lab cycle	Take part in the analysis of the Living Lab cycle	Take part in the analysis of the Living Lab cycle

4.3 Involvement of external parties in the Living Labs

Managing involvement of external parties (stakeholders, users, customers) in a Living Lab is a very important continuous process. Experiences from previous Living Lab projects show that several things are to be taken into consideration:

- It is important to mix different competencies to stimulate knowledge sharing and to increase understanding of the involved stakeholder's/user's vision. This is essential in order to gain a common perspective.
- Involve stakeholders, users, customers as much as possible from the very beginning in the Living Lab process. Being involved in the process of developing the solutions to be implemented in the Living lab they will be more likely responsive in adopting these ideas.
- Make sure that all involved external parties agree with the basic objectives of the developed concept.
- Stakeholder ambitions and expectations can change during the course of a Living Lab. Changes in ambition of key stakeholders need to be identified as soon as possible. Involving stakeholders regularly and have personal contact helps in doing this. When the change has been identified, the impact on the Living Lab needs to be determined. It needs to be decided if and how the change is incorporated.
- When partners are added to the Living Lab look critically at their expected role and possible contribution and also look for conflicting interests and possible issues resulting from competition in real life. The Living Lab complexity will exponentially increase with the number of partners involved. There should be enough but not too many partners.
- Take into account personal animosities between key figures of organisations. Identify the risk of non-compliance from either of the organisations and take mitigating actions when possible.

Extent of the end users (or group of people who will actually try out the implementation case) involvement in the Living Lab process is a strategic decision to be taken during the Planning phase of the Living Lab. Higher the involvement of the users in the different stages of the Living Lab, the higher the expected benefits might be: higher acceptance, faster time to market, likelihood of higher adoption rate (Innovation Alcotra, 2011). In the situation of the highest involvement rate, end users are the part of the design team and are taking part in each Living Lab step. Opposite and at least, end users need to understand what the Living Lab solutions are for, how they need to use the technical functionality and what the impact is on their operational procedures. Furthermore, they need to see the benefits of the proposed solution in order for them to adopt it in their day-to-day work.

Management of end users of the Living Lab of the Living Lab solution may involve communication at another level than management on an organisational level.

5 Further elaboration of the Living Lab methodology

The methodology presented in this deliverable guides Living Lab participants through the process of establishing and conducting a Living Lab in the urban freight transport sector. It builds on existing methodological frameworks and is further adapted and fine-tuned to the city logistics sector.

These guidelines presented here are the first step to work on city logistics living labs; it is expected that execution of the Living Labs within the CITYLAB project will provide many important lessons learned that can improve the Living Lab approach within a city logistics setting. Specifically useful would be to use concrete examples from the city logistics to better illustrate different steps of the Living Lab approach. Additionally, information received from the Living Lab process evaluation can serve as valuable input in order to reinforce parts on the Living Lab management process. Finally, tools and methodologies used by different CITYLAB Living Lab participants can further reinforce specific city logistics sector toolbox for Living Labs. Therefore, the experiences and lessons of different CITYLABs' participants are used as an input to improve and update the guidelines presented in this deliverable 3.1. At the end of the CITYLAB project, an updated version of the guidelines in which the lessons from using the guidelines are captured and incorporated is made in CITYLAB's deliverable 3.4 'CITYLAB Handbook for City Logistics Living Laboratories'.

It is therefore recommended for the Living Labs to follow the different Living Lab phases and steps when reporting the main results of their implementations.

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Annex A. Planning Phase

Introduction of Living Lab Phase 1: Planning

The objective of the first phase is to decide what will be the ambition of the Living Lab and how it will be achieved. When implementing the first Living Lab cycle, more efforts are to be expected in order to get a complete and well performing Living Lab environment. If the Living Lab is in a follow-up cycle where solutions or technology from the previous phase are adjusted or new solutions are to be tested, than focus will be more on revising and updating the previously performed analyses.

Figure A-1 schematically represents the conceptual structure of the Planning phase. The planning phase has some crucial structuring inputs into the rest of the Living Lab. First, once ambition, scope and structuring external environment factors and risks are identified these are closely monitored throughout the whole Living Lab. Second, the implementation cases defined in the design phase define the structure of the Living Lab cycle to be performed. The implementation plan provides a planning for the cycle, assigning resources and milestones to the process. Finally, the evaluation framework which is developed in the design block (1.3, Figure A-1) defines monitoring processes and methods to be implemented and a list of indicators to be collected in the implementation phase evaluation mechanisms to be applied in evaluation phase and, the most important a decision making mechanism for the act phase (links between 1.3.4 and 2,3 and 4). The implementation plan is a logical summary of all the steps performed in the planning phase.

External parties are actively involved at this stage as clear understanding of their needs, requirements and possibilities is crucial for the development of a successful implementation case. Therefore, if considered necessary, all of the external parties are consulted at different stages of the system analysis (1.2.2; 1.2.3; 1.2.4) and are also actively involved in the ‘fit evaluation’ process (1.3.2).

There are two possible repetitive cycles in this phase:

1. between steps 1.1 and 1.2, when series of system analysis performed might bring to reconsideration of the project ambition and scope.
2. the ‘fit evaluation’ (between 1.3.1 and 1.3.2) where Living Lab participants first come up with a list of possible implementation cases to address the objectives of the Living Lab and then discuss it with the external parties. Results of this discussion may result in another round of definition of implementation cases. The final result should be a selection of the solution(s) to be experimented in the current Living Lab cycle.

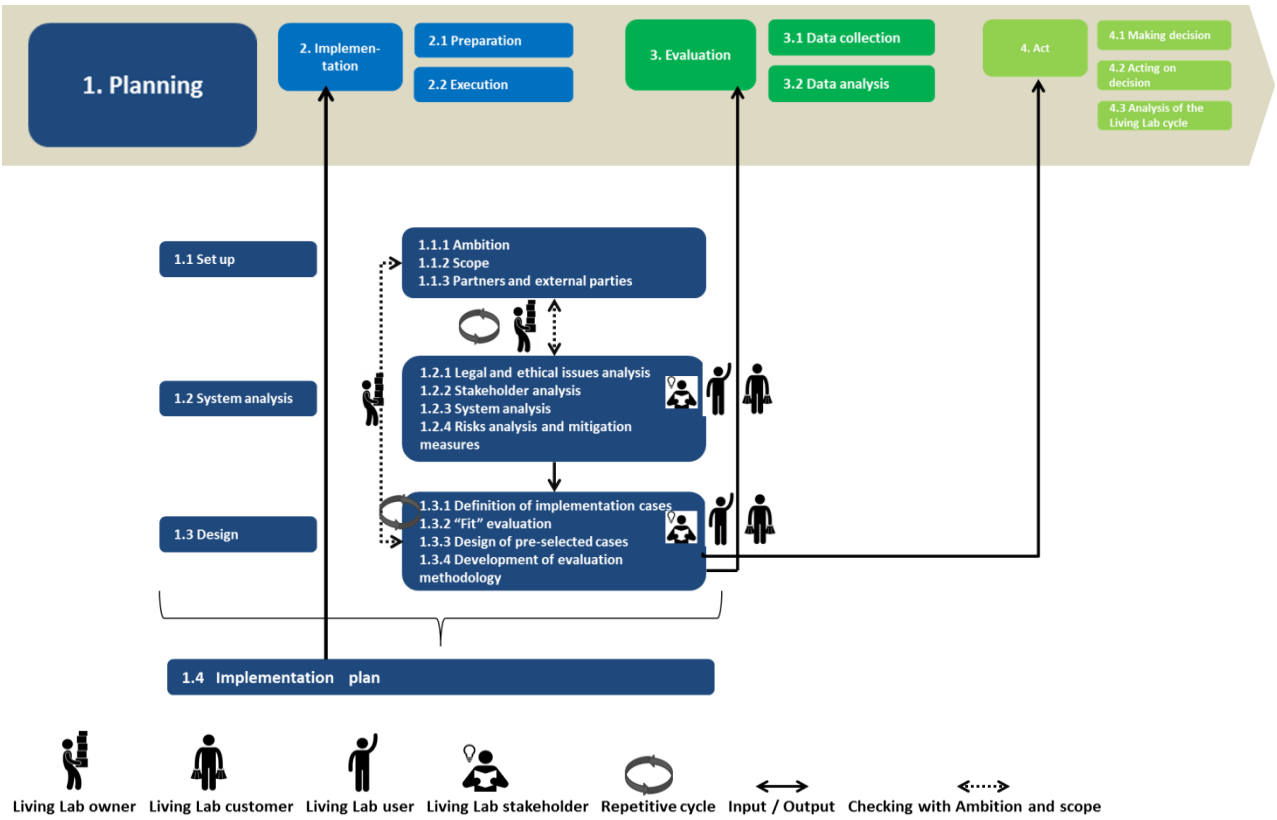


Figure A-1 Conceptual structure of the Planning phase

The Living Lab owner has a crucial role in setting up the Living Lab process and in giving a start to all the activities. The owner's role is to bring the participants together on a social level but also on a content level. The owner therefore needs to have a basic understanding of the various perspectives, e.g. logistics and IT. Next, the coordinator should be able to work as a translator and moderator in discussions (or appoint someone who does it on the owner's behalf). During the process the Living Lab owner performs regular checks if ambitions and scope remain the same and in case of change what kind of impact that has on the whole Living Lab process. If any changes need to be introduced into the process (verification links between different activities of 1.1 and 1.2, and 1.1 and 1.3, see Figure A-1). Together with the Living Lab participants the Living Lab owner decide whether one or several repetitive cycles are necessary between steps 1.1 and 1.2.

Set-up (phase 1.1)

In this activity block (i.e. 1.1. Set-up in Figure A-1) the overall goal and ambition for the Living Lab are defined, crucial partners are identified, consulted and involved and the scope of the Living Lab within the real-world environment, is determined.

The setting up phase consists of three elements:

- Living Lab Ambition;
- Living Lab Scope; and
- Living Lab Partners and Stakeholders.

Often, the main elements of the set-up phase have already been predefined before the start of the Living Lab (for instance in a proposal or partner selection stage). However, it is recommended to organise something together with all partners, e.g. conduct a one day workshop with the Living Lab participants, to create understanding and consensus on the different elements. Table A-1presents a set of tools that can facilitate the achievement of the results expected from 1.1. set up activity. These methods are more detailed in Annex E (that

provides an overview of Living Lab supporting tools, that could be helpful in different stages of a living lab).

Table A-1 Tools and methods to perform Set Up

Tool	Application for the set up phase
Cultural probes	Kick off, initialisation of the project
Dialog cafe	Ambition, Scope, Stakeholder definition, System analysis
Focus-group interview	Ambition, Scope, Stakeholder definition, System analysis
Future search	Ambition, Scope, Stakeholder definition
Story-telling	Ambition, Scope
Brainstorming	Ambition, Scope, Stakeholder definition
SMART criteria	Ambition

[1] Source: adapted from http://www.lltoolbox.eu/methods-and-tools/all-methods

Living Lab Ambition

Objective: To define Living Lab ambition, objectives and goals.

Approach: A project ambition (or problem to be solved, challenge or a goal) as stated in project management theory is what the client wants to achieve with the project results (IPMA, 2011). In case of a Living Lab there can be multiple clients or stakeholders who all have separate ideas of how the Living Lab outcome should fit in and contribute to their strategic objectives. Furthermore, the ambition of the Living Lab may need to be in line with the ambition of a wider project or program as it concerns bigger challenges then projects in general. At the creation of a Living Lab therefore an overall ambition (or vision) will be drafted, which will in most cases consist of one sentence or paragraph. When the Living Lab goal is being formulated it is essential to clearly formulate all the sub goals for all participants and make sure there are no conflicting ambitions.

The ambition will be further developed into concrete goals that will need to be met by actions performed in the Living Lab. The goals (or objectives) should be made as concrete as possible. A possible helpful tool in doing this is by applying the SMART criteria.

If relevant, it is also important to clearly state which goals will not be addressed in the Living Lab to make sure that expectations of external parties are realistic. If implicit ambitions are not made explicit and discussed properly, these will still be part of the expectations of the stakeholders and these will have to be managed later during the project.

The ambition and goals defined in the first phase are not stagnant throughout the duration of the Living Lab. The Living Lab owner should constantly check over the course of the Living Lab if changes need to be made. On another hand, the Living Lab owner also needs to make sure that actions performed within Living Lab are aligned with the ambition and contribute to an overall Living Lab goal.

Result: All Living Lab participants have clear understanding and agreement on Living Lab ambition, objectives and goals.

Living Lab Scope

Objective: To establish the boundaries of the Living Lab system.

Approach: Living Lab scope is a description of the boundaries of the Living Lab system that distinguishes it from its environment (Living Lab environment). The Living Lab ambition states the expected result, whereas the Living Lab scope defines the conditions under which this

ambition will be achieved. The Living Lab scope therefore states the boundaries of the Living Lab and a first high level description of what is within this system. It is important to check the Living Lab scope in a common session with all participants, to create common understandings on what will and will not be taken into account within the settings of the Living Lab.

For any Living Lab in the city logistics, the following aspects should be considered as part of the scope description:

- Area (which city area, the city centre, …)
- Main policy / city objective and the influence of city logistics on it
- Logistics specification (e.g. sector specific, or vehicle specific, …)
- Shipment specification (e.g. goods type, conditioned goods or pallets, boxes, etc.)
- Users involved for execution of operations (including for example subcontractors)
- Users involved for planning of operations that are often outside the city (e.g. logistics service providers, shippers)
- Main customers, receivers and size of freight market (e.g. shippers or freight forwarders involved), as well as power in the supply chain
- Other involved stakeholders

A draft version of the scope of the Living Labs can be found in the annexes.

Result: All Living Lab participants have clear understanding and agreement on Living Lab scope, on what is included and what is not in the Living Lab environment.

Living Lab partners and external parties

Objective: To determine which organisations need to take part in this Living Lab and what will be their roles and responsibilities.

Approach: It is essential that all relevant external parties that can directly influence the success of the living lab are included or at least involved. The ambition and the scope of the Living Lab are the foundation to identify necessary external parties.

At this stage, it is sufficient to define which roles Living Lab participants are playing within the Living Lab (user, customer, stakeholder, owner). If Living Lab participants play several different roles, that should be made explicit too. Then, a first overview of all relevant external parties that are necessary to address the issues at hand have to be done and it needs to be decided what kind of external parties are missing in Living Lab in order to achieve its goals. This interaction could be performed in a form of a workshop.

This list and possible roles of the stakeholders can later be extended as a result of the stakeholder/external party analysis.

If a partner or external organisation wants to be involved in a Living Lab, make sure these parties have enough higher management support for their involvement. Living Labs can be costly, for all partners, so the organisation should consider their involvement as an investment that contributes to their strategic goals. Higher management support can make sure that the organisation's Living Lab team members have the authority to act and make the necessary changes for their organisation's task during the Lab execution. Higher management support can also work extremely well as a motivation for the Living Lab team: having higher management representatives at certain meetings can boost team spirit and drive.

During the Living Lab it is important for the participants and important for external organisations to exchange experiences and evaluate the Living Lab regularly. This enables a steep learning curve and also stimulates the continuous development of the Living Lab with multiple loops. For this it is important to decide before the Living Lab starts how this will be organised and if necessary make arrangements for regular face-to-face or teleconference meetings. In order to facilitate a smooth implementation of solutions, it is recommended to develop a communication strategy to engage users as early as possible. User engagement is one of the distinctive features of the Living Lab. Two modes can be distinguished:

- a reactive mode, in which users are consulted to give a feedback on an existing proposal, prototype or product; or
- a proactive mode, in which they are actively involved over the course of the project and contribute by generating ideas to improve a product or service along its development process.

The way users are involved in the Living Lab depends strongly on the specifics of the solutions. In this stage it is sufficient to identify important potential user groups that need to be involved in the Living Lab, but it is also necessary to keep in mind that selected degree of the user involvement will largely shape different processes within Living Lab.

Result: Living Lab participants have a clear understanding and agreement on their roles; agreement on who are the additional stakeholders, users, customers that need to be associated to the Living Lab.

Living Lab Public Private Partnership

The forming of freight partnerships could be a good start for a city logistics living lab; currently many examples exist of these freight partnerships (see also Quak et al., 2015). These freight partnerships, or 'living lab public private partnerships', could be either a good starting point in the set-up of a living lab or the experiences from existing freight partnerships could be very helpful in setting up these necessary public private partnerships. For the city logistics context it is important to have a public private partnership, as public parties are responsible for city infrastructure, city access, and city space issues, as well as societal and environmental issues, whereas usually private partners are responsible for logistics operations. Without a good public private cooperation, these city logistics living labs are doomed to fail.

System analysis (phase 1.2)

In the activity block '1.2 system analysis' (see Figure A-1) both the Living Lab system itself and the real-life environment are analysed. Stakeholders, processes, products and technology are analysed in their current state. The system analysis provides a crucial starting point for the design (the next activity block in Figure A-1) where requirements are formulated.

The system analysis asks for a significant involvement of Living Lab participants and external parties and contains at least the following elements:

- Legal and ethical issues analysis;
- Stakeholder/ end user analysis;
- System analysis; and
- Risks analysis and mitigation measures.

Ideally, in the first Living Lab cycle the system analysis will be fully executed. In subsequent cycles, it needs to be decided if additional specific analyses are required according to the specific Living Lab user case. As much as possible, the analyses performed in this activity block should build on existing assessment studies which can be further adapted to the specific Living Lab case. Table A-2 provides an overview of some tools that can be helpful for the system analysis.

Table A-2 Tools and methods to perform System analysis

Tool	Application for the set up phase
Story-telling	Stakeholder analysis, system analysis
ZMET	Stakeholder analysis, System analysis, risk analysis
Bodystorming	Stakeholder analysis
Brainstorming	Legal and ethical issues, System analysis, Risks and mitigation measures
Actor – relation model	Stakeholder analysis, System analysis
Force-field analysis	System analysis
Value network modelling	System analysis
Why Why Why	Stakeholder analysis, System analysis, Risks and mitigation measures

[1] Source: adapted from http://www.lltoolbox.eu/methods-and-tools/all-methods

Legal and ethical issues analysis

Objective: To identify the relevant legal and ethical issues that influence the development of the Living Lab. The monitoring process for legal and ethical issues has to be identified as well.

Approach: This step can serve as a check to see whether the Living Lab ambitions can be applied in real life without raising legislative issues. Questions that can be addressed are:

- Which legal frameworks are relevant for this Living Lab system?
- Are there expected legal issues in executing the Living Lab?
- Are there expected ethical issues in executing the Living Lab?

For this analysis the legal framework and cultural aspects of various countries can be relevant and specific regulations can apply depending on location, goods to be shipped, type of company to be involved, etc. One point that could be considered is the use of exemptions during the first tests, and how these could be transformed to policy in a later stage. Therefore, this analysis needs to be done in parallel to the other analyses in this chapter as the relevant scope of the legal framework can change when more details become available on the Living Lab system and its environment. The legal framework should be monitored on a regular basis by the Living Lab owner, for instance every 6 months.

Result: All Living Lab participants are aware of legal and ethical issues and these factors are taken in consideration for the development of implementation cases. Process for the monitoring of the legal and ethical issues is established. Identified issues are input into the analysis of risks.

Stakeholder and end user analysis

Objective: The goal of the stakeholder/end user analysis is to understand the drivers, interests, culture and way of working of all parties related to the Living Lab (stakeholders, users, customers) in order to guarantee their continuous involvement in, and commitment to, the Living Lab.

Approach: It is likely that the external parties have an interest in participation when the Living Lab addresses topics that are aligned with their strategic or medium-term goals, or addresses a problem which they are currently facing. Important aspects to address during the stakeholder/end user analysis are:

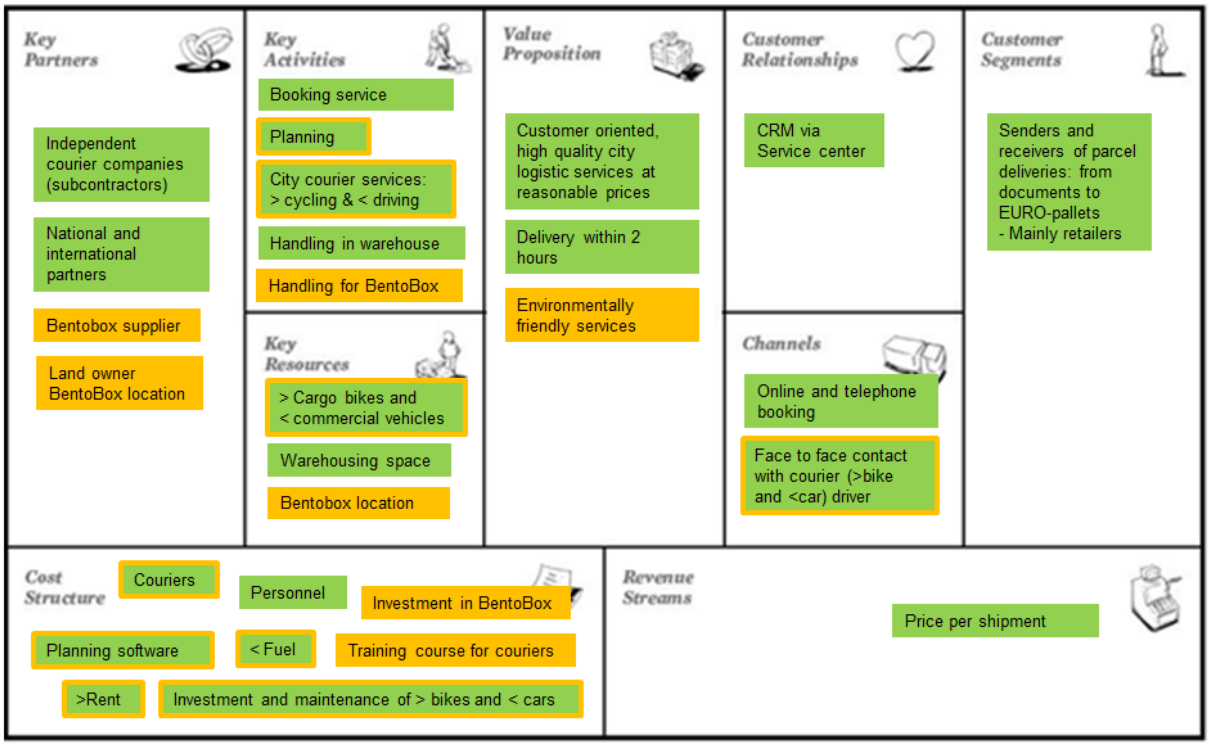
- Strategic and medium-term goals or issues;

- Interests, drivers, and business model; and
- Stakeholder/end user culture.

Depending on the Living Lab scope and ambition, it should be decided whether this analysis will focus only on end users, stakeholders or on both groups. In some cases analysis of goals, drivers, culture of the customer might be needed as well.

A first overview of the goals of important stakeholders to be taken into account in the Living Labs can be found in the annexes.

Directly related to the strategic goals are the stakeholders' underlying interests and the drivers in participating in the Living Lab. These aspects could be summarised in a business model canvas for each stakeholder. The business model canvas provides the Living Lab participants with background information on what aspects of the Living Lab results will be important to them and give insight on how to best approach them. Some innovations will also ask for changes in the stakeholder's business model. Therefore even more thorough analysis of the current business model will be needed. An example of a business model canvas (and corresponding analysis) for a city logistics case can be found in the following figure (and via the reference).



The green boxes present the business as usual for the courier service Messenger, whereas the orange colour represents changes caused by or required for the BentoBox solution.

[1] Source: Quak et al (2012)

Figure A-2 Business model analysis

For some stakeholders, it is not enough to just perform an analysis at the level of the organisation. For these organisations different (potential) user groups within the organisation should be addressed.. In order to ensure involvement over the duration of the project, it is important to understand the drivers, problems and culture of the specific user group.

Based on the individual business models, an overview of the system as a whole can be generated (for example using a value network analysis). This provides an insight in conflicting interests that need to be addressed in the design of the Living Lab, but can also highlight common grounds.

Results: Clear understanding of each other's needs and goals (as Living Lab participants) as well as of needs and goals of all Living Lab stakeholders, users and customers. The process for monitoring stakeholder goals or other important changes is established. Input into the analysis of risks related to stakeholders is collected.

System analysis

Objective: The goal is to analyse the direct environment that can influence implementation cases of the Living Lab.

Approach: In the system analysis an overview needs to be made considering the aspects of the real world environment that can influence the success of the Living Lab. The real-world environment can not only impact the design of the Living Lab and implementation cases within Living Lab but also influence its results.

The biggest challenge in this environment analysis is to know when to stop and when to go further with the analysis. The goal is to analyse only the direct environment that can influence the implementation case of the Living Lab. However, factors that seem hardly important now can become (extremely) important in the future. The Living Lab owner has the job to balance this activity and identify the environmental factors that have significant potential impact and thus need to be further researched.

The following aspects need to be addressed:

- Trends and developments in policy (EU, national, regional);
- Trends and developments in client markets (i.e. retail, construction, waste, etc.);
- Trends and developments in other relevant industries (i.e. infrastructure provider, vehicle manufacturers, etc.);
- Trends and developments in space (urban planning, space available for logistics, property prices, etc.);
- Running initiatives of interest groups, government bodies, etc.;
- Technological innovations (i.e. trends in data sharing or on ICT equipment)

A very valuable part of this exercise is to get a common understanding of the system for the whole team. This helps to create a team bond, help people understand each other's business language and develop solutions that really fit in the current system (i.e. create a "shared situational awareness (SSA)", see for more details on SSA in city logistics and the creation of living labs, Quak et al., 2015). It is a crucial step when formulating detailed use cases and solution requirements in the following activity blocks.

Result: After the system analysis, the Living Lab team should have a common understanding of how the system works in relation to the Living Lab ambition.

Risks analysis and mitigation measures

Objective: To identify potential risks that the Living Lab or the activities undertaken in the Living Lab might face, to define risk monitoring process and mitigation measures.

Approach: Based on the previous steps in the system analysis, this task will explore the main potential risks for implementing Living Lab solutions. Examples of such risks are:

- Legal risks;
- Risks related to stakeholder, user or customer involvement;
- System risks;
- Operational risks;
- Financial risk; and
- Environmental or safety risk (for some particular cases).

One of the possible ways to identify the risks is Failure Mode and Effect Analysis (FMEA). In the FMEA methodology for each of the risks the following aspects will be identified:

- Probability of the occurrence;
- Severity (impact);
- Means of detection and dormancy period (can the issue be spotted easily and early).

Based on the combination of these three factors the risk occurrence level can be identified. Together with partners and stakeholders it needs to be decided which of the identified risks need to be mitigated and how, as well as how identified risks will be monitored.

Risks identified at this stage should address both Living Lab process risks and Living Lab environment/system risks. In the Preparation phase this is further reinforced with risks particular to specific implementation case.

Result: Risks are identified, monitoring process is established and mitigation measures are identified.

Design (phase 1.3)

In the Design (phase 1.3 in Figure A-1) of the Living Lab, solutions or technology that will be tested in the concrete Living Lab cycle are defined and described. This is one of the most important phases of the Living Lab, as it defines what will be the focus of a concrete Living Lab cycle. Therefore, it is crucial for the Living Lab success that the results of this activity block are of a high quality. All the work of the previous blocks is fed into it and then this design phase determines what exactly will be experimented in the Living Lab. Consequently, it provides crucial feedback to the Living Lab set-up and to the system analysis. In addition to looking back, this block is also looking at the phases ahead. Its outcomes are crucial input for the specifications of the implementation phase and determine to a large extent what the evaluation of the results will look like.

To achieve highest possible quality several iterations between the various steps in this block as well as iterations with the other activity blocks in the Planning phase (Phase 1, see Figure A-1) might be necessary. For this, good communication between Living Lab partners, stakeholders, users and customers, being involved in different tasks, is essential:

- Living Lab participants who are in charge of defining concrete implementation cases;
- Living Lab participants who have done the earlier set-up and system analyses;
- Stakeholders with domain expertise;
- Users/ Living Lab participants that will be involved in implementation and capturing the results; and
- Living Lab participants who will analyse the data in the evaluation phase.

Design consists of the following steps:

- Definition of the implementation cases;
- 'Fit' evaluation;
- Design of the implementation cases; and
- Development of evaluation methodology.

The first two activity blocks are to be repeated until all of the Living Lab participants are satisfied with the short list of implementation cases or a choice of one implementation case to be experimented with in the Living Lab.

A set of tools can be used to facilitate the processes of the design phase. The summary of these tools is presented in Table A-3.

Table A-3 Tools and methods to perform Design

Tool	Application for the set up phase
Story-telling	Definition of implementation cases; design pre-selected cases

Tool	Application for the set up phase
ZMET	Definition of implementation cases; design of pre-selected cases
Open Space technology	Definition of implementation cases
Brainstorming	Definition of implementation cases
Why Why Why	Definition of implementation cases
Experience prototyping	Definition of implementation cases; Design of pre-selected cases
Idea generating questions	Definition of implementation cases; Design of pre-selected cases
Triple helix workshops	Definition of implementation cases; Design of pre-selected cases
Focus-group interview	Definition of implementation cases; "Fit" evaluation; Design of pre-selected cases; Development evaluation methodology
Future search	Definition of implementation cases
Innovation by boundary shifting	Design of pre-selected cases
Story Boards	Design of pre-selected cases
Functional analysis	Definition of the implementation cases; Design of pre-selected cases
Mock ups	Design of pre-selected cases
Rapid prototyping	Design of pre-selected cases
Predictive models	Definition of implementation cases; design of pre-selected cases

[1] Source: adapted from http://www.lltoolbox.eu/methods-and-tools/all-methods

Definition of the implementation cases

Objective: To identify a list of implementation cases contributing to achieve the specific objective of the Living Lab and which will be potentially addressed in the current Living Lab cycle.

Approach: The objective of a Living Lab is to examine, design and experiment, or evaluate certain technology or concepts (or, so-called implementation cases), in order to address specific questions or issues that are formulated by involved organisations in order to improve their decision making (policy-making and market strategies). Identifying the most relevant implementation cases to successfully address the goals and reach the Living Lab ambition is one of the major challenges.

Table A-3 gives some idea on tools and methods that can facilitate a process of definition of implementation cases. At this stage input on needs can be collected from all Living Lab participants, external users, stakeholders, customers. Once this process is finalised, these needs are analysed and translated into the concrete concepts of solutions / technologies that will help resolving issues .

Results: A list of implementation cases that potentially resolves the problem addressed by the Living Lab (i.e. achieves the ambition).

"Fit" evaluation

Objective: To evaluate suggested cases on a set of criteria and to come up with a short list of cases / prioritisation of cases. This determines a shape of the current Living Lab cycle.

Approach: It is important to make sure that all defined implementation cases contribute to the Living Lab ambitions and, vice versa, that all Living Lab ambitions are reflected in these implementation cases. Therefore it is necessary to check if proposed solution / technology:

- Satisfies the ambition of the Living Lab;
- Responds or addresses one of the goals and objectives of the Living Lab;
- Is compliant with the needs of the users, customers and stakeholders;
- Is risk sensitive or not.

From the system analysis it needs to be checked whether all implementation cases can be performed in the Living Lab system and that no additional partners need to be included.

Moreover, the list of solutions needs to be further fine-tuned/limited considering – at that moment counting - Living Lab limits: budget, available resources (both time and man power), fit to the operational process, technical capabilities or system maturity. Those may lead to a decision to reduce the amount of implementation cases or to prioritise them. Note that it can also be part of the Living Lab process to find for example budget or resources to actually experiment with a solution (in that case, the first step is to make sure budget and / or resources are available, before the actual technology / solution experimentation can start).

Although one partner should be ultimately responsible for guiding the fit process, it is important to involve users, customers and other stakeholders in the process. The final decision should be supported by all major partners.

Result: Implementation case(s) for the current Living Lab cycle is (or are) identified.

Design of the implementation cases

Objective: To have a good description of the implementation cases and the boundary conditions of the proposed solution / technology.

Approach: A description of the implementation cases down to an adequate level of detail is to be done. This means that the main aspects of the solutions or technology to be developed, its intended benefits and intrinsic limitations have to be described. Everybody needs to understand objectives and limitations in order to derive reasonable use cases. In this phase we move from concepts to more developed prototypes of solutions.

Besides the more general details about the proposed solution (e.g. intended benefit, limitations, any other additional instruction) some refinement of the system analysis might be necessary, making it specific to the actual implementation case. The scope of the implementation case will then describe where and under which circumstances the implementation case will operate according to its specifications. This also provides input to how this case needs to be tested during the execution phase and which type of data needs to be recorded to enable a good interpretation of the results. Description of the boundary conditions of the specific implementation case can consist of:

- System requirements: requirements for infrastructure, modalities, geographical influences and environmental restrictions. These are requirements for the Living Lab system as a whole.
- User requirements: requirements for user characteristics, such as age, educational level, user experience, physical characteristics and attitude towards e.g. automation, technology, safety, etc. These are requirements for the personal actors in the Living Lab system.
- Others might be relevant depending on the Living Lab ambitions and content.

Results: Implementation cases are described to a sufficient level of detail that baseline measurements can be done.

Development of evaluation methodology

Objective: Develop evaluation methodology for the Living Lab cycle, define monitoring methods, measurement approaches.

Approach: The objectives, framework and methods to be used in order to perform an evaluation of the Living Lab results need to be defined already at this stage. The evaluation

framework established here will shape the Evaluation phase of the Living Lab. Based on the results of the evaluation, a decision has to be taken on the success or not of the implementation case and on the follow up actions to be taken, guiding the Act Phase (i.e. phase 4 in Figure A-1).

Two levels of evaluation need to be developed: evaluation of the implementation case and evaluation of the Living Lab itself.

In evaluation of the implementation case, depending on the Living Lab ambition and scope the following performance indicators should be considered:

- Key performance indicators to evaluate efficiency of solution/technology
- Adoption indicators or users feedback on the solution/technology
- Impact on the business model and technological maturity of the solution/technology.

Key Performance Indicators (KPIs) are quantifiable and clearly defined measurements, that reflect the core goals and targets of the intended measure based on the stakeholders' perspectives. When selecting performance indicators, consider how to measure and quantify the indicators. When setting up KPIs it is recommended to consider what KPIs are relevant for which organisation that is involved. Different organisation types (for instance a logistics service provider or a transport operator) have different business models, and will therefore have different relevant for them KPIs, see for example STRAIGHTSOL, deliverable 3.3.

Behavioural change is essential for a solution to become successful. Performance indicators such as load factor, emissions and costs may show a significant improvement, however, in the end, the behaviour of people determines whether these improvements can be achieved and sustained for a longer time. It is therefore important to include behavioural elements in the evaluation which are than reflected in user feedback. When doing so, both adoption in a sense of buying and using the innovation should be considered. Innovation adoption is a multidimensional process where individuals' behaviour is influenced by a variety of learning, social and technological conditions. Data for the Adoption indicators can be collected during workshops, interviews and through questionnaires.

Stage of adoption in reporting period:

Receptive	Understanding	Being able	Wanting	Doing	Persevering
○ Is open for change	○ Understands what the solution is about	○ Has what it needs to use the solution	○ Thinks that benefits outweigh the costs	○ Uses the solution	○ Keeps using the solution, even when obstacles arise
1 -	2 DCT PKP Cargo Lotos	3 GTK, GTC	4 PCC Intermodal Cargosped Loconi Balticon	5 Spedcont Polzug Pol-Agent CHS Polsin	6 BCT

[1] Source: LogiCon Handbook (2014)

Figure A-3 Example of a behavior change model

A good way of structuring and presenting this aspect is by using a behavioural change model, which distinguishes six required elements for long-term adoption of a desired behaviour. An example of the six-step approach is presented in Figure A-3.

Apart from the adoption and the performance indicators, influences on the business models of the Living Lab participants can determine the success rate of the demonstration and more importantly the uptake of the results after the completion of the case in the Living Lab. A

business model is a description of how a company or a set of companies intends to create and capture value with a product or service. A business model defines the architecture of the product or service, the roles and relations of the company, its customers, partners and suppliers, and the physical, virtual and financial flows between them. Finally, the technological maturity of the solution / technology needs to be evaluated.

When selecting performance indicators it is important to determine what will be the decisive factors for (dis)continuation of the new concept/technology in the Living Lab. Indicators should help to decide whether an implementation case is considered successful or unsuccessful. Therefore, the methodology for the decision making process that has to be performed in the Act Phase should also be a part of the general evaluation methodology.

Finally, the parameters to evaluate the Living Lab cycle process have to be defined as well. It is advised to make the process evaluation a periodic process, e.g. checking within regular timeframes how the Living Lab is developing and how the experiences of the stakeholders are. This approach will help to capture the specific characteristics for each of the Living Lab phases as responsible actors will fill in the periodic evaluation forms when their memory is still fresh. It is suggested to include the following information in the periodic forms:

- Reporting period;
- Phase/activity block at which Living Lab is situated at current stage;
- Phase/activity blocks that were performed within Living Lab during reporting period;
- Any delay encountered according to the plan. If yes, why?;
- Describe the Living Lab situation / statusright now;
- Any barriers encountered during the reporting period;
- Facilitators that helped development of the Living Lab during the reporting period;
- Lessons learnt during the reporting period;
- Any other relevant information.

Summarising, the evaluation framework needs to include at least the following indicators:

1) Indicators to evaluate the results of the implementation case: KPIs, adoption indicators, the impact on the business model, the technological readiness of the solution.
2) Indicators or decision processes that will help to take a decision on the continuation or discontinuation of the Living Lab cycle and on the shape of the new Living Lab cycle in the Act Phase.
3) Indicators to evaluate the Living Lab process.

Besides designing the different indicators, a decision should be taken on how and when in the process of the Living Lab the evaluation should be performed and what type of analysis should be used. If several implementation cases are running within one Living Lab environment, the evaluation framework also needs to foresee the ways to perform cross-evaluation (as well as interdependency between these cases) of the results from different implementation cases. Results from one case should be made available for other cases.

Examples of tools that can be helpful in setting up evaluation processes are listed in Table A-4. Selected tool / methods, indicators and processes to collect these indicators are together forming the Evaluation framework of the Living Lab cycle.

Table A-4 Tools and methods to develop Evaluation framework

Tool	Application for the set up phase
Analytical evaluation	Ex ante and ex post evaluation of the Living Lab results (KPIs, adoption indicators)
Conjoint method	Ex ante evaluation of adoption indicators
Behavioural change model	Adoption indicators

Tool	Application for the set up phase
Business model Canvas	Impact on business models
Business, market and competitive analysis	Impact on business models
Usability testing	Technological maturity, KPIs, impact on business models, adoption indicators
Walkthrough testing	Ex ante evaluation
Discovery methods	Adoption indicators, KPIs
Tracking methods	KPIs, adoption indicators, technological maturity, impact on business models
Cost benefit analysis	Impact on business models, KPIs
Multi-Criteria analysis	Impact on business models, KPIs
Multi Actor Multi-Criteria Analysis (MAMCA)	Impact on business models, KPIs of several stakeholders

Source: adapted from http://www.lltoolbox.eu/methods-and-tools/all-methods

Results: Monitoring method and process are defined and indicators to be collected are identified. All participants have a clear understanding of what kind of data need to be collected, when and by whom.

Living Lab Implementation Plan (phase 1.4)

For a Living Lab to "proceed smoothly, a plan of action must be developed which documents the scientific, technical, administrative and procedural activities and tasks that are needed to successfully complete it. Given that the lifecycle typically evolves through many phases, there are many issues to consider" (FESTA, 2011). This plan of action will be called the Living Lab Implementation Plan or LLIP.

Based on the FESTA implementation plan and looking at project management principles, at least the following topics should be covered in the LLIP (IPMA, 2011):

- Living Lab ambition
- Living Lab scope
- Living Lab risks
- Living Lab deliverables and milestones
- Living Lab approach
- Living Lab time line and planning
- Living Lab resources (people, means and tooling) and their organisation
- Living Lab budget and expected costs
- Living Lab monitoring, control, reporting and communication

Additionally to the items already discussed (ambition, scope, risks), to make the LLIP practical, concrete questions are defined for each of these categories in Table A-5. Note that these lists of concrete questions are not exhaustive.

Table A-5 Key questions when creating LLIP

Preconditions for success, external dependencies and assumptions	• What are the relevant legal frameworks for the Living Lab system? • Are there legal issues during the execution of the Living Lab? • Which dependencies exist between the Living Lab system and its environment? • What are the critical quality factors? • Which assumptions are made?

	• Are there ethical issues in executing the Living Lab?
Risks	• What are the risks in Living Lab execution? • What are the risks of stakeholder change? • What are the technology related risks? • What are safety and security risks? • For each of the risks what are probabilities and effects and how can the risk be mitigated?
Deliverables and milestones	• What are the official deliverables? • What are the official milestones? • What additional deliverables are needed for project control and reporting? • What additional milestones are needed for project control?
Approach	• How are the activities executed? • Which methods are used, such as interviews, questionnaires, workshops, etc.? • How do partners and activity teams interact?
Timeline and planning	• What is the expected duration of all Living Lab phases and activity blocks? • What dependencies influence the planning? • Does the resulting timeline fit with the project timeline?
Resources and their organisation	• What are the partners' responsibilities in the execution? • Who are the critical people needed in the team? • What is critical technology needed? • What other resources are needed? • Under which conditions can these resources be made available for the Living Lab?
Budget and expected costs	• What is the overall Living Lab budget and is it distributed correctly among partners so that it reflects their respective work? • How is the budget spending over time related to milestones and deliverables?
Monitoring, control, reporting and communication	• How does the team work together? • Are sub-teams needed? • Are there cultural/language barriers in the team? • What are the procedures or protocols to communicate with partners? • What are the procedures or protocols to communicate with stakeholders? • Which meetings are needed and used and when? (Telco's, face to face meetings) • How do we report on meetings? • How do we resolve issues? • How and to whom do we report issues?

Key messages for Planning (Phase 1)

Set up	
Result	• Ambitions and scope of the Living Lab are clear to all Living Lab participants • Living Lab roles are defined and acknowledge • Living Lab participants and external parties agree on the ambition, objectives and goals of the Living Lab
Highlights	• Create an explicit overview of all Living Lab sub-ambitions for each stakeholder, check for issues, sign these off before the Living Lab start and manage these during the project. • State the scope as SMART as possible and where possible or needed also state what will not be done in addition to what will be done. • Identify all relevant participants of the Living Lab and determine their roles and responsibilities are precise as possible. Be critical when selecting the Living Lab partners. • Make sure there is higher management support for Living Lab partners.

Set up	
System analysis	
Result	• Underlying context and specific circumstances of the project are defined • Key aspects that can influence the Living Lab and that need to be monitor throughout the Living Lab are identified • Constraints and boundaries are defined and agreed upon • Risks and mitigation measures are clear to all of the Living Lab participants
Highlights	• System analysis is heavily defined by the results of the Set up phase. At the same time, results of the System analysis may lead to reconsideration of the ambition, scope or stakeholders to be involved in the Living Lab. • Continuously monitor the Living Lab environment as it will not only impact design but also results. • Know when to stop with environment analysis, do not model the world. Understand and monitor evolving trends in the related industries and running initiatives of interest groups, government bodies, etc. and assess their impact on the Living Lab. • Involve an expert when you think legal or ethical issues can be expected. • Understand the ambitions and drivers of your stakeholders.
Design	
Result	Implementation cases that will be tested within Living Lab are defined Implementation cases are prioritised Implementation cases are described at the highest level of detail Evaluation framework is established, containing indicators to evaluate implementation case, Living Lab cycle and indicators guiding decision making process for the Act Phase
Highlights	Review previous steps when further detailing implementation cases in the Design block. • Pay attention to overlap in implementation cases, how they interact and influence each other and try to disentangle where possible. • Balance between implementation cases that are either too vague and holistic or too specific (and unchallenging). • Development of implementation cases and “fit” evaluation are in repetitive cycle until the moment all of the involved parties agree on the short list of pre-selected implementation cases. • Develop a proper evaluation framework focusing on three main aspects: - Evaluation of your implementation case - Process to make a decision in Act Phase, as well as corresponding indicators and values - Evaluation of your Living Lab cycle.
Implementation plan	
Result	Living Lab participants agreed on the shape of the next Living Lab cycle detailed in the Implementation plan. Implementation plan contains at least: ambition, scope, risks, deliverables and milestones, approach, time line and planning, resources, budget and expected costs, Living Lab control, reporting and communication mechanism
Highlights	Living Lab implementation plan is a summary of all the precedent steps in the Planning phase. It contains all main aspects in order to manage the Living Lab.
Outcome Planning Phase	• Clear Living Lab ambition, scope, stakeholders • Implementation cases to perform within a cycle a selected • Evaluation framework for the Living Lab cycle/case is developed • Implementation plan is developed

Annex B Implementation Phase

Introduction of Living Lab Phase 2: Implementation

Concrete solutions to be tested are identified in the Planning phase (phase 1). Next, a detailed plan on how to implement these solutions is developed. The main objective of the implementation phase is to test these pre-selected solutions/technologies in real life. The implementation phase consists of two steps, detailed in Figure B-1:

1. Practical preparation of the implementation case (preparation);
2. Performing the case (execution).

The implementation phase results in tested solution/technology and the collection of required data for the evaluation process.

Figure B-1 illustrates important links between the implementation and other Living Lab phases. In the Preparation phase the Living Lab owner needs to check regularly whether the ambitions and the scope of the Living Lab remains the same and, most important, if there were any critical changes in the Living Lab environment that can influence the implementation process (verification link 1.2 – 2.1). If these changes are reported, these should be incorporated in the implementation plan and consequently into the preparation block. Next, the Living Lab owner needs to monitor if the execution of the case follows the implementation plan and if it is well in the timeframe and resources dedicated to it. Again, if any unforeseen changes happen, the implementation plan has to be adjusted and the execution needs to follow accordingly (verification link 2.2 – 1.4 checking whether the process is going according to the plan).

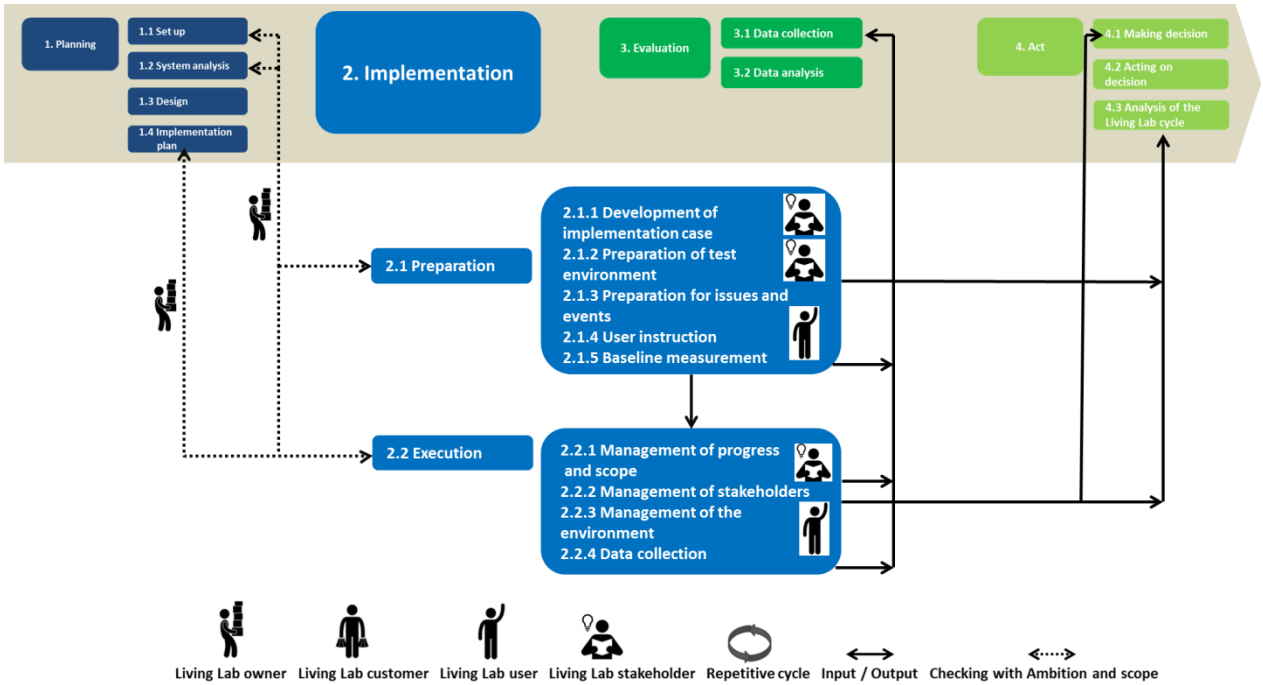


Figure B-1 Conceptual structure of the Implementation phase

The implementation phase provides direct input into the Evaluation and Act phases. Baseline measurements performed in the Preparation block and the first data collection activities performed in Execution block serve as a foundation to start data collection activities in Evaluation phase (links between 2.1.5, 2.2.4 and 3.1). The information received during the management of progress, stakeholders and environment provides a foundation to take a decision and evaluate the performance of the Living Lab cycle in the Act phase (links between 2.2.1, 2.2.2, 2.2.3 and 4.1 and 4.3).

External parties are involved throughout this phase, specifically stakeholders and users. Stakeholders are taking part in the development of implementation case (2.1.1), preparation of test environment (2.1.2) and, where applicable, throughout the execution of the implementation case. Users are at least involved in user instruction (2.1.4) and are playing a central role during the execution activity block. Both stakeholders and users are approached for the baseline measurements and data collection (2.1.5, 2.2.4).

The following paragraphs further discuss the approach for each of the activity block in Implementation phase (see Figure B-1).

Preparation (phase 2.1)

The goal of the preparation activity block is to complete all necessary preparations to make the concrete implementation case of the Living Lab operational. For example IT requirements have to be properly developed, if necessary technology has to be produced, requirements for interoperability and exchanging information platform among stakeholders need to be prepared, all administrative procedures are updated, licenses are arranged and, if necessary, the staff needs to be trained. Also, in the first implementation round of the Living Lab, baseline measurements need to be done in order to be able to compare the results of the solution with the before situation.

The following steps are proposed to be included in the preparation of the Living Lab:

- Operational preparation of the implementation case;
- Preparation of the test environment;
- Preparation for issues and events;
- Workshops for user instruction, kick off and learning curve; and
- Baseline measurement.

Operational preparation of the implementation case

Objective: To perform all activities necessary to make the implementation case operational.

Approach: Solution / technology that will be tested in the Living Lab is developed according to the requirements developed in the Design phase. Further development of implementation case(s) should focus on:

- Technical design of the solution(s) / concept, including
  - All functions and elements of the implementation case;
  - Operational flow of the case (which steps are taken in an operational procedure);
  - Information flows
- Operational design, including:
  - Planning of implementation of implementation case;
  - Detailed plan for the involvement of Living Lab partners, users and other stakeholders.
- Other relevant case specific elements.

Experience from the previous Living Lab projects shows that sometimes implementation cases are better delivered in smaller improvement cycles where ever possible, as it facilitates active involvement of users (and Living Lab participants). Although a cyclical development approach has become more popular in recent years, not all users and Living Lab participants will be used to this way of working. They might be tempted to specify and develop solutions until they are perfect and include all user needs that were identified upfront. This waterfall approach does not completely fit in a Living Lab approach, also reinforcing idea of smaller improvement cycles.

The development on solutions may not have been fully completed, which means that the exact requirements for parts of the implementation case may not yet be ready. Therefore, it is than suggested to start development work as soon as possible and deliver first results. The ‘Act’

loop in the Living Lab model will then analyse what changes are needed to the solution to keep Living Lab and R&D results as much as possible aligned.

Result: Implementation case is ready for operation from technological and operational point of view.

Preparation of the test environment

Objective: To make sure that solution can be tested in a variety of desirable situations.

Approach: Depending on the type of solution that needs to be tested and the KPIs that have been selected, right situations need to occur during the test period. Some testing events might need to occur that are more difficult to plan, for example unexpected hindrances or extreme weather conditions. Therefore, it is important to create an overview of typical situations that need to be tested and whether these need specific action to make sure these will take place. For situations that could not be predicted or scheduled some simulations might be needed and this also requires preparation. Examples of the situation aspects that need to be considered are:

- Desired participant and user types, e.g. non-educated users;
- Desired modality or vehicle types and combinations, e.g. multimodal transport solutions;
- Desired locations, e.g. city locations, remote locations;
- Potential external events, e.g. extreme weather, road blockage;
- Potential criminal events, e.g. smuggling, cargo theft;
- Disturbances from within the Living Lab, e.g. strike, system down-time.

Result: Arrangements are made to test solution/technology in different environmental settings or simulation exercises are prepared for cases where real life testing is not possible.

Preparation for issues and events

Objectives: Identify risks and outside events that may be of influence during the execution of the solution.

Approach: A set of overall Living Lab risks was identified in the planning phase of the Living Lab. During the testing in the Execution phase, these issues can occur or some other unforeseen events may happen that have a significant (negative) influence on the success or continuation of the Living Lab solution. Therefore, the overall risk analysis and mitigation measures need to be reviewed at this stage and adapted from the Living Lab level to this concrete implementation case.

Together with partners and stakeholders it needs to be decided which of the identified risks needs to be mitigated and how, and where needed escalation protocols need to be drafted. These escalation protocols describe how to communicate and act in the case of issues, events and disruption.

Results: Risks and mitigation plan is adjusted to the specific implementation case. Mechanism to monitor and early detect new risks is established. Fall-back procedure is established.

User instruction

Objectives: Create understanding of the implementation case and process from all Living Lab users

Approach: Before the real life execution can start, the users need to be properly instructed. A Living Lab is executed in a real-world environment and this means there are no test scenarios or test cases that users need to follow. For the users involved in the Living Lab it is therefore important that they understand what the Living Lab solutions are for, how they use the technical functionality and what will be the impact on their operational procedures. Therefore, user instruction must focus on:

- Creation of a good understanding for all users what the project ambition is and why this ambition is relevant for the users (e.g. supporting their work instead of cutting costs).
- Explaining the work procedure during the execution phase. It is important that all participants have an equal level of understanding on what is going to happen, when and why.

To give the users proper understanding of what is expected from them two things might be needed:

- Training/user manuals; and
- A kick-off meeting.

The choice for one or the other depends on the type and complexity of the functionality involved and the level of understanding and day-to-day involvement of the users in the development of the implementation case.

Results: All Living Lab users have a clear, common understanding of the Living Lab implementation case and its functionalities. These are committed and prepared for the execution phase.

Base line measurement

Objective: Provide a measurement of all relevant indicators to use as a reference for measuring the success of Living Lab solutions.

Approach: To evaluate the success of the Living Lab's solutions after the implementation, it is important to understand the performance of the Living Lab system before solution(s) were implemented. Measurement of the current status of the system is called a baseline measurement and these needs to be performed before the execution block starts. Baseline measurement is at least performed for KPIs, adoption indicators and business models. Tools and methods to perform these measurements are established within the evaluation framework defined in the Design block of the Planning phase.

Depending on the indicators to measure, possible sources of data are:

- IT systems of users, such as on board equipment of the trucks or vans operating in the city or of third parties (such as the customers or the infrastructure manager);
- Data logbooks kept by users during the course of the implementation phase;
- Surveys performed at customer (company level or employee level);
- Reports / overviews published by parties

Having the right performance indicators and making proper measurements of both the baseline and during Living Lab execution are essential for the Evaluation phase. It is therefore important to assign the responsibility for making these measurements to specific persons making sure that they understand the importance of high data quality.

Result: Baseline measurements are performed according to the requirements of the Evaluation framework.

Execution (phase 2.2)

During the Execution activity block (see Figure B-1) the solutions and technologies are tested in the real world and input for Evaluation is gathered. To minimise the costs of the Living Lab, the Execution should be as short as possible. However, the Execution should be long enough to obtain valid results of implementation of the case.

During the execution phase care need to be taken of:

- Management of the progress and scope (internal management);
- Management of stakeholder and user commitment (external management);
- Management of the environment (external management);
- Data collection.

Management of progress and scope

Objective: To make sure that real life implementation progresses according to the implementation plan and right test situations are happening.

Approach: When the Living Lab solution is implemented in real life both progress and scope need to be monitored to check whether the right tests are performed in the right way and under the right conditions. Important aspects that need monitoring are the external influencers, risks and data collection. Important events in the Living Lab, e.g. implementation dates, milestones, changes, unforeseen events need to be reported so that these can later be included in the evaluation where needed.

In addition, it is valuable to consider the strengths and weaknesses of the Living Lab and its execution on a regular basis. This helps to continuously improve the Living Lab during the execution, to gather new insights for future iteration cycles and to identify risks in an early stage. Table B-1 shows a template for performing such an analysis.

Table B-1 Identify strengths and weaknesses

Strengths	Weaknesses
What goes well?	What does not go well?
Identify crucial factors of success	Identify vulnerabilities
How does this contribute to the achievement of the Living Lab and can it help to improve further?	How can barriers be overcome and make the Living Lab less vulnerable?

Result: Testing of the implementation case is progressing under close supervision; changes and main milestones are closely monitored and properly reported.

Management of stakeholders and users commitment

Objective: To make sure stakeholders and users have the right expectations from the Living Lab and stay committed to the Living Lab process.

Approach: Stakeholder and user commitment needs to be managed throughout the Living Lab to guarantee that stakeholders and users have the right expectations from the Living Lab and its outcomes and stay committed. Stakeholder and user management during the execution of the Living Lab needs to be performed on two aspects:

- Manage stakeholder and user expectations; and
- Manage stakeholder and user concerns.

Management of stakeholder expectations starts with having a good understanding of the stakeholders expectations performed in the set up block of the planning phase. During the analysis, design and preparation blocks users and stakeholders are than consulted to validate major steps. Involving stakeholders continuously throughout different stages of the Living Lab will make sure that they have a clear understanding of what to expect in the execution phase. Then, in the execution phase the main activity is to make sure users and stakeholders have feedback and support on the implemented solution as fast as possible and that they provide feedback on their experiences with the solution. In this sense, it is important to keep communicating regularly about the progress and to share information openly. Sharing of successes is essential for keeping up spirits and motivation but sharing of unforeseen risks and events, especially when these affect expectations, are essential for keeping up trust.

Result: Stakeholders and users receive efficient support throughout the execution of the implementation phase.

Management of the external environment

Objective: Make sure external environment is continuously monitored and any important changes are fast incorporated into the tested implementation case.

Approach: As discussed in the system analysis and preparation activity blocks, changes in real-life environment can have a major impact on the process and results of the Living Lab execution. Therefore, identified outside events and risks need to be continuously monitored in order to assess their potential impact on the Living Lab success. The end responsibility of monitoring these developments is with the Living Lab owner but can of course be delegated to relevant experts. When a change has been identified, the impact on the Living Lab needs to be determined. It needs to be decided if and how the change is incorporated.

Result: Changes in external environment are closely monitored and, if necessary, are acted upon during Execution phase.

Data collection

Objective: To collect data necessary for Evaluation purposes.

Approach: Evaluation framework defined in the Design block of the Planning phase was build up around the following set of indicators:

1) Indicators to evaluate results of the implementation case: KPIs, adoption indicators, impact on the business model, technological readiness of the solution
2) Indicators to evaluate Living Lab cycle
3) Indicators or decision process that will help to take a decision on the continuation or discontinuation of the Living Lab cycle and on the shape of the new Living Lab cycle in the Act Phase.

Even though the majority of the data collection takes place in the Evaluation phase, in some specific cases on-going or periodic monitoring is necessary during the real life implementation of cases. For the purposes of the evaluation of the Living Lab cycle periodic progress evaluation needs to be established. Regularity will depend on specific implementation case. This progress evaluation can contain the following information:

- At which phase of the Living Lab are you situated?
- Description of activities performed since the last reporting period.
- Were there any changes in ambition, scope, external factors observed during the reporting period and how did this impact the Living Lab process?
- What were the lessons learned during this reporting period?
- What are the next steps of Living Lab development?

Results: Data for evaluation purposes is collected.

Key messages for Implementation (Phase 2)

Preparation	
Result	• Living Lab technology/solution is fully ready for implementation: all operational arrangements are made, solution is developed and users are instructed on the process. Baseline measurements are performed.
Highlights	• Identifying the most relevant implementation cases is one of the major challenges • It is important to involve users, customers and stakeholders into the "fit evaluation" process.
Execution	
Result	• Implementation case is executed and data for various purposes of the evaluation phase is collected.
Highlights	Use short development cycles and avoid a waterfall approach. Communicate clearly to manage stakeholder expectations, especially on alignment with R&D developments. Prepare for the situations that you need to encounter in Living Lab execution. Manage the Living Lab system vs. Bigger system interactions. Prepare for issues and events (risk management). Educate the users and keep them updated. Assign responsibilities for monitoring and inform the people involved on the goal of measurements.
Outcome Implementation Phase	• Living Lab implementation case is executed within the real life environment setting. Data are collected for evaluation purposes

Annex C Evaluation phase

Introduction of Living Lab Phase 3: Evaluation

The evaluation is performed in order to be able to draw conclusions on the success of the implementation case. It is performed according to the evaluation framework developed in the Planning phase design block and data collected during Implementation phase preparation and execution blocks (input output links 1.3, 2.1, 2.2 with 3.1,Figure C-1).

In general, two main steps can be applied to any framework which will differentiate according to the concrete selected evaluation method: data collection and data analysis. More detailed activities, interaction with other phases of the Living Lab as well as roles performed by different actors are illustrated in Figure 4-5. The final output of this phase is a clear understanding of main effects of the Living Lab implementation case(s).

Figure C-1 illustrates that the Living Lab owner needs to make sure that if there were any changes in ambition, scope, or external factors influencing the implementation case, these need to be well reflected in the renewed and adjusted evaluation framework (verification links 1.1, 1.2 – 3.1.1). The Living Lab owner needs to inform partners responsible for the evaluation as soon as these changes occur. The owner also needs to make sure that ambition and scope of the Living Lab process are guiding the whole data analysis process (verification link 3.2 – 1.1). Furthermore, the evaluation phase builds up on the input provided from the planning and execution phase, where the initial evaluation framework was developed in the design block and first data received from preparation and execution blocks (links 1.3, 2.1, 2.2 with 3.1.2). Results received after all analyses are performed in the data analysis block serve then as a direct input into all of the stages of the Act phase (links 3.2 and 4.1, 4.2 and 4.3).

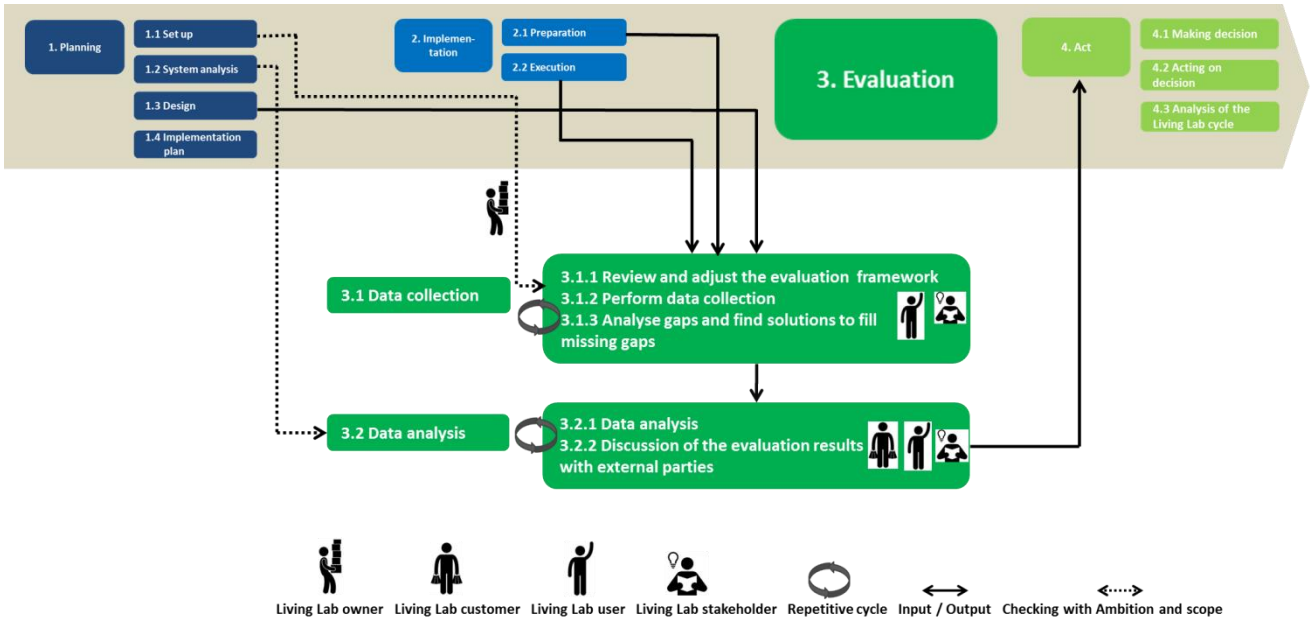


Figure C-1 Conceptual structure of the Evaluation phase

Figure C-1 indicates that there are two possible repetitive cycles within this phase. Once the analysis of gaps is performed, it is necessary to go back to the data collection process in order to fill in these gaps. If next round of data gaps analysis shows that still crucial data is missing, other data collection methods might need to be used, such as modelling or simulation (repetitive cycle between 3.1.2 and 3.1.3). Another repetitive cycle is within data analysis block. Once the first results are obtained and discussed with project participants, it is important to discuss these with and communicate these to external parties (customers, users,

stakeholders) as well. Discussion may result in the fact that additional data analysis is necessary, or simply feedback from external parties needs to be incorporated in the analysis, therefore repetition of these two activities would be necessary (repetitive cycle between 3.2.1 and 3.2.2).

Finally there is a high involvement of external parties in this phase. First, users and stakeholders are approached for the purposes of the data collection. Second, users, customers and stakeholders are involved into discussion of evaluation results.

Data collection (phase 3.1)

Data collection will be performed throughout the different stages of the Living Lab cycle. During the evaluation phase first, the evaluation framework needs to be reviewed in order to make sure it still corresponds to the ambitions and scope of the project. Next, all the data collected through the Living Lab process is reviewed and gaps analysis is performed in order to identify data missing for the evaluation purposes. Once missing data is identified either additional data collection has to be performed or the evaluation framework has to be revised again adapting to the available dataset.

Review and adjust evaluation framework

Objective: Critically review the Evaluation framework proposed in the Planning phase and adjusts to the new situation, if necessary.

Approach: Following the results of recent Living Labs (such as the Logicon project, or the KPI framework in STRAIGHTSOL) it was concluded that not all KPIs or other indicators that are developed in the design phase will in the end be useful or possible to collect. Possible causes are that data on KPIs are not available or are not at a detailed level which is useful for evaluation. Furthermore, there might be unexpected results from the solution that were not considered beforehand. If the ambition and scope of the whole Living Lab or one of its participants changed, that can also have an impact on final list of indicators to collect. In this step, it is therefore useful to critically reconsider the developed indicators list over the course of the task and readjust it when deemed necessary.

Result: List of indicators in the Living Lab evaluation framework reflects current ambitions and scope of the project as well as possibilities of data to be collected within this concrete implementation case.

Perform data collection

Objective: To make a full overview of all the data collected throughout the Living Lab process.

Approach: There are the following data collection moments during the Living Lab process:

- Planning – System analysis: data can be used for ex ante evaluation and baseline scenarios;
- Implementation – Preparation: baseline measurements are collected and can be used for comparison with “business as usual” situation;
- Implementation – Execution: data collected during the implementation of the solution/technology serves as the main source of evaluation data.

In this step data on the performance and other indicators established in the Evaluation framework and which are collected throughout all previous stages of the Living Lab is brought together and organised. Next, additional data is collected in order to have a full set of data foreseen in evaluation framework.

Result: Data collected throughout the Living Lab is organised. Additional data is collected.

Analyse gaps and fill in missing data gaps

Objective: To have as much as possible good quality data to perform evaluation according to established method.
Approach: In this step we compare if the data currently available is enough to perform the evaluation of indicators according to the developed evaluation methods. In the case data gaps were identified, additional data have to be collected.

In order to estimate the adoption rate both quantitative hard data (such as number of times solution is used) as "softer" data such as the stakeholders perspective of the implementation case needs to be collected. These are thereby also linked to the final set of indicators linked to the business model and readiness of the solution. Possible criteria that need to be considered include:

- Technical readiness of the solution;
- Innovative character of the solution;
- Easiness to use;
- Compliance to business needs;
- Robustness;
- Openness to further development;
- Opportunities and barriers for usage of the solution.

Data for the adoption and business case indicators can be collected through activities such as:

- User data directly from IT systems;
- Workshops,
- Interviews; or
- (Online) questionnaires.

If data gaps are identified, additional data collection has to be performed. In the case it is not possible to collect any additional data, simulation or modelling exercises can be performed.

Results: All data necessary to perform evaluation of the implementation case as well of the Living Lab process is collected and organised.

Data analysis (phase 3.2)

Data analysis is performed according to the framework or the method established within the Planning phase and adjusted in the previous step. This part provides general indicative steps when the specific evaluation tool/framework was not developed. Once analysis of the data is performed and results of the evaluation are available these need to be discussed with the main stakeholders, users and customers of the Living Lab. This 'external' view on the Living Lab result provides another evaluation loop for the Living Lab.

At current stage of the Living Lab focus is only on the evaluation of the implementation case(s), leaving up the evaluation of the whole Living Lab cycle for the later stage.

Data analysis

Objective: Assess the findings of the Living Lab implementation case(s) by comparing the before and after situation.

Approach: In this phase an evaluation is performed on three levels:

- Assessment of key performance indicators to evaluate the efficiency of the solution / technology compared to the Living lab goals;
- Assessment of adoption indicators to evaluate users' feedback on the solution / technology; and
- Assessment of the business model and technological maturity of the solution / technology.

The assessment of the KPIs compares the situation before the solution was in place with the situation after implementing the situation. When assessing the results, it is important to take

outside influences into account, such as unexpected market developments or weather conditions. Results therefore should always be checked and interpreted together with users. It is important to keep in mind that interpretation of some KPIs can be contradictory depending on different user. These situations need to be identified and clearly explained.

The assessment of the adoption and user perspective is qualitative in nature and could be performed with different stakeholders in a stakeholder session. Important output of such session is to see if all stakeholders have reached the desired adoption rate. If not, it is important to consider what are the main barriers for adoption and to consider if there are any activities (for instance in a new cycle) that could alleviate these barriers.

The assessment of the business model and the readiness of the solution can best be performed by structurally going through all elements of the business model using, for instance, the business model canvas or other tools proposed within a toolbox. Usability evaluation is an important part of the process as it helps to determine which changes are necessary. The challenge in this process is to evaluate users' real experiences with the solution / technology developed. As part of the assessment it can be beneficial to consider the scale up potential and the wider benefits for a commercial roll-out of the solution. The assessment should be performed at a high level, to give some idea of the readiness of the solution in the current state.

Finally in this step, results need to be synthesised and overall conclusions need to be derived. To be able to do this, a comparison should be made between results of the different types of analysis. Some methodologies can help in structuring different findings in order to derive the main conclusions. Examples are: conjoint analysis; analytic hierarchy process; value case methodology; multi criteria analysis.

All methodologies use weights to determine the importance of different aspects. The main difference between the methodologies is in how these weights are derived.

Results: Clear understanding of the main effects of the Living Lab implementation case.

Discussion of evaluation results

Objective: To inform users, stakeholders and customers about the implementation case evaluation results and discuss the results with them.

Approach: The whole idea of the Living Lab is about involving the end user in the process as much as possible in order to increase possible adoption rate of the solution/technology. Discussion of the final evaluation results with major users, stakeholders and customers is therefore one of the most crucial steps in terms of the user-involvement process. This step also provides a direct input into the next Act Phase, as well as contributes to the shape and design of the new Living Lab cycle in case that will happen. Suggestion for discussion points are:

- What are external stakeholders', users', and customers' interpretation of results?
- Do they agree with them?
- Does this correspond to the results that were expected and how do these reflect the current needs?

This external feedback on results needs to be properly reported and incorporated into the final evaluation report.

Results: External feedback on the evaluation results is collected and incorporated into the analysis.

Key messages for Evaluation (Phase 3)

Data collection	
Result	All data necessary to perform evaluation of the implementation case as well of the Living Lab process is collected and organised
Highlights	• Reconsider the plan of approach and KPIs from the design phase at the beginning of this activity • Collect both quantitative data as well as qualitative data on “soft” criteria to get a clear overview of different aspects of the living lab solution
Data analysis	
Result	• Structured overview of the results of the Living Lab solution • Users, customers, stakeholders are informed about the results of implementation and their feedback is considered in the analysis
Highlights	• Check and interpret main results together with the users to check for outside influences • Make sure enough of repetitive cycles are performed in order to have the good evaluation results
Outcome Evaluation phase	• Evaluation of the implementation case is performed

Annex D Act Phase

Introduction of Living Lab Phase 4: Act

Following the planning, implementation and evaluation of the Living Lab solution, in this phase a decision is taken on whether the outcomes of the current Living Lab cycle are successful or not and what the next steps should be. The decision can, for example, take form as following:

- Rolling out of the solution;
- Disruption of the Living Lab; or
- New cycle entry with adjustments on the tested technology / solution, or the implementation of new case.

Acting on the chosen decision is the second step which is performed within Act Phase. Finally, the evaluation of the whole Living Lab cycle takes place and conclusions are made on whether the Living Lab setting is favourable in order to address the problems, what went good and wrong during the process and what kind of recommendations or improvements can be made for the future cycles.

On the Living Lab level, the output of the implementation phase is either an entry to the new cycle of the Living Lab or full disruption of the Living Lab cycle. On the level of concrete implementation case(s), possible outcomes are: to stop the implementation case, to roll it out for wider uptake or to perform adjustments in the new Living Lab cycle. Within the Living Lab framework, this phase represents a linkage between different Living Lab cycles.

Figure D-1 illustrates the interaction of different activities performed within the Act/Decision phase with other Living Lab stages as well as involvement of external parties in this process.

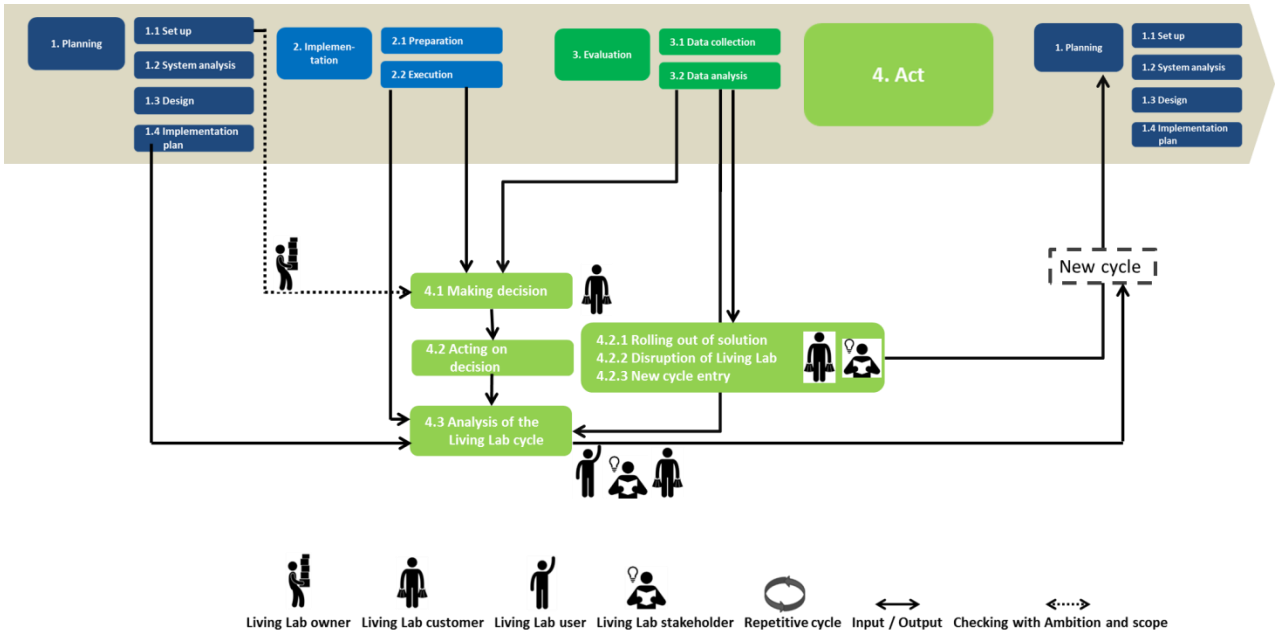


Figure D-1 Conceptual structure of the Act phase

In the first step a decision is made on what to do further with implementation case(s). This decision is made based on the results of the evaluation phase and including experiences form the execution of the Living Lab (links 2.2 and 3.2 – 4.1). Depending on the decision taken in the next steps different inputs from the evaluation and implementation phases will be used in step 4.2. The Living Lab cycle is finalised by the Living Lab cycle analysis. This is a very important step where actual results and processes are compared with the initial Living Lab ambitions, goals and plans. Therefore input into the analysis of the Living Lab cycle is provided

from all of the previous stages (specifically links 1.4, 2.2, 4.2, 3.2 – 4.3.). In its term, the results of this analysis and, specifically, the lessons learned, barriers encountered and mitigation measures performed must feed the next Living Lab cycle (links 4.2, 4.3 – 1.1a).

The Living Lab participants as well as the Living Lab owner have the most important roles in the decision making process. The Living Lab owner needs to guide the process and needs to make sure that the overall Living Lab ambition and scope are guiding the whole decision making process (verification link 1.1 – 4.1). Depending on the implementation case(s), users, customers and stakeholders also might play an important role during the decision stage and should be involved accordingly.

Making a decision (phase 4.1)

Objective: To make a decision on the follow-up steps in the Living Lab.

Approach: There is a point in the Living Lab framework where a decision needs to be taken whether the implementation achieved its results or not, and whether it can be considered as fully implemented or not. If the solution is fully implemented, it can either be successful or unsuccessful. When all goals are sufficiently met, this means that the solution / technology is ready for further roll-out or commercialisation. If the outcome is not yet completely satisfactory, a decision should be made on whether the implementation case needs to be adapted or improved, or that the solution should be discarded. Furthermore, on the level of the Living Lab, a decision needs to be taken whether participants want to start a new cycle or they want to stop the Living Lab (cycle).

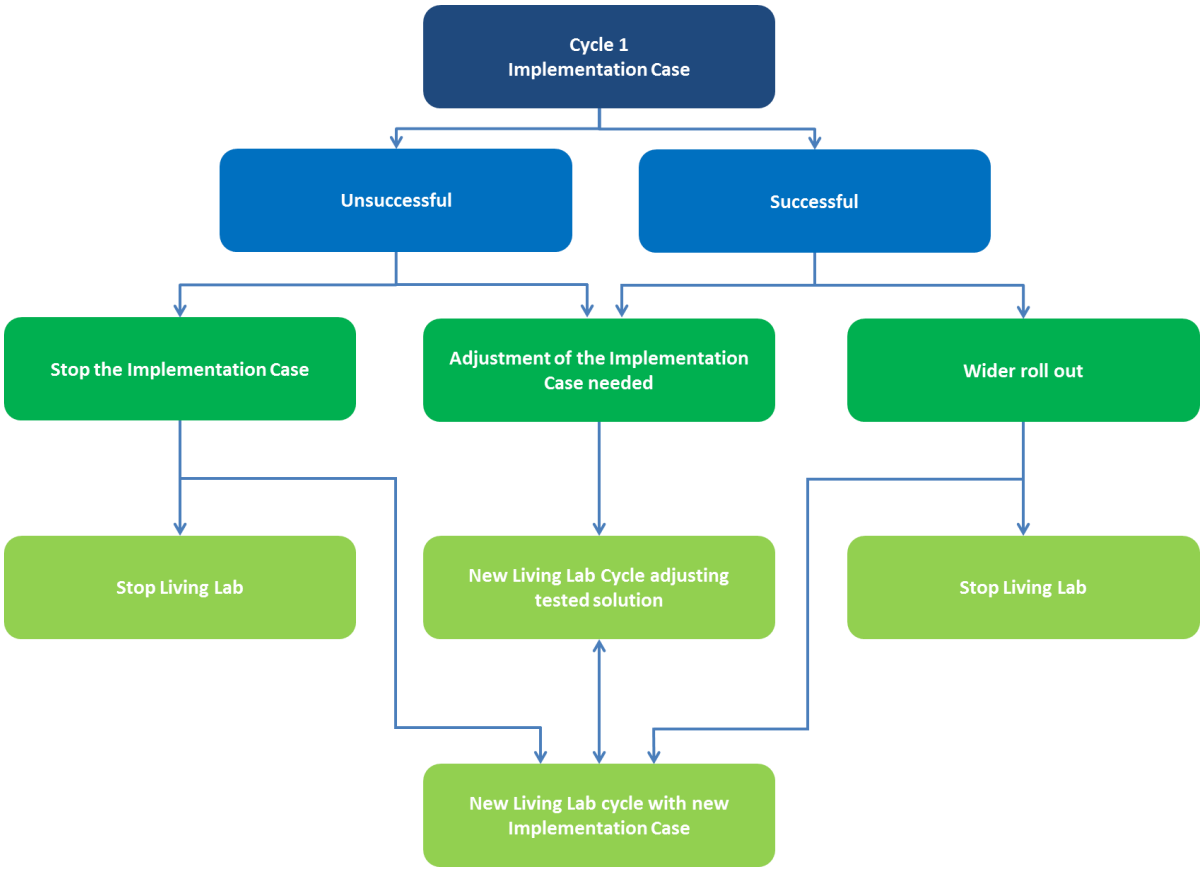


Figure D-2 Possible developments of the Living Lab cycle

Possible developments of the Living Lab cycle are schematically represented in Figure D-2. The decision-making mechanism, detailing the process, indicators and critical values should

be laid down early in the Living Lab process, specifically during the preparation of the Evaluation framework in the Design block of the Planning phase.

Summarising, during this stage decisions should be taken on continuation and the future shape of the whole Living Lab. The most common configurations of the decisions are:

- Stop current implementation case, but continue Living Lab with new implementation case;
- Stop current implementation case, stop the whole Living Lab environment;
- Wider roll out of the tested implementation case, stop the Living Lab environment;
- Wider roll out of the tested implementation case, new Living Lab cycle with new implementation case;
- Start new cycle adjusting tested implementation cases, continue Living Lab;
- Start new cycle with new implementation case, continue Living Lab;
- Start new cycle with both adjusting tested implementation case and starting test of the new solution/technology.

The decision-making process will be Living Lab specific. Important input to take into account in this process is:

- The Living Lab implementation plan from the Planning phase, with special attention to the ambition and goals;
- Results of the evaluation results;
- External parties' consultations on evaluation results.

Results: Decision on next step for the implementation case. Getting an insight in the next cycle for the living lab.

Acting on the decision (phase 4.2)

This activity block will take a different form in each Living Lab cycle as it depends on the decisions taken in the previous stage. The following major activities might need to be implemented:

1. New Living Lab cycle entry;
2. Wider roll-out of the Living Lab solution; or
3. Disruption of the Living Lab.

Please note that this block may also consist of multiple actions. If a solution is found successful, but other solutions are still to be considered in the Living Lab, both a new cycle and a roll-out plan for the current solution need to be developed in parallel. In this case a wider roll out plan for the current implementation case can be outsourced to another project.

New Living Lab cycle entry

Objective: Perform transfer from one Living Lab cycle to another. Shape the new Living Lab cycle.

Approach: A new Living Lab cycle can either focus on adjustment of the previously tested solution or may start up with new solutions to be implemented.

Before entering a new cycle, some preparatory actions may be appropriate. First, the most important outcomes of the current Living Lab cycle need to be reported as part of a CITYLAB WP deliverable. In case of disruption of the Living Lab solution of the previous cycle, the report should mention the main reason for the disruption and explain the underlying factors that made the implementation case unsuccessful.

Second, an adjustment plan should be made specifying what parts of the Living Lab implementation case need to be reviewed and adjusted in the next cycle, based on the results of the evaluation. Important factors to consider are for instance:

- Internal and external barriers for the Living lab;
- Internal and external factors of success for the Living Lab; and
- Involvement of external parties and cooperation.

It is important to go through each of the steps and see whether adjustments are needed, for example:

- Adjustment of scope or ambition of the Living Lab (for instance to make it more appropriate or acceptable for stakeholders);
- Adjustment of stakeholder groups (adding new stakeholders or adjusting the role of certain stakeholders);
- Adding new risks or outside events that need be taken into account in the next Living Lab cycle

When implementing new solutions, actions to be taken depend on what stage the new solution was developed. If it is a completely new idea coming out of the evaluation, repetition of all steps in the design phase might be necessary. If the idea was already developed in the Design phase, it will be sufficient to just update work performed in this stage.

Results: The shape of the new Living Lab cycle is defined. Transfer mechanisms from one Living Lab cycle to another are described.

Wider rolling out of the Living Lab solution

Objective: To prepare the wider rolling out of the Living Lab solution outside of the Living Lab setting.

Approach: Once the preliminary decision on the potential rolling out or commercialisation of the solution / technology has been taken, some preparatory work for the rolling out of the solution needs to be performed.

The main results of the Living Lab need to be reported as part of the CITYLAB WP report. As part of the report a roll-out plan may be needed, containing the following elements:

- Functionalities of the solution;
- Scope (market segments, geographic areas);
- 'Owner' of the solution and involvement of the different stakeholders;
- Assessment of the wider impact of the solution (impact assessment and scaling up);
- Business model, including the revenue framework (i.e. manufacture model, licensing model) and cost structure;
- Options for marketing and wider dissemination; and
- Time planning.

Stakeholders should be involved in the setting up of the wider roll-out.

After the decision has been taken on the wider rolling out of the implementation case, the Living Lab participants can either take a decision on full disruption of the Living Lab, or start a new cycle of the Living Lab with another implementation case.

Results: Report containing all necessary information for the wider roll out or commercialisation of the solution.

Disruption of the Living Lab

Objective: To perform all actions necessary to stop the Living Lab and finalise the reporting on the implementation case(s).

Approach: When deciding to end the Living Lab cycle, some actions should be taken to wrap up the Living Lab.

First, interaction should be organised with the users, stakeholders and customers involved in order to get a clear picture why a decision of disruption was taken (e.g. Living Lab set up is not beneficial to achieve the goals of the project wants to reach; implementation case was

unsuccessful and there are no more cases to try out). A workshop can act as a closing session for the Living Lab and should thus consider the lessons learned of the Living Lab as a whole. Furthermore it should be considered if continuation of some aspects of the Living Lab could be beneficial, such as, for example, stakeholder gatherings after the disruption of Living Lab or addressing the same goals but within other approach (e.g. traditional demonstrator).

Second, the main results of the Living Lab need to be properly reported. The report should present the main overview of:

- Process followed over the duration of the Living Lab;
  - Number of cycles involved;
  - Main changes made between the cycles as well as within the cycles;
- Main results of the Living Lab
  - Impact on goals
  - Maturity of the solution(s) that was introduced
- Reasons for disruption of the Living Lab and underlying factors for it.
- Lessons learned from the implementation case and Living Lab set up.

Results: Living Lab is discarded. Report on main lessons learned of the Living Lab.

Analysis of the Living Lab cycle process (phase 4.3)

Objective: Evaluate the Living Lab cycle.

Approach: An analysis of the Living Lab cycle is an important step within the Living Lab approach. The analysis should build up on all the steps performed before. If all necessary input is collected during the evaluation phase and supplemented with experiences received in previous Act phase steps (making decision process and acting on it), this activity could be performed in the form of an one day workshop. It is important to understand what went good and wrong during the Living Lab cycle and, most important “why”? What were the actions that were taken by Living Lab participants in order to resolve any conflict or bottleneck situation? Were external parties satisfied with the level of their involvement in the Living Lab cycle and, with its results?

It is essential that lessons learnt from one cycle are incorporated into the new cycle. For this reason, results of the Living Lab cycle analysis are to be incorporated into the reports that establish transfer mechanisms for the new cycle.

Results: Main lessons learned from the Living Lab process.

Key messages for Act (Phase 4)

Making decision	
Result	• Decision on the Living Lab continuation; • Decision on the solution/ technology mainstreaming/ adjustment/disruption; • Decision on the shape of the new Living Lab cycle.
Highlights	Living Lab owner needs to make sure decisions taken include the effect on initial (or evolved) living lab ambitions, goals and objectives. It is important to involve important external stakeholders in the decision making process and inform all external parties on the decision taken.
Acting on decision	
Result	• Depending on the previously taken decision: • Roll out of implementation case • Starting up of the new Living Lab cycle (with adjustment of implementation case or completely new idea) • Disruption of implementation case • Disruption of the Living Lab
Highlights	• Rolling out of the case might be performed within a setting of another commercial project. • For any decision taken it is important to document the lessons learned, providing valuable inputs for the future Living Lab experiences.
Analysis of the Living Lab cycle process	
Result	The main lessons learned from the Living Lab process, based on periodical input by all involved partners.
Highlights	Evaluate the living lab process on a periodical basis in order to get good insight throughout the cycle. Inform all necessary external parties on lessons learned from the Living Lab cycle.
Outcome of the Act/Decision phase	Living Lab continues with the new cycle (new implementation case of adjusting previous case) Living Lab is disrupted Solution is taken up in another project to commercialise Living Lab cycle is analysed

Annex E Overview of Living Lab support tools

Phase	Living Lab steps	Method	Description	Possible application
Plan	Set up	Cultural Probes	The method cultural probe is a design-led approach to understanding users that stressed empathy and engagement. Using this method, people are given a package of things inspiring them to collect a diverse set of data about their lives. In these packages maps, postcards, disposable cameras, photo albums and media diary can be included.	Workshops: First assignment in stakeholder meeting to get to know each other on a more personal level. Kick off, initialisation of the project
Plan	Set up	Dialog cafe	Create a common dialog to exchange experiences and knowledge, to highlight the common knowledge and to enrich the fellowship. This process is carried out in small conversation groups around round tables exploring a question or a specific theme.	Workshops: idea exchanger. Ambition, Scope, Stakeholder definition, System analysis
Plan	Set up Design	Focus-Group Interviews	Qualitative group interview by a discussion leader	Workshops/ stakeholder meetings: Possibly good to get first shared reactions on opinions and attitudes towards problems or possible solutions Ambition, Scope, Stakeholder definition, System analysis Definition of implementation cases, design pre-selected cases, development evaluation methodology
Plan	Set up Design	Future Search	The process of future search is to, in different groups, explore history, present and to design a desirable future. It is an open process where all participants are in the same room and all documentation is put up on the walls.	Workshops: Suitable as a step to find a common vision and actions for the future. Good step in beginning of the process or after one living lab iteration Ambition, Scope, Stakeholder definition Definition implementation cases
Plan	Design	Open Space Technology	The open space means to take away hinders in order to facilitate engaged persons to take responsibility for matters they are concerned with. This method is especially suitable when the issue being discussed is complicated and nobody knows the answer. Groups are formed in relation to interest areas and each group report, prioritise, and plan for how they should continue their work.	Brainstorming technique when looking for solutions. Definition of implementation cases

Phase	Living Lab steps	Method	Description	Possible application
Plan	Set-up System analysis Design	Story-Telling	Story-telling is a method to encourage users to tell rich stories with the purpose of identifying their needs, or underlying rationale, relevant in a particular situation. Focusing on telling stories instead of answering specific questions about needs and requirements encourage users to talk about, and discuss, their situation and dreams independent of any technical solution or artefact.	Method to get to know ideas and underlying thoughts of different stakeholders Ambition, Scope Stakeholder analysis, system analysis Definition of implementation cases, design pre-selected cases
Plan Implementation	System analysis Design	Why-Why-Why	Ask a number of “why” questions and by that means build a chain of relations backwards from the original formulation. These chains give many ideas to visions dependent on where in the chain you enter and on what values you bring in.	Method to get a thorough understanding on the problems and underlying mechanisms Stakeholder analysis, System analysis, Risks and mitigation measures Definition of implementation cases
Plan	System analysis Design	Zaltman metaphor Elicitation Technique(ZMET)	Method for getting beyond surface thinking and ‘down’ to the underlying thought patterns that reveal how people really feel about product relevant categories. Approximately one week before the interview (or series of interviews), participants are asked to find pictures that express how they feel about the topic at hand. These pictures are visual metaphors that introduce topics that the interviewer then tries to dig deeper into. As such the pictures serve as initial probes, which the interviewer investigates further by use of verbal follow up probes.	Icebreaker. Possibly a good method during opening round in a workshop Stakeholder analysis, system analysis, rick analysis Definition of implementation cases, design pre-selected cases
Plan	System analysis Design	Bodystorming	Role playing session for a specific situation. the scenario the design team is able to gain deep understanding of a situation and to act from different predetermined roles in the specific situation	Similar to gaming, stakeholders ca n gain a deeper understanding of the different roles and behaviours under certain conditions Stakeholder analysis
Plan	Set-up System analysis Design	Brainstorming	Generate and systematise a vast amount of ideas based on a given question or problem, in a quick manner. This method consist of three steps (1) to gather a group of people, (2) to generate ideas without critique or analyse, and finally (3) to systematise the results to make it available for future usage	Idea generation and exchange Ambition, Scope, Stakeholder definition Legal and ethical issues, system analysis, risks and mitigation measures Definition of implementation cases
Plan Implementation	Design/	Experience prototyping	Experience prototyping is a method that focuses on how a task or a situation is experienced with the main purpose to gain understanding of users and their experiences in a real world context and to evaluate and communicate design ideas.	Part of gaming, stakeholders ca n gain a deeper understanding of the different roles and behaviours under certain conditions Definition of implementation cases, Design of preselected cases

Phase	Living Lab steps	Method	Description	Possible application
Plan	Design	Idea Generating Questions	Asking questions to stimulate curiosity and creativity has proven helpful for all kinds of endeavours, whether problem solving, product development, inventing, or communication. what-iffing involves describing an imagined action or solution and then examining the probable associated facts, consequences, or events	Idea generation Definition of implementation cases, design pre-selected cases
Plan	Design	Triple helix workshops	To find opportunities and generate ideas for innovations it is important to bring together people from all type of potential partners; researchers, industry and government.	Definition of implementation cases, design pre-selected cases
Plan	System analysis	Actor relation model	To identify the interaction and relations between the different actors in the system Result is an actor-relation model with a visual and descriptive part. The visual component is a schematic that expresses the actors and main activities in the logistics chain. The descriptive part is a document that provides additional information about the activities and actors included in the schematic.	Stakeholder analysis System analysis
Plan	System analysis	Force-field analysis	Force-field analysis provides a framework for looking at the factors (forces) that influence a situation, originally social situations. It looks at forces that are either driving movement toward a goal (helping forces) or blocking movement toward a goal (hindering forces)	Stakeholder analysis System analysis
Plan	System analysis	Accountability in data chains	Based on technical and organisational aspects, the origins and the quality of data can be traced, thereby realising accountability for reasons of reliability of data and privacy protection. Enabling the tracing of outcomes of data analysis according to multiple aspects: process, ownership, dataset and algorithm.	
Plan	System analysis	Value Network Modelling	Businesses deliver to other business and end users, they are supplied and serviced by other business, whereas governmental and domain institutions set boundaries with respect to running the business. Businesses have a position in various networks. Value Network modelling is a methodology related to social network analysis to analyse the relations via which a business interacts with its context.	Stakeholder analysis System analysis

Phase	Living Lab steps	Method	Description	Possible application
Plan Evaluation	Design Evaluation	Business, market and competitive analysis	In order to develop new business models to deliver and capture value a deep understanding of the current business, its market context including competitive forces is key. We have experience in utilising various business analytical concepts.	Impact on business models
Plan	Design	Innovation by Boundary Shifting	To form, or enrich, an operative image of a future solution, a movement outside the problem delimitations can be required (Löwgren and Stolterman 2004). This method consists of four stages: 1.Identify the necessary functions that a system must have to fulfil the desirable objective. 2.Identify conflicts between the current way to bring about the necessary functions within the suggested problem delimitations. 3.Identify resources outside the suggested problem delimitations that could be used to transform the problem. 4.Search for functioning sub-solutions to the problem that could make it possible to use the new resources.	Implementing design of implementation case Design of preselected cases
Plan	Design	Story-Boards	a series of drawings showing how a certain example of a use situation takes place in the mock-up. To create an increased engagement and commitment it is important that the readers can identify themselves with the situation being described.	Concept design Design of preselected cases
Plan	Design	Functional analysis	The thought with the functional analysis is to express what the future system should do (functions) but not how. The functions are usually expressed with two words; a noun and a subjective. If a function is absolutely crucial for the system to be able to fulfil its central purpose it is classified as necessary.	Design and implement ideas Definition of implementation cases, design pre-selected cases
Plan	Design	Mock-Ups	A user interface mock-up is a drawing of how the future systems user interface is meant to be designed. When you do a mock-up you are forced to handle more detailed questions about interaction techniques and graphic form compared to using scenarios.	Use to get a common vision on interphase and functionality Design of preselected cases
Plan	Design	Rapid prototyping	The development of a simulation or prototype of the future system can be very helpful, allowing users to visualise the system and provide feedback on it. Thus, it can be used to clarify user requirements options.	Software design Design of preselected cases

Phase	Living Lab steps	Method	Description	Possible application
Evaluation	Evaluation	Analytical Evaluation	In analytical evaluation two categories of evaluation methods are considered; inspections including heuristic evaluation and walkthroughs, and theoretically based models which are used to predict users' performance. In heuristic evaluations, knowledge about a typical user is applied, guided by guidelines and standards to identify usability problems. Walkthrough involve experts in walking through the application with a scenario at hand.	Ex ante/ ex post evaluation
Evaluation	Evaluation	Conjoint Method	Conjoint analysis is a quantitative method for assessing the strength of people's preference for certain product attributes and/or attribute combinations. It is generally thought of as a high level, late stage investigation used to forecast consumer reactions to various product versions.	Evaluation method to take qualitative results in account Ex ante evaluation of adoption indicators
Plan Evaluation	Design Evaluation	Predictive Models	Here experts are involved by using formulas to derive various measures of user performance. Predictive modelling techniques provide estimates of the efficiency of different systems for various kinds of tasks	Ex ante/ ex post evaluation Definition of implementation cases, Design of preselected cases
Evaluation	Evaluation	Usability testing	The aim is to test if the product is usable by the intended user population to achieve the task for which it was designed. In this approach, the key components are the user test and the user satisfaction questionnaire.	Technological maturity, KPIs, impact on business models, adoption indicators
Evaluation	Evaluation	Walkthrough methods	One way to predict users' problems without doing user testing is to do walkthroughs. These involve walking through a task with the system and noting problematic usability features.	Ex ante evaluation
Evaluation	Evaluation	Discovery Methods	Discovery methods can be used to find out needs or problems that customers are not fully aware of. Methods include following users or evaluating user data.	User evaluation Adoption indicators, KPIs
Evaluation	Evaluation	Tracking Methods	Tracking methods can be used to track consumption and performance (Best, 2005). Tools such as customer surveys, customer panels, and scanner data can be used to track product awareness, intention to purchase, and ratings of performance relative to competing products	User evaluation KPIs, adoption indicators, technological maturity, impact on business models
Evaluation	Evaluation	Cost Benefit Analysis	A cost and benefit model can be used to analyse decisions from a broader perspective, including societal, environmental or strategic issues.	Impact on business models, KPIs

Phase	Living Lab steps	Method	Description	Possible application
Evaluation	Evaluation	Multi Criteria Analysis	MCA describes any structured approach used to determine overall preferences among alternative options, where the options accomplish several objectives. In MCA, desirable objectives are specified and corresponding attributes or indicators are identified. The actual measurement of indicators need not be in monetary terms, but are often based on the quantitative analysis (through scoring, ranking and weighting) of a wide range of qualitative impact categories and criteria.	Impact on business models, KPI

[1] Source: adapted from http://www.lltoolbox.eu/methods-and-tools/all-methods