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SmarterLabs

Improving Anticipation and Social Inclusion in Living Labs for Smart City Governance

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Summary

The “Smart City Living Lab” is an emerging approach in European cities. It brings together citizens, policymakers, businesses, and researchers to test smart, ICT-based solutions to urban problems in real-life contexts. However, solutions that “work” in the particular reality of a Living Lab may not be adopted at a large scale. Urban infrastructure is interwoven with the daily lives of citizens and therefore difficult to change, and large groups may not even have access to ICT-based solutions. In this framework, the SmarterLabs project develops a novel approach that anticipate major risks of a smart technology innovation (resistance to change, exclusion of social groups) and performs action research in Living Lab activities in four cities: Bellinzona, Brussels, Graz and Maastricht. By explicitly addressing anticipated barriers and incorporating groups at risk of exclusion in the Living Lab experiment, the chances of successful uptake of the end result are enhanced. For all European cities with Smart City initiatives, the project delivers generic implementation guidelines for Smart City Living Labs on how to address barriers to upscaling that may stem from resistance to large-scale change in socio-technical systems and from people being excluded (in direct or indirect way). By giving special attention to anticipation of possible resistance and social exclusion in the form of Living Labs, the results of Smart City initiatives (now and in the future) are expected to become better scalable and more robust in terms of value creation for a wide range of stakeholders.

Zusammenfassung

Die "Smart City Living Lab" Methodik ist ein aufstrebender Ansatz in europäischen Städten. Es bringt Bürger, Entscheidungsträger, Unternehmen und Wissenschaftler zusammen, um intelligente, IKT-gestützte Lösungen für städtische Probleme in realen Kontexten zu testen. Lösungen, die innerhalb eines Living Labs "funktionieren", werden jedoch möglicherweise nicht auf großer Skala übernommen. Die urbane Infrastruktur ist mit dem täglichen Leben der Bürger eng vernetzt und daher schwer zu ändern. Ferner haben große Bürgergruppen möglicherweise nicht einmal Zugang zu IKT-basierten Lösungen. Innerhalb dieser Rahmenbedingung erforscht das SmarterLabs-Projekt einen neuen Ansatz, um die mit intelligenter Technologieinnovation verbundenen Risiken (Widerstand gegen Veränderungsprozessen, Ausschluss sozialer Gruppen) vorherzusehen und durch projektbegleitender Studien (Action Research) im Rahmen eines „Living Lab“-Konzepts in vier Städten in Angriff zu nehmen: Bellinzona, Brüssel, Graz und Maastricht. Durch die im Living Lab-Experiment explizite Thematisierung der zu erwartenden Barrieren einerseits, und die Einbeziehung von vor sozialer Ausgrenzung bedrohter Gruppen andererseits, erhöhen sich die Chancen erfolgreiche Ergebnisse zu erzielen. Das Projekt liefert an all die europäischen Städte die an Smart-City-Initiativen interessiert sind, allgemeine Leitlinien für die Umsetzung von Smart City Living Labs und befasst sich vor allem mit Upscaling Hindernissen die sich durch den Widerstand gegen große Veränderungsprozesse in Sozio-technischen Systemen ergeben können, wie auch durch die Exklusion bestimmter gesellschaftlicher Gruppen (direkt oder indirekt).
Besondere Aufmerksamkeit wird der frühzeitigen Problemerkennung gewidmet, die durch mögliche Umwandlungen und soziale Ausgrenzung entstehen können, und durch Living Labs getestet. Somit erwartet man das die Ergebnisse von gegenwärtigen und zukünftigen Smart-City-Initiativen, Dank der Schaffung von neuen Werten in Bezug auf verschiedene Anspruchsgruppen, robuster und besser skalierbar werden.

Résumé

Le «Smart City Living Lab» est une approche émergente dans les villes européennes. Il rassemble des citoyens, des décideurs, des entreprises et des chercheurs pour tester des solutions intelligentes, basées sur les TIC, à des problèmes urbains dans des contextes réels. Cependant, les solutions qui «fonctionnent» dans la réalité particulière d'un laboratoire vivant ne peuvent pas être adoptées à grande échelle. Les infrastructures urbaines sont intimement liées à la vie quotidienne des citoyens et sont donc difficiles à modifier. De grands groupes peuvent même ne pas avoir accès à des solutions basées sur les TIC. Dans ce cadre, le projet SmarterLabs développe une nouvelle approche qui anticipe les risques majeurs d'une innovation technologique intelligente (résistance au changement, exclusion des groupes sociaux) et effectue des recherches-actions sur les activités du Living Lab dans quatre villes: Bellinzona, Bruxelles, Graz et Maastricht. En se référant explicitement aux obstacles anticipés et en incorporant des groupes à risque d'exclusion dans l'expérience Living Lab, les chances d'aboutir à la réussite du résultat final sont améliorées. Pour toutes les villes européennes ayant lancé des initiatives Smart City, le projet fournit des lignes directrices de mise en œuvre génériques pour Smart City Living Labs sur la manière de surmonter les obstacles aux changement de dimension pouvant découler de la résistance aux changements à grande échelle des systèmes sociotechniques et des personnes exclues (directement ou indirectement). En accordant une attention particulière à l'anticipation d'éventuelles résistances et exclusions sociales sous la forme de Living Lab, les résultats des initiatives Smart City (actuelles et futures) devraient devenir plus évolutifs et plus robustes en termes de création de valeur pour une large gamme des parties prenantes.

Contents

List of abbreviations

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1 Introduction

This report presents activities developed in the SmarterLabs ERA-NET project, that involved collaboration between academic research groups, policy-makers, public administrations, and non-governmental associations (NGOs) from four European countries (Switzerland, Austria, Belgium, and The Netherlands). The project developed action research activities in four cities in such countries (Bellinzona – CH, Graz – AT, Brussels – BE, and Maastricht – NL), and strongly built on the interactions between all the actors involved in such processes.

In this Report we specifically focus on activities developed by the Swiss partners of the SmarterLabs consortium (the University of Applied Sciences and Arts of Southern Switzerland SUPSI, the City of Bellinzona, and the NGO Provelo Ticino). However, most of the project dealt with interaction between the project partners (researchers, policy-makers, public administrations, NGOs) and cross-comparison of the activities each of them developed, and the project outcome is the result of a highly collaborative process. Therefore, when necessary and useful, in this report we will also refer to activities developed by the SmarterLabs partners in other countries.

2 Background and project goals

To address climate change, many European cities explore new opportunities to lower their carbon footprint [Castan et al, 2013]. An important avenue is the 'smart city', where widespread implementation of 'smart', often ICT-supported energy and transport technologies results in improved energy and resource efficiency. The current view is that efficient and successful implementation of these technologies requires 'smart governance': the inclusion of not only industry, researchers and urban decision makers in the innovation process, but also citizens with their needs, priorities, preferences and experiences. Useful elements appear to be experimentation and attention to contextual conditions, both as opportunities and possible sources of resistance to change. A promising approach is the 'Smart City Living Lab' (SCLL), a forum to integrate these actors in exploring and testing new solutions in real-life contexts. The claim is that, for innovations produced by Smart City Living Labs, nobody will have to ask "But will it work in reality?", because" it is already taking place in reality". However, in case of smart city technologies for energy and transport, there are two important reasons why a technology that 'works' in the reality of a Living Lab, may not be adopted at a large scale (upscaling) or may even produce unwanted effects.

First, energy and transport networks are not only an omnipresent part of the physical urban infrastructure, but also pervasively interwoven with the social fabric of the city and used by all citizens in their daily lives. In other words, energy and transport networks are complex socio-technical systems and part of a larger and even more complex socio-technical system: the city in its regional context.

The interaction of the social and technical dimension often make urban infrastructure quite resistant to change, and requires specific attention when new technologies are to be introduced [Hommels 2005]. The current approach of Living Labs to technologies, however, is focused on small-scale performance tests and technology-user interactions, largely ignoring the larger social-institutional context [Karvonen & van Heur, 2014]. In case of smart energy and mobility technologies, successful implementation in the reality of a Living Lab would therefore not be a warrant for the large-scale adoption required to reach their full effect in resource efficiency.

Another problematic characteristic of the current Living Lab approach to smart urban technologies is its focus on 'smart citizens' as users and partners. The point is that the 'smart city' not only offers 'smart services' for its citizens as consumers, but also requires the active participation of its citizens as co-producers of these smart services, because the services make use of the information provided by the smart devices of their users. 'Smart citizens' are those with both the cognitive and material resources to consume and co-produce the smart services of the smart city. Citizens lacking these resources will normally not be included as users and co-creators in Living Labs, nor are they likely to be able to make use of the smart services once these are implemented on a larger-scale [Dutilleul et al., 2010]. The consequence is not only limited adoption and use of these smart technologies, but also social inequality and exclusion [Evans & Karvonen, 2013].

Both aspects constitute major risks to the successful implementation of smart energy and transport technologies, which could result in time delays, increased costs, ineffective implementation or even cancelling of the innovation altogether.

2.1 Project goals

The SmarterLabs project aimed at developing a Living Lab approach to effectively deal with two major risks to the successful, widespread implementation of smart mobility technologies. We summarized these two risks as:

- exclusion of social groups not matching the required 'smart citizen' profile;

- barriers to large-scale adoption and change of socio-technical transport systems (upscaling).

To explore these risks, SmarterLabs focused on four European cities: Bellinzona (CH), Brussels (BE), Graz (AT), and Maastricht (NL). In all four cities, implementation projects of smart mobility solutions were already planned, which offered good opportunities for Living Lab experiments. To identify common constraints precluding social inclusion and effective upscaling, a retrospective analysis of urban governance processes was first performed, followed by action research [Whyte, 1991] in Living Lab experiments, aimed at testing and refining ways to address those constraints.

The main feature of this novel approach was to anticipate major risks of a smart technology innovation (barriers precluding effective upscaling and exclusion of social groups). By explicitly addressing anticipated barriers and incorporating groups at risk of exclusion in the Living Lab experiments, the chances of successful large-scale uptake of the end results were expected to be enhanced.

More specifically, the project's ambition was to further develop the participatory governance approach of smart city Living Labs, to enhance widespread and successful uptake of smart innovations. Therefore, the project outcome was designed in order to be useful for both the involved cities and also other cities engaged in smart city initiatives: in fact, the final aim of the SmarterLabs project was to deliver generic implementation guidelines for smart city Living Labs on how to address barriers to upscaling that may stem from resistance to large-scale change in socio-technical systems and from people being excluded (in direct or indirect way). Such implementation guidelines were developed as both a policy brief (governance instrument, see Section 7.3) and also as a practitioner brief, thus providing any interested actor (researcher, business, citizen, or any other stakeholder) that considers organizing a Living Lab, with food for thought on both the reasons for activating a 'smarter' Living Lab and also on how to successfully implementing it (see Section 7.4).

3 Approach and methodology

The overall design of the SmarterLabs Living Lab experiments is based on principles of 'transition experiments' [Hoogma et al., 2002]. In contrast to traditional innovation experiments aimed at testing and demonstration, transition experiments focus on broad stakeholder involvement, co-creation, and strategic learning to achieve systemic change [Kemp & van den Bosch 2006; van den Bosch, 2010].

The SmarterLabs project involved a combination of applied and strategic research. The emphasis was on applied research, and the focus was on generating knowledge to enhance the effectiveness of Living Labs. Applied research was in fact conducted through

- retrospective analysis of urban mobility governance in Bellinzona, Brussels, Graz and Maastricht,
- and action research in Living Lab experiments in these four cities.

The combination of in-depth retrospective analysis of post-implementation projects and action research in implementation projects in four different cities, and the cross-comparison of activities, constraints outcomes, allowed to generate strategic knowledge and understanding about the potential of Living Labs as governance approaches to effectively address social inclusion and favour upscaling of urban innovation.

The whole methodology followed in the SmarterLabs project is summarized in Figure 1. We first performed a literature research (WP2) and developed a retrospective analysis on mobility and land planning processes in the four cities participating in the SmarterLabs project (WP3). We referred to upscaling as the emergence and expansion of an innovative practice (i.e. new way of doing something) in the particular urban area. We referred to social exclusion as a multidimensional, multi-layered and dynamic understanding of deprivation that people may suffer because of new urban practices. Note that social exclusion is a key constraint affecting upscaling itself. For the sake of simplicity, we keep them separate here. However, in our understanding, addressing constraints on social inclusion is a pre-condition to effective upscaling.

In WP2 a literature review was conducted around smart city Living Lab experiences as well as socio-technical barriers and issues of social exclusion encountered in large-scale implementation of smart city technologies, with a focus on smart urban technologies for transport and mobility. This literature review was aimed at informing the development of the methodological framework and specific research questions for the retrospective analysis of urban mobility governance and for the action research in Living Lab experiments in implementation projects in smart urban mobility in the four cities.

The retrospective analysis of urban mobility governance (WP3) addressed past projects and interventions in the four cities, and then a comparative analysis was developed, to identify common and recurrent constraints affecting social inclusion and upscaling. Insights that became available from the retrospective analysis were then used to guide the action research in each city, in each Living Lab (WP4). Activities in WP2 and WP3 allowed in fact to identify a number of critical recurrent constraints affecting social inclusion and upscaling of urban experiments (see Table 1). Then, the most appropriate constraints were identified in each SmarterLabs partner city, and the "smarter" Living Lab processes were explicitly designed and managed in order to address and anticipate them (WP4).

Constraints on social inclusion		Constraints on upscaling	
Exclusion from the Living Lab	Exclusion in the Living Lab	Related to Living Lab design	Related to Living Lab context
1. Citizen's lack of financial, intellectual and human resources 2. Mismatching goals between the citizens and the Lab 3. Overlooking people outside lab context	4. Reproducing existing power structures inside the Lab	5. Limited learning 6. Wait-and-see attitude 7. Poor timing	8. Low stakeholder receptiveness 9. Low institutional receptiveness 10. High institutional fragmentation 11. Sticky urban assemblage 12. Neglecting effects outside project locality

Table 1: Constraints precluding social inclusion and upscaling, as they were identified at the end of WP3 activities.

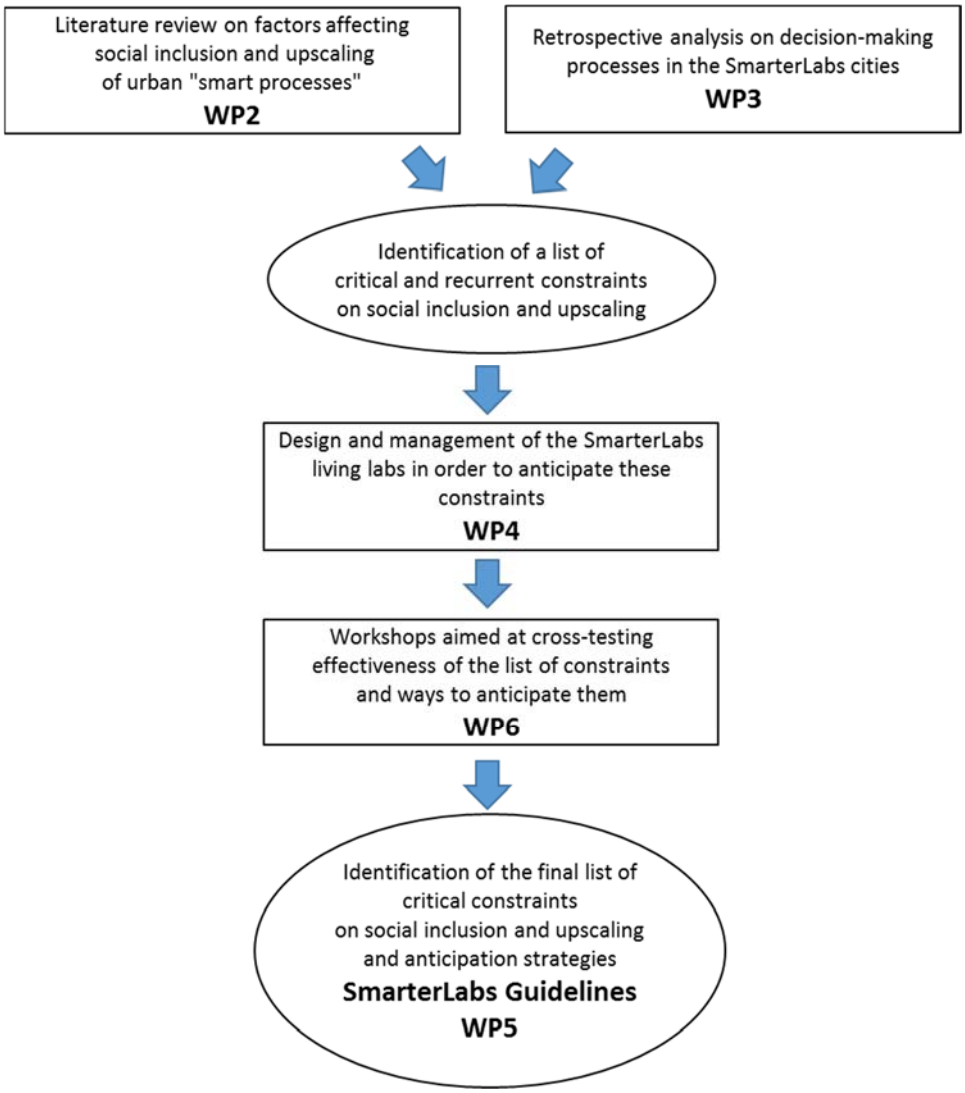

Figure 1: Steps of the methodology followed to develop the SmarterLabs guidelines.

As long as action research was developing in the Living Labs, and insights on effectiveness of the anticipating strategies were gained, a number of those constraints were more sharply formulated, new ones emerged, and a few ones were discarded, being acknowledged as strictly dependent consequences of already indicated elements.

Evaluation of the effectiveness of the anticipating strategies aimed at avoiding social exclusion and favouring upscaling was at first performed by the managers of each Living Lab process, within structured evaluation processes, that also included the relevant actors engaged at the local level. Then, findings from each Living Lab were compared (cross-analysis), and successful strategies across different contexts were identified; similarly, strategies failing to achieve their intended outcome were identified as well, and possible reasons behind their failure were identified. The focus in this step was on a comparative evaluation of the four cases, to identify common and recurring risks to implementation of smart mobility solutions and effective ways of addressing these risks in a smart governance approach.

Finally, insights from such cross-comparisons were brought to discussion also outside the SmarterLabs research team: to enhance the transferability and applicability of the guidelines and thus stimulate their successful implementation elsewhere, three dissemination workshops were organized in three European cities, targeting practitioners, representatives of the public administration and universities as well (WP6). These workshops were organized in Helsinki (FL), Istanbul (TK), and Santander (ES), and allowed to:

- better focus and refine insights from the Living Lab activities, as long as they were developing over time;
- discuss the context-dependency and transferability to other contexts of the identified ways to anticipate critical constraints on social inclusion and upscaling.

Therefore, through these workshops the results of Living Lab experiments in terms of implementation guidelines were tested in different city contexts and refined, based on the advice of stakeholders. At the end of these activities, the final set of constraints affecting effective implementation of urban Living Lab processes in the context of smart governance and smart citizens was identified, together with a corresponding set of successful anticipation strategies.

4 Literature review

A twofold literature review was performed by researchers involved in the SmarterLabs project: on the one hand, the review aimed at better clarifying key concepts and buzzwords around smart city and Living Lab processes, as well as identifying already known and investigated constraints affecting social inclusion and upscaling of Living Lab outcomes. Such concepts and buzzwords were first identified in a collaborative process involving all the project research groups; then, each group focused on a subset of concepts and buzzword, explored them in details, and reported them to the other groups through periodic in-person and online discussions and exchange of written documents.

On the other hand, additional literature review aimed at identifying specific constraints precluding effective outcomes of the four Living Labs activated in each city. To this purpose, each research group only focused on the topics that were relevant for the specific topic of the 'smarter' Living Lab held in their city. Therefore, in this Chapter we provide an overview of the elements arising from the general review of concepts and buzzwords, while specific elements characterizing single Living Labs are reported in Chapter 0, which deals with action research in the Living Labs.

Since most of the key concepts and buzzwords analysed within the literature review were of general guidance for project activities as a whole, and set a shared theoretical framework for the specific activities that were run in each country in each Living Lab, as well as for the following cross-analyses, in this report we also include literature review material that was not directly developed by the Swiss research team. In particular, here we present a selection of materials regarding the following concepts, which were strategical for the whole SmarterLabs project:

- 'smart and smartness' – developed by SUPSI;
- 'smart mobility and urban systems' – developed by SUPSI;
- 'participatory planning and governance' – developed by the University of Graz;
- 'social exclusion and inclusion' – developed by the University of Maastricht;
- 'upscaling' – developed by the University of Maastricht;
- 'co-creation and Living Labs' – developed by Vrije Universiteit Brussels.

We conclude this chapter by summarizing findings about the need for 'smarter' Living Labs, at the light of the above literature review. The full outcome of literature review is available at the SmarterLabs project website, within Deliverable D2.1 (https://smarterlabs.uni-graz.at/en/publications-results, last accessed online on March, 11 2019).

4.1 Smart cities (SUPSI)

The concept of "Smart city" was first introduced in the late 1990s, initially limited to the diffusion of modern information and communication technology (ICT) infrastructures within cities. The rise of such a concept is usually related to the unprecedented growth in urban population worldwide and the fast increase in the size of urban agglomerations and related high urbanization rates.

While these are drivers for wealth and economic growth, they also bring about high rates of resource consumptions, and the related environmental and health problems, challenging city managers for effective provision of services in the fields of energy, mobility and waste management. Also, they intensify social conflicts among stakeholders and groups in the urban community, where limited resources and differing interests and expectations increasingly clash with each other.

City politicians and administrators are therefore facing a variety of problems and are called to ensure better living conditions and favour sound economic growth [Nam and Pardo, 2011; Chourabi et al., 2012]. Respect to the '90s only ICT-based definitions, the smart city concept has evolved a lot, now taking on a wider perspective of people and community needs within the city. For instance, many authors acknowledge a city is smart if it strives for *smart economy*, *mobility*, *environment*, *people*, *living* and *governance* [Giffinger et al., 2007]. Others, such as [Nam and Pardo, 2011] and [Meijer and Rodriguez Bolivar, 2016], focus on *smart technologies*, *people* and *collaboration*. One of the most effective definitions is provided by [Caragliu et al., 2011], according to whom a city is smart when "investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance".

Smart technologies

Information and communication technologies (ICT) allow the city's infrastructure components and services to become more intelligent, interconnected and efficient [Washburn et al., 2010]. Smart cities deploy sensor infrastructures for real-time data collection, transmission and storage, together with algorithms for automatic analysis of data and decision-making optimization. Many authors see smart cities as large organic systems, whose subsystems and components are connected by means of an artificial nervous system [Mitchell, 2006; Dirks and Keeling, 2009; Kanter and Litow, 2009; MIT, 2013; Neirotti et al., 2014]: digital communications are the nerves, ubiquitous intelligence is the brain, sensors and tags are the sensory organs and software and algorithms are knowledge and cognitive competences. This allows cities, companies and associations to supply (cost) effective services to citizens, which drive urban economic development, while at the same time being safe, secure and environmentally green [Hall et al., 2000; Washburn et al, 2010; Caragliu et al., 2011; Batty et al, 2012; Pellicer et al., 2013; Albino et al., 2015].

Exploitation of ICT can occur both in a top-down framework, by means of centrally planned networked infrastructures, and in a bottom-up framework, by which citizens independently have access to data provided by the city and make their own decisions [Neirotti et al., 2014].

Smart people

Authors such as [Komninos, 2009] stress that technological innovation is a means, not an end: technology is in fact a catalyst for the creation of an innovative environment, which requires comprehensive and balanced development of creative skills, innovation-oriented institutions, broadband networks, and virtual collaborative spaces. That is: the critical factor to actually improve living conditions in cities lies on the people and the way they interact to solve urban problems [Partridge, 2004; Hollands, 2008; Nam and Pardo, 2011; Albino et al., 2015]. Also, the sole availability of ICT itself cannot automatically transform and improve all citizens, since they might be affected by barriers related to language, culture, (digital) skills and other disabilities. In such a context, smart cities should strengthen human capital and resources, striving for increased awareness, education, leadership and social learning. Doing so, they would attract creative, well-educated and skilled workers and favour innovation and entrepreneurship, with the final result of improving economic competitiveness and productivity.

Smart collaboration

Urban smartness also requires effective and productive interactions and collaboration between urban institutions, citizens, communities, stakeholders and business, with the aim of solving common problems, in a good governance[1] framework [Nam and Pardo, 2011; Carayannis and Campbell, 2004]. The potential of creativity and technology is in fact fully exploited when governing choices are

[1] According to the definition provided by Wikipedia, "governance" refers to all processes of governing, based on interaction and decision-making among the actors involved in a collective problem, and leading to the creation, reinforcement, or reproduction of social norms and institutions [Wikipedia definition retrieved online on July, 2016].

transparent and accountable and when citizens are given access to decisions that affect their lives: participatory approaches to co-design, co-develop, co-produce city services should become general rule in smart cities. To emphasize this, some authors coined the concept of “human smart cities” [Marsh et al., 2014; de Oliveira, 2016].

In conclusion, a *smart city* can be seen as an organic integration of a city’s various systems, encompassing both “hard” domains (such as buildings, natural resources, energy grids, water management, mobility and logistics infrastructures) and “soft” domains (such as education, culture, intellectual capital in companies, policy innovation, organizational capital in public administrations, social inclusion and government) [Neirotti et al., 2014; Albino et al., 2015].

4.1.1 Overview of practical “Smart city” experiences

In spite of the richness and variety in literature concerning theoretical definitions and systematization of the *smart city* concept, definitely less literature proposes empirical analyses on smart cities initiatives and their effects: in most cases in fact the concept either remains at the planning level (blueprints, policy documents) or actual developments respond to small-scale pilots or fragmented initiatives and are not effectively up-scaled at the city level [Kitchin, 2015; March and Ribera-Fumaz, 2014; Pow and Neo, 2013].

In this context, a 2014 EU survey exploring the activation of smart city initiatives in 468 EU cities with more than 100’000 inhabitants, identified some general traits and tendencies of current smart city experiences [Manville et al. 2014]. Next to confirming the relative immaturity of most initiatives, the survey also found that the larger the size of the city (more than 500’000 inhabitants), the higher the probability that some kind of smart city initiatives are launched, due to availability of larger funding resources. Furthermore, current activities seem to predominantly address environmental and mobility issues. Table 2 provides a framing of some of the examples of smart city initiatives examined in the EU survey, classifying them into five main action domains.

Similar findings are obtained also by [Neirotti et al., 2014], based on the analysis of a sample of 70 cities worldwide that claimed to have developed projects in the smart city domains. Again, measures in the transportation and mobility sectors reach the highest diffusion – at the opposite, initiatives regarding city governance are less popular. Cities tend in fact to invest more in hard ICT technology-based measures, which seem easier to implement, neglecting instead initiatives directly aimed at people engagement, exploitation of their collective intelligence and creativity, with the aim of counteracting possible risks of social exclusion. Moreover, successful results in the environmental and mobility fields might be more easily perceived by the population than results in other sectors, and therefore they attract political attention. Finally, reflecting emphasis from the international community, these issues rank high on the agendas of civil society groups and, to some extent, also of industry representatives (in relation to corporate social responsibility).

Category	**Example of concrete initiatives**
Smart Neighbourhoods	ICT-enabled infrastructure to create carbon neutral and sustainable residential areas, typically built for 10,000 to 40,000 inhabitants.
Testbed micro infrastructures	ICT-enabled infrastructure for piloting a network of technologies that interact in a given area of a city. Typically this involves sensors and devices creating data and therefore by-passing human involvement.
Intelligent traffic systems	ICT-enabled systems based on road sensors or GPS to monitor real-time traffic information and manage city traffic in an efficient and sustainable manner.

Resource management systems	ICT-enabled infrastructure to improve the management of utilities for a city such as energy, water or electricity, e.g. smart power systems with intelligent management of energy mixes, smart grids, smart metering, heat storage, solar energy management systems, and surveillance management systems for resources such as clean tap water or wastewater or heating efficiency systems.
Participation Platforms	ICT-enabled citizen participation open data strategies, crowdsourcing and co-creation platforms.

Table 2: Examples of concrete initiatives activated by smart cities throughout the EU (table extracted from [Manville et al., 2014], page 53 and 54).

4.1.2 Limitations of the "Smart city"

Hollands [2008] argues that smart city initiatives are often presented in self-congratulatory ways by the cities, even though they might turn out to be rather ineffective or become sources for social or environmental problems, as unintended indirect consequences. In this section we present main critiques and limitations discussed in literature.

Excessive faith in technology and neutral decision-making
Some authors assess smart cities mainly considering the "smart technology" aspects underlying them. Authors such as [Greenfield, 2013] and [Haque, 2012 and 2013] depict smart cities as technocratic utopias, which claim for objectivity and optimization of infrastructure and services, while this is inherently impossible – besides being nor fair nor desirable. Data gathered are taken as neutral expression of scientific objectivity, which will lead to impartial decisions ("there is a fetish dependence on data", states [Haque, 2012 and 2013]). However, since no Pareto-optimal solutions can be found for complex systems as cities, any decision is necessarily the result of trade-offs and political choices: algorithms can take automatic, optimal decisions, but they will in any case be the result of some political choices, which are not made explicit and transparent and are totally left in the hands of the companies developing the algorithm. Endowing those companies with such decision-making power might even lead to de-politicization of city planning and management, reduction of political conflict and resistance and creation of "disciplined" cities, trapped in prior, non-critical consensus [Vanolo, 2014; March and Ribera-Fumaz, 2014] - being therefore in strong contrast with the governance pillar of the smart city concepts.

Similar critiques against a technocratic vision of smart cities are advanced by [Hill, 2013] and [Haque, 2012 and 2013], who highlight that relying on technologies might reduce citizen involvement: smart cities would imply a governance concept in which infrastructures get active and are empowered, while citizens are lead to passivity and discouraged in their constructive creativity.

Lack of prerequisites for fair and proactive collaboration
Smart cities need to adopt a citizen centric approach. According to the majority of authors [van Waart et al., 2015; Meijer and Rodriguez Bolivar, 2016], this requires wide transformations of the present city government systems and cannot simply be met by small adaptations. In particular, a cultural change in public institutions is needed: from centralized managers of the city, they need to evolve as facilitators and coordinators of urban decision-making processes, open to co-design and co-implement solutions to urban problems interacting with urban actors and citizens, building on their wisdom, competences and direct experience of problems [Marsh et al., 2014; Laniado and Cellina, 2005]. ICT technologies can broadly support these process since they offer opportunities to directly involve citizens into collaborative processes, allowing structured data exchanges and access to information, communication and public debate (e-governance) [Nam and Pardo, 2011; Chourabi et al., 2012; Murgante and Borruso, 2013; Marsh et al., 2014; March and Ribera-Fumaz, 2014; Albino et al., 2015]. However, to this purpose, present structural elements of governance (norms, policies, practices, information, technologies, skills, and other resources, according to [Johnston and Hansen, 2011]) need to be reconsidered.

Lack of social inclusion and creation of social disparities

Even if a city opts for soft technological development, based on smartphones, Apps and related devices, there is the risk that only a subset of more technology-oriented citizens is positively affected, and that social disparities increase, instead of decreasing. Not only having the technology does not always lead to its take-up, but also take-up rates are not always equitable. Technology illiterates and poorer components of the society are in fact more exposed to risk of marginalization, which would make urban growth unfair [Graham and Marvin, 1996; Hollands, 2008; Caragliu et al., 2011; Chourabi et. al., 2012; Murgante and Borruso, 2013; Vanolo, 2014].

Marginalization might be a very concrete risk especially in those cities who explicitly target educated, middle class professionals and ICT workers (i.e., representatives of the creative classes): exploiting digital technologies might improve quality of life for the wealthier social classes, however deepening social and economic inequality and polarization, to the detriment of the unskilled and ICT illiterate part of the population [Smith, 1996; Peck, 2005; Hollands, 2008]. Concentrating smart city initiatives in specific areas of the city might even result in urban gentrification and marginalization phenomena, in total contrast with the inclusive smart city concept.

Further unintended causes for social disparities are related to the fact that city resources are finite and limited: orienting resources towards “gleaming infrastructures” and global ICT business might entail diverting monetary investments from other less glamorous, long-standing infrastructures or services of the city, with the risk of depriving part of the population of basic services [Graham, 2010].

Privacy and security problems

Surprisingly, privacy and security issues are not frequently mentioned in smart city body of literature. However, there’s general agreement that the wide diffusion of ICT infrastructures and service-oriented information systems, gathering high amounts of data and integrating them across government systems, might endanger general safety and personal privacy issues [Bartoli et al., 2011; Chourabi et al., 2012; Martínez-Ballesté et al., 2013; Elmaghrabi and Losavio, 2014].

Citizens are in fact supposed to interact with ICT by means of a variety of devices (smartphone, tablets, personal computers) and from a variety of places; the sensitive information collected is stored into heterogeneous systems, which could be easy target for hackers, or simply entities interested in exploiting it for commercial reasons. As observed by [Martínez-Ballesté et al., 2013], acknowledging this might strongly dissuades citizen from engaging in smart city initiatives. Therefore, smart cities attempts can be successful only if they actively guarantee privacy protection.

Increase in overall resource consumptions: rebound effect

In line with the visions and concepts of the “degrowth” theory (a movement inspired by the ideas by Nicholas Georgescu-Roegen, then systematised, among the others, by Jacques Grinevald and Serge Latouche), which criticize sustainable development theories, Hollands [2008] argues there is an intrinsic conflict between economic growth and environmental sustainability and highlights the impossibility to achieve both of them. Therefore, according to him the smart city concept is intrinsically flawed. Also, he highlights that wide diffusion of ICT infrastructures and services might increase natural resources and energy consumptions, with the unintended consequence of a generalized rebound effect.

Other authors mention other unintended environmental consequences of smart cities: Hill [2013], for example, noticed that opting for ICT such as home automation and domotics at the city level (for example, by automatically controlling heating consumptions of buildings connected to district heating networks), would reduce people conscious decision-making and consequent awareness of consequences of individual actions. In the long run, this would produce a society who is less likely to care for use of natural resources, decreasing therefore sensitivity towards environmental and sustainability goals and principles [Hill, 2013].

Furthermore [Wachsmuth et al., 2016] also highlight that improved environmental performances in urban areas often imply worsening of environmental conditions in the surrounding agglomeration areas, with consequent strengthening of social disparities to the detriment of already disadvantaged social groups. They cite the example of the city of Freiburg (Germany), where energy-efficient districts were created, exploiting renewable energies and endowed with efficient public transport and walking and cycling lanes: while environmental performances in the urban area tangibly improved, making the urban settlements more desirable and expensive, its workforce turned to cheaper suburbs for housing, with the final effect of increasing environmental problems at the large scale and producing significant social impacts. Moreover, even though during the working week wealthy people living in central urban areas were adopting sustainable lifestyles, their overall ecological footprint would tend to worsen, due to their leisure time and week-end consumption patterns and travels.

4.1.3 Suggestions for advancing “Smarter cities”

If we take into account the many technology-related limitations of current smart city concepts, surely the availability of Intelligent Transportation Systems (ITS) elements alone does not represent the only driving factor to ensure a “smart” urban development process. Overcoming also the human and governance related (or soft) limitations (such as education, culture, intellectual capital in companies, policy innovation, organizational capital in public administrations, social inclusion and government) of current smart city development is as crucial. In fact, next to guaranteeing an appropriate technology use, smart transformations of an urban mobility system implies also the diffusion of new lifestyles, values and attitudes. Ultimately, the striving for an effective social inclusion and adequate up-scaling of smart city initiatives is the way forward to ensure that any future practises represent an advancement of past experiences.

Addressing barriers to social inclusion and upscaling of “smart” urban mobility initiatives

Smart-*er* cities need to focus on people and their active engagement (“smart people” and “smart collaboration”), as to ensure a more progressive and socially equitable urban transformation. Hollands [2008] for example recalls the need to explicitly build on human capital, namely the people and their social relations and networks of trust and reciprocity [Carley et al., 2001]: “local community partnerships – not wires – are in fact the fibres that bind smart communities” [Coe et al., 2000]. Cities are suggested to promote empowerment and education of citizens and to favour democratic debate on their lives and the urban environment they habit, by means of both technology-mediated and in-person collaboration activities, with the aim of making interests and priorities of a wide range of citizens emerge.

According to the majority of authors [van Waart et al., 2015; Meijer and Rodriguez Bolivar, 2016], this requires wide transformations of the present city government systems and cannot simply be met by small adaptations. In particular, a cultural change in public institutions is needed: from centralized managers of the city, they need to evolve as facilitators and coordinators of urban decision-making processes, open to co-design and co-implement solutions to urban problems interacting with urban actors and citizens, building on their wisdom, competences and direct experience of problems [Marsh et al., 2014; Laniado and Cellina, 2005].

However, for such governance processes to be effective, cities need to build reciprocal trust with and between citizens and urban actors, mending past failure interactions, which failed due to asymmetrical power relationships. This requires that institutions, citizens and public and private actors are given the same decision-making power in co-designing activities. In such a context, “urban arenas” and “urban Living Labs” provide exceptional opportunities to experience new governance approaches, as long as organizers strive for including all the main categories of social actors, with a special attention for those who are traditionally marginalized, such as younger, elderly, and ethnic groups, adopt a problem-driven approach and perform both face to face meetings and virtual platforms to share ideas, assessments and counter-proposals [Marsh et al., 2014]. To avoid general rebound effects, smart-*er* cities must widen

boundaries of action and take into account large-scale and life-cycle analyses when co-designing and co-implementing the path for the evolution of the city.

Consequently, smart cities should not opt for heavy technology, infrastructure-led visions, favouring instead soft visions, where technology is directly in the hands of the citizens, who exploit it by means of smartphone and social media [Hill, 2013]. That is: focus of cities' actions should move from "smart technologies" to "smart people" and "smart collaboration". In fact, even when digital literacy is granted, experience shows that digital-based activism is not enough to guarantee interest by individuals for a long period of time: it needs to be nurtured, rekindled and further stimulated by physical, in person meetings and activities. For example, [Hill, 2013] presents effective governance in smart cities as a combination of social media and "the piazza" (explicitly naming it in Italian: the square, seen as the central urban meeting and discussion place, recalling the ancient Greek "agorà").

As Lindner [2013] notices, "smartness" is usually automatically associated with speed and accelerated lifestyles: smart cities are efficient, controlled and fast. What if technologies were used to decelerate cities and favour slowness, instead of increasing speed? Becoming a smart city would be the occasion for the city to steer clear of some of the most critical effects of the consumerism society, such as precariousness, inequality, excess and waste production.

Critique/Limitation affecting *Smart cities*	**Suggestion for *Smarter cities***
Excessive faith in technology and resulting neutrality of decision-making, implying risk of de-politicization and lack of citizen empowerment.	Avoid heavy technology, infrastructure-led programmes. Instead, favour soft technology programmes (smartphone and social media-based) and give them directly in the hands of the citizens.
Lack of prerequisites for fair and equitable collaboration.	Promote a cultural change in public institutions: from centralized city managers to facilitators of urban decision-making processes. Guarantee trust by avoiding asymmetrical power distribution.
Social exclusion due to the lack of digital skills in the poorer and/or older members of the population, with consequent increase of social disparities.	Promote empowerment and computer science education of citizens. Back up technology-mediated activities with in-person collaboration activities.
Effective upscaling at the city level might be precluded by privacy concerns.	Communicate strong commitment for active privacy protection.

Table 3: Main limitations of the present understanding of the smart city concept and suggestions to overcome them.

4.2 Smart mobility and urban systems (SUPSI)

Cities are places where exchange between networked infrastructure and natural environments occurs on a daily basis and resource flows are 'metabolized' by infrastructures in a geographically concentrated area. Socio-technical innovations in water and energy supply, sanitation and transport have been drivers for liberated urban growth enabling to exceed the carrying capacity of urban bioregions and fuelling this metabolism [Monstadt, 2009; Swyngedouw, 2006]. There are different characteristics to urban growth and development in general when compared on a worldwide level. European cities, for instance, are more compact than cities in the USA for example [Newman and Kenworthy, 1999], a result of different approaches in city planning (e.g. liberal market-guided development vs. controlled planned development) as well as of the historical interaction of different market forces (e.g. pre-car vs. post-car

era). Since the 1980's, moreover, there have been fundamental transitions in infrastructures in Western cities due to more liberalisation and privatisation and the commercialisation of infrastructure services, technological innovation, and environmental regulation [Monstadt 2009].

When putting the focus on mobility, there is a strong interaction between mobility and spatial dynamics, implying that spatial planning, real estate development, infrastructure planning and transport policy all have to be considered in the context of the development of urban infrastructures [Priemus et al., 2001]. As several studies show, a dense, polycentric city structure, organised on small and medium-sized, compact centres, well connected through an efficient public transport proves to be the most sustainable solution in various aspects [e.g. Breheny, 1996; Hall and Landry, 1997]. Equally, it has been demonstrated that energy consumption (CO_2 emissions) from transport (i.e. daily travel) are correlated with population density [e.g. Grazi et al., 2008; Le Néchet, 2011]. From an economic perspective public costs are higher when the density is low and the distance to the city centre is high. This goes hand in hand with a weak competitiveness of public transport and a modal split that favours the car. A diffused urban development cannot be adequately served by public transport infrastructure [Camagni et al., 2002].

4.2.1 Framework factors favouring transformation of urban mobility systems

In the post-World War II era cities by and large and to a greater or lesser extent by urban sprawl: low density development over a large area, characterised by monofunctional land uses and high car dependency. Consequences are high costs for infrastructure and energy, congestion of transport networks, increasing segregation and specialisation of land use, degradation of the environment, and social segregation. While one of the main causes behind urban sprawl is probably the increasing affordability of the private car, other residential, economic and institutional factors have played a role in reinforcing these urban sprawl dynamics: the decline in environmental quality of the densely built city centre, due to traffic congestion, pollution, degradation of public spaces and reduction of safety; a change in lifestyles, which prefers more spacious decentralised housing; the replacement of residential land use in the city centre by tertiary activities; the fact that housing improvement in the city centre costs more than new construction outside the city; the housing supply strategies of real estate agents; lower development costs in suburban areas; the difficulty of access to the city centre by car; the development of forms of out-of-town retailing based car use; the suburbanisation of housing and hence of part of the consumer and labour market; the fragmentation of responsibility for town planning; and an imbalance in local tax base [Camagni et al., 2002].

Recent sociological analyses seem to indicate that the emergence and diffusion of new lifestyles, values and attitudes among younger generations can potentially contribute to changing these urban sprawl dynamics. In particular, three socio-cultural trends will play a role in shaping future urban mobility systems and are expected to influence and act in synergy with smart city initiatives:

- in contrast to previous generations, who preferred to live in suburban car-dependent single family homes, emerging trends indicate that the Millennials (people born between the early 1980s and the early 2000s) prefer living in central urban areas, where all the commodities are easily reachable within walking distance [Frontier Group and U.S. PIRG Education Fund, 2012];
- the sharing economy emerged also in the mobility sector, with the development and fast diffusion of car-sharing and ride-sharing opportunities: while car ownership is still increasing (e.g. because of declining average family size), new generations increasingly have the option of using shared mobility services;
- new generations are also said to lose an interest in cars, postponing the obtainment of a driving licence (see for example data of the Swiss Census on Mobility and Transport) and favouring use of public transport [Frontier Group and U.S. PIRG Education Fund, 2012; McDonald 2015].

4.2.2 Classification of smart mobility initiatives

Against the background of these broader framework conditions and societal trends, many cities have launched mobility and transport initiatives under the 'smart city' label. The approaches used and experiments initiated are as diverse as the definitional debates on smart cities and Living Labs, but it does seem possible to identify four types of smart mobility initiatives: 1) reducing mobility demand per se; 2) reducing car use, making other modes of transport more attractive and competitive; 3) using cars differently; and 4) using different cars. From a different angle, these initiatives can also be classified on the basis of the so-called "intellligent transportation systems" (ITS) technology they exploit (for a general overview on ITS, see Shaheen 2013). For the purpose of our analysis, we propose two technological classes: infrastructure-based initiatives and app-based initiatives. Figure 2 shows the resulting double-entry classification.

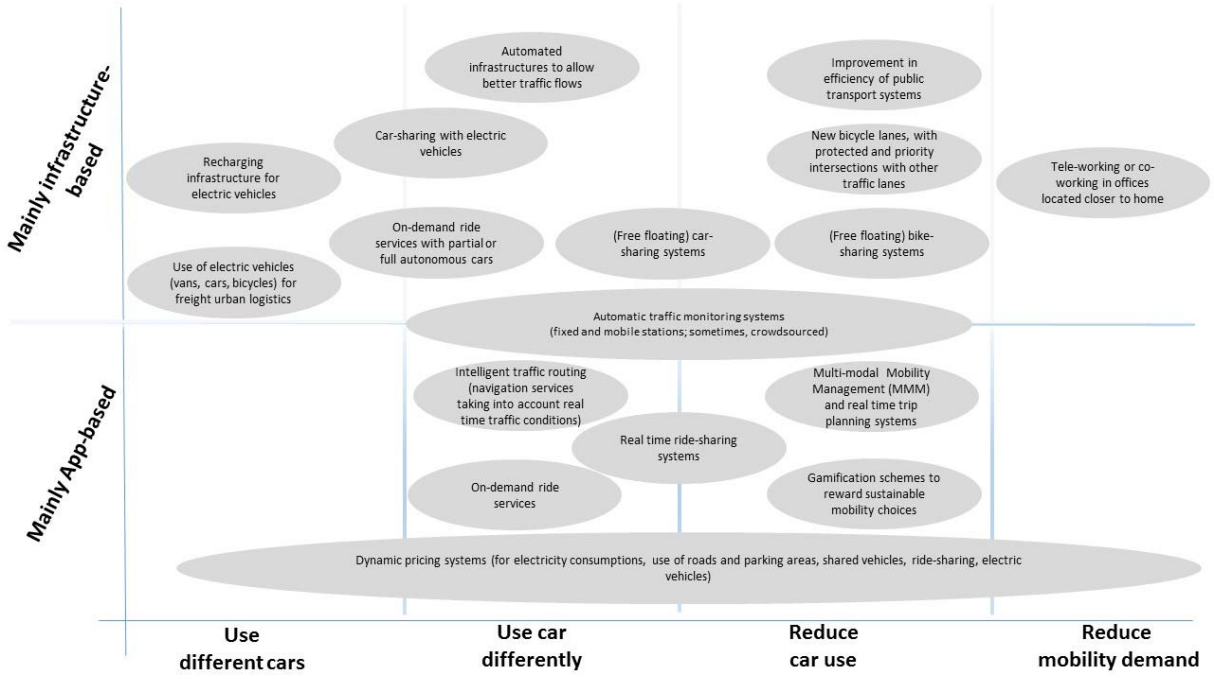

Figure 2: A classification of "smart mobility" initiatives, based on their main goal (horizontal axis) and the key ITS element they exploit (vertical axis).

The two goal categories "reduce mobility demand" and "reduce car use" mainly reflect a strong understanding of "sustainable mobility" and support a paradigm shift to overcome car dependence [Berger et al., 2014; Newman and Kenworthy, 2015]. Significantly breaking with past development plans and programmes, some cities are in fact now re-organizing their whole land-planning and mobility systems, with the aim of changing the dominant modal split and transforming individual behaviour towards the sustainable mobility paradigm proposed by Banister [2007] or the eco-mobility concept by Kodukula [2013]. In such cases, key smart city initiatives favour integration of public transport and slow mobility: dense city areas are created, to sustain effective rapid transport systems, and large portions of the city are pedestrianized, with significant improvements in overall quality of life. Cars are still used, but lose their dominant role. The other two goal categories "use car differently" and "user different cars" mainly reflect a weak understanding of "sustainable mobility": based on the assumption that no other means of transport than the car offers comparable levels of freedom, safety and comfort [Mitchell et al.,

2010], initiatives in these categories aim at the transformation instead of overcoming of the automotive system. From this point of view, “smart mobility” initiatives should not impose trade-offs between personal mobility needs and economic and prosperity enabled by cars. Instead, they should aim at changing both cars themselves and the way they are used. “Reinvented” cars would be electric and fed by renewable energies, lighter and smaller, would move at lower speed and would be connected to other cars (“vehicle to vehicle” V2V technology) and to the system within which they are moving (road, intersections, parking lots: “vehicle to infrastructure” V2I technologies) [Mitchell-Waldrop, 2015]. Either partially or fully autonomous, they would not circulate in pedestrianized areas and would be attributed dedicated lanes with intelligent intersections with other modes of transport.

Infrastructure-based initiatives

Early smart mobility initiatives were based on infrastructural measures and aimed for the creation of car and bicycle sharing systems, related bicycle lanes, the development of networks of public recharging stations for electric vehicles, and the creation of systems for the automatic management of traffic flows.

Car-sharing is a car rental by-the-hour system, effective in dense urban areas. It allows to avoid fixed costs and efforts related to car purchase, maintenance and assurance. In the past, car-sharing schemes were quite rigid, as cars had to be delivered in the same place they were picked up, pick up points were limited and early booking was necessary, due to the low number of cars available. Now, again exploiting apps and ICT, new “free floating” car-sharing schemes are widely diffused: cars can be picked up and given back wherever users like, provided that they remain within a delimited urban area, since Apps and GPS devices allow other users to identify their precise position.

Similarly, also bike-sharing schemes were developed, working exactly in the same way. The strength of bike-sharing does not only lie in the possibility to avoid owning a bicycle – which has very low maintenance costs. Instead, their strength is that, combined with public transport and especially rail-based transport, they allow to reach a wide variety of destinations very fast, enabling citizen to avoid using cars – and they are useful both for commuting purposes and for leisure activities. For the development of bike-sharing systems, however, cycling safety infrastructures and regulations are also essential, which is why, in cities where bike usage is still new, the creation of new bike infrastructure and bike-sharing systems go together, with mutual reinforcement. Since the early 2000s, bike-sharing schemes are spreading throughout the world, albeit with very different rates of success (Demaio, 2009].

The development of charging stations for electric vehicles is one of the most appreciated initiatives within smart mobility programmes, because it requires relatively cheap public investments, leaving to private citizens the cost of investment for the substitution of internal combustion engine vehicles (ICEVs) with electric vehicles (EVs). EV charging stations are an essential infrastructure to give drivers the possibility to recharge on the go. Together with the creation of the network of recharging stations, the city’s smartness can be enhanced by direct investments in urban photovoltaics power plants, directly feeding the charging stations, and in promoting research projects aimed at exploiting EVs’ batteries as active components of new generation smart electricity grids. The creation of an electric charging station network is often accompanied by the development of measures for electric urban logistics: freight delivery in urban central areas are performed by small e-vans, e-cars or, more recently, even e-bicycles and tricycles, which, in some cases, can take advantage of extended loading and unloading hours.

Smart infrastructures are also frequently used to automatically control and manage traffic flows: exploiting a network of thousands of sensors able to track traffic and environmental parameters such as pollution or noise, cities can for example provide users with real-time information about the closest available parking areas, coordinate traffic lights in order to prioritize public transport and induce the most adequate speed, or even suggest alternative routes in case of emergencies, traffic jams or other events/environmental conditions. Data tracked cannot simply measure car traffic, but they can also consider level of use and demand of public transport or bicycles and provide information to their users.

In this regard, very innovative measures are planned in Helsinki (Finland), where by 2025 bus routes might be dynamically defined based on real-time transport demand [Viechnicki et al., 2015]. The same authors highlight that real-time monitoring activities are increasingly being used also to understand urban cycling patterns, with the aim of developing effective slow mobility and land-use plans and programmes.

Besides initiatives directly targeting the transport system, other very effective initiatives connected to the smart mobility concept within smart cities are those facilitating teleworking activities: teleworking in fact provides cities with opportunities for cutting mobility demand. Availability of high-speed internet connectivity throughout the city is essential to this purpose. Another interesting urban phenomenon that deserves further attention are co-working experiments: these in fact overcome the main critical aspects related to teleworking, which are the difficulties to separate between working and private time, and the need for human contacts during the working days. At the same time, they can offer shorter commuting routes, with overall benefits both from a mobility and environmental perspective.

App-based initiatives

If users are given the possibility to choose between different modes for a given trip, rather than defaulting to individual car use, there are chances that they actually reduce their car use. Such an ambition necessitates enhanced integration of transport options and availability of multi-modal transportation possibilities – that is, the possibility to access multiple modes of transport, with optimized interchange times, when making a single trip. With a very appropriate slogan, Newman and Kenworthy [2015] argue cities need to evolve “from cars to cards”. To realize this goal, some cities have developed digital integrated platforms and tools, often referred to as Multi-Modal Mobility Management (MMM) systems, fully available by smartphone Apps: they allow users to seamlessly compare (cost, route, time spent etc.), access and pay for different transportation services [Shaheen and Christensen, 2014]. Provided that adequate data inter-operability standards are respected, given a user mobility option to go from point “A” to point “B”, such digital platforms allow users to get (pre-trip or real-time) dynamic information about available multi-modal mobility options, compare them, book a place and even pay for the transport service, simply by using their smartphone. Then, to practically access the transport service, inter-operable multi-purpose RFID (radio frequency identification) cards are used. Such systems also make it possible to differentiate tariffs according to the time of the day (for example, considering peak and off-peak hours) or the user profile (for example, child/adult/retired). In principle, it would even be possible to create fairer tariffs from a social point of view, differentiating tariffs according to income levels (higher/lower income) [Staricco, 2010].

Possible mobility options proposed by these app-based initiatives can be very different and depend on the mobility services available in the city. Besides individual car and traditional public transport or slow mobility (walking and cycling), the system might also propose one of the new multi-modal or shared mobility options:

- ride-sharing: users share the same car (one as a driver and at least another one as passenger), by means of pre-arranged decisions. This is what in the past was more frequently called as carpooling: the advantage brought about by ICT is that now dynamic ride-sharing services are available, based on apps that match demand and offer in (nearly) real-time, without prior planning. Also, effective integrations with public transport or slow mobility systems can be envisioned, in a multi-modal ride-sharing framework. Availability of new ICT therefore allows for a revival of the carpooling concept, which, as Viechnicki et al. [2015] notice, was common in the 1960s and 1970s, but then lost popularity at the same time as the consumer society became more pervasive.

- on demand ride-sharing schemes: similar to taxi schemes, they are mainly based on ICT technologies, which allow users to book and pay rides by means of Apps. In some cases, cars are owned by a company, in other cases drivers offer the service by using their own private car;
- car or bicycle sharing systems.

In all these cases, one of the most critical factors for success is the harmonisation of tariffs and revenues between the transport providers, and making them accept that prices are fully and directly comparable – obstacles are therefore to be found more on the human and social side than the technological side of smart mobility initiatives. Also, and as already mentioned in our review of the smart city literature, some authors highlight that app-based initiatives can reproduce or even deepen social inequalities, affecting people with limited access to smartphones (due to age, education level, income) or limited digital skills [Staricco, 2013; Shaheen and Christensen, 2014].

Smartphone apps are also increasingly popular for mobility tracking: besides the fixed network of sensors introduced in the previous section on infrastructure-based initiatives, many advanced smart mobility initiatives engage citizens to crowdsource mobility and traffic data, by using dedicated smartphone apps. For example, the city of Copenhagen (Denmark) collects crowdsourced data from bicycle riders. This allows the city to provide real-time information on bike lanes conditions, in the fashion of a bicycle-dedicated navigation system. Moreover, it also allows the city to identify routes with higher mobility demand, and consequently priorities for the development of new bike lanes, and also highlights already secure routes for bicycles available in the city. In line with the comprehensive smart city approach introduced above, crowdsourced data are thus used to co-develop with citizens more effective policies, plans and programmes and to manage in a different way traffic and mobility demand. Finally, some mobility tracking Apps are also endowed with gamification elements, such as collecting points to be redeemed for tangible or monetary prizes, to stimulate citizens to reduce car use and opt for alternative mobility options. In some cases, such as Paris (France) and many other European cities, bike commuters are even directly paid a certain amount of money for every kilometre they travel by bicycle (of the order of 0.25 € per kilometre) – and the amount of kilometres travelled is certified by an app.

4.3 Participatory urban planning and governance (University of Graz)

Since the construction of the first cities, city planning has been essential for urban development. While there are many definitions and different ways of implementation, in general, city planning can be considered the firm base for the building of a healthy and happy community [Lewis, 1916, p. 9]. It is a spatial activity and an institution of policies and laws to regulate and control land use in urban areas. The Compendium of European Spatial Planning defines spatial planning as a method used largely by the public sector to influence the future distribution of activities in space [Van Assche and Verschraegen, 2008]. Planning activities are usually performed by the urban government respectively at the order of the urban government [Gregory et al., 2011].

Banister et al. [2011] discuss how experts have importantly shaped the discourse and associated conceptualisation of transport problems and solutions among policymakers, researchers and lobby organisations over the past decades, with a significant input form the engineering and economic sciences, later also psychology. The main characteristics of such a way of thinking are determinism and predictability, namely the idea that events in mobility systems are causally determined by, and can be predicted from, previous events according to a limited number of principles (laws). In terms of solutions, this thinking leads to strong beliefs in technology push and in the structuring influence of land-use measures, and infrastructure provision as effective means to influence mobility. In contrast, it involves an underappreciation of unexpected events or the possibility of unintended and unanticipated outcomes. Such a paradigm tends to change rather slowly, although it came into existence when the key challenge

facing mobility planning was to accommodate the growing demand for mobility, while today it is primarily about how mobility can be decarbonized.

4.3.1 Governance

This expert-shaped way of thinking is also reflected in established procedures and governance structures, and prohibit radical change in mobility governance in at least two ways [Banister et al., 2011]. First, despite experiments with bottom-up and participatory approaches based on communicative planning models in specific cities and settings [Hysing, 2009; Whitmarsh et al., 2009; Vigar, 2006], the governance of mobility systems remains in many ways a technocratic exercise that is: strongly driven by technical expertise; exclusionary in that only a subset of stakeholders is involved; and organized in a top-down manner. As a result, the structural bias toward determinism, instrumental rationality, and technology push continues to be reproduced continually in transport governance [Weiner, 2008; Vigar, 2006].

Second, the predisposition toward Fordist specialisation and compartmentalisation is so wired into mobility governance rules that the (rhetorical) ideals of coordination and holism are difficult to carry through into real-world planning practice. The idea that the compartmentalisation of responsibilities represents a significant challenge to mobility governance is far from new [Goodwin, 1998; Rietveld and Stough, 2006; Anderton, 2010] but becomes all the more pressing in those instances where a wider range of stakeholders is involved in mobility governance. Within most countries, land-use planning tends to be a responsibility of local public authorities. Finance, however, for major (mobility) projects comes from national governments and increasingly from private investors, whereas implementation is often in the portfolio of other subnational entities. Complex vertical power relations are compounded by horizontal power relations, given that responsibilities for land use and mobility are often split across multiple agencies at the same level of government, often with no department taking overall control. Banister et al. [2011] conclude that it is not surprising that such fragmented institutional arrangements frequently produce public policy agendas lacking a clear direction (i.e., ineffectual, piecemeal, and convoluted policies), with overreliance on technical expertise, powerful pro-growth lobbies, and continued carbon lock-in.

Street [1997] summarized the discussion above in two major limitations of traditional approaches to policy and decision-making. First, traditional approaches focused on the consultation of sciences and experts to the disadvantage of excluding alternative viewpoints and values that could emerge from outside the realm of science. Second, because of the complexity and “high systems uncertainties” of many environmental problems, science based policy and decision making is no longer an appropriate approach. Instead, uncertainties enhance the role of people and the importance of “their knowledge, values, agreement and participation” [Street, 1997, p. 143].

4.3.2 Participation

Arnstein [1969] states that participation without the sharing of power is a meaningless task for the ones usually excluded. In a “ladder of participation” she describes eight different levels of participation. Each rung symbolises a specific degree of power involved with the lowest rung providing the least and the highest rung providing the most power. The two lowest rungs, “manipulation” and “therapy”, describe ways of “non-participation” without any share of power providing only the appearance of participation through information and education. The middle rungs, “informing”, “consultation”, and “placation”, are levels of “tokenism”, where people can articulate their needs and wishes but lack the power to ensure consideration. On the three highest rungs actual power is given to the people either through “partnership” in negotiation processes, “delegated power”, or even “citizen control”, the highest rung where citizens have the power to decide and manage. As Arnstein [1969] states, this simplified ladder pattern helps to make clear that participation can be carried out in various ways, some offering

partnership and a redistribution of power to the powerless and some being empty phrases used by the ones in power to maintain the status quo.

Despite these distinctions, various intensities of participation are likely to be appropriate in different contexts, depending on the purposes of the activities and the capacity for actors to influence the results. In recognition of this, attempts have been made to characterise and legitimise different methods and approaches for stakeholder participation [Richards et al., 2004; Tippett et al., 2007]. Davidson [1998] proposes a “wheel of participation” as an alternative approach that puts emphasis on the legitimacy of different levels of involvement. Other typologies focus on the nature rather than the degree of participation, identifying various forms of engagement by the direction that communication flows between parties [Rowe and Frewer, 2000]. Other approaches focus more on the theoretical frameworks, especially distinguishing between normative and/ or pragmatic participation [Habermas, 1987]. Okali et al. [1994] describe “research driven” and “development-driven” participation approaches based on their actual objectives. Likewise, Michener [1998] distinguished between “plan-centred” participation focusing on concrete results and “people-centred” participation, emphasising capacity building and stakeholder empowerment.

The success of results gained through participatory approaches is mostly connected to the quality of the process leading to them. Therefore, Reed [2008] proposes eight key features of successful participation practices based on a Grounded Theory Analysis of relevant literature. These principles follow the premise that participation should be regarded as a process rather than a ‘tool-kit’ approach. Accordingly, stakeholder involvement should be based on a worldview that puts emphasis on empowerment, equity, trust and learning. Additionally, participation should be taken into account as early as possible and throughout the process, involving relevant actors in a structured approach. The process should have well-defined goals that meet with general approval of all stakeholders and should include high quality facilitation. The specific participation methods should be selected and tailored to the individual governance context, reflecting aims, stakeholders and adequate levels of involvement. In this process, local and scientific knowledge should be integrated to provide a better understanding of the complex challenges and dynamics. Moreover, the author argues that stakeholder participation should be institutionalised in order to overcome many of its limitations, creating organisational cultures that promote collaborative negotiations of planning objectives with unbiased outcomes.

However, it is important that participation is carried out properly based on true partnership and a redistribution of power. Hence, participation requires a balance of economic interest and power relations, but this can hardly be achieved under unequal politico-economic and socio-spatial relations [Huisman, 2014; Maloutas and Malouta, 2004; Swyngedouw, 2005; Gerometta et al., 2005]. Unequal conditions regarding socio-economic and other power relations between actors lead to unequal levels of participation, empowering some while disempowering others [Huisman, 2014; Swyngedouw, 2005]. And this has clear implications for social innovation agendas [Moulaert et al., 2007; Eizaguirre et al., 2012]. There is a risk of misuse “[...] to win acceptance and facilitate the implementation of decisions already made” [Street, 1997, p. 144]. For people who want to be engaged, participation can only be meaningful if their contributions are being recognized and have an impact on results. Therefore, a central challenge for the notion of participation is the conflict of interests inherent to processes of urban (re)development [Eizaguirre et al., 2012].

Participatory governance

A flood of scientific literature on governance has been produced throughout the last two decades since Rhodes [1996] first published on ‘governance without government’. Politics and planning as a common task, as a public-private partnership – not in economic terms but in terms of responsibility – has become a sort of master frame, a striking metaphor for contemporary analyses of policy processes [Kesselring, 2016]. The concept of governance hence tries to loosen up existing hierarchies and power relations by including multiple actors. Good governance takes into account the views of minorities and makes sure

that the voices of the most vulnerable in society are heard in the decision-making process [Rezazadeh, 2011, p. 260]. It entails openness (active, transparent and comprehensible communication), participation, accountability, effectiveness and coherence. One of the key concepts of good urban governance nowadays is the engagement of the local communities in the decision-making process in order to make decisions more equitable [Rezazadeh, 2011, p. 261]. There are several conditions which are needed in order to get the local community engaged in this process: access to all information necessary, the ability to participate in and influence the decision-making process and the right for authorities to control and influence the government. Furthermore, all of these arrangements are used in the process of building participatory governance.

Participatory governance is a variant of governance "[...] that puts emphasis on democratic engagement in particular through deliberative practices" [Fischer, 2012, p. 457]. This type of governance is the response to the deficit of democracy in modern political systems with strong hierarchies and the domination of a top-down approach with little possibility to involve the local citizens in the process of making of decisions about the place where they live or work. According to Fischer [2012, p. 458-460], there are certain key benefits of participatory governance: more equal distribution of political power, fair distribution of resources, decentralisation of decision-making processes, transparent exchanges of knowledge and information throughout the actors, establishment of collaborative partnerships, greater accountability, building community capacity and citizen empowerment. Furthermore, Irvin and Stansbury [2004] analysed the arguments in the literature in favour of participation in government decision-making and listed the benefits for government and citizens. Citizens benefit from gaining knowledge, as they "learn from and inform government representatives", have the possibility to "persuade and enlighten the government", and "gain skills for activist citizenship". Governments are getting educated by citizens, can "build trust", "gain legitimacy of decisions", and "avoid litigation costs" [Irvin and Stansbury, 2004, p. 3]. Street [1997] argues that it can contribute to social inclusion if people usually excluded from political decision processes are enabled to become engaged and be heard.

Still, while there is broad consensus among scholars that participation is necessary and beneficial, it is not absolutely clear whether it should be enforced on all of the space of planning as the ideas of the local citizens could contradict with the rationality that professionals can provide to the process of planning [Van Marissing et al., 2006].

Participatory planning

Amado et al. [2010] emphasize that a participatory approach should be a key concept in urban planning in order to achieve successful transformation and sustainable development of urban settlements in the future. Participatory planning is one such paradigm that attempts to enact principles of local-level governance, in involving and engaging communities in the development of their area. However, citizen participation is nothing new in the field of urban planning. The start of usage of participation for the needs of urban planning took place in 60s and 70s years of the 20th century along with the movement for human rights and the creation of approaches such as advocacy planning. The idea of advocacy planning is based on the argument that there are big inequalities in the political processes and bargaining situations, which denies a large part of the citizens, to have the possibility to influence the process of local governance and planning. Advocacy planning claims that the citizens of the selected area should be equally represented during the planning process in order to give them an opportunity to advocate their interests [Davidoff, 1965].

Jennings [2004] contends that the advantage of citizen involvement in planning processes lies not only in the development of democracy on the local level, but also in the huge utilitarian importance of this concept. According to a case study analysis which was made by Keating and Krumholz [1999, cited in Jennings, 2004], urban communities, which have a strong community-based organisation, have much bigger chances of successful development in the future. These findings are in line with Lebel et al. [2006] who examined which attributes of governance are enhancing the capacity of societies to manage

resilience. Accordingly, the authors stated that diverse participation, open communication, and deliberation are important because they support building trust and shared understanding among diverse stakeholders needed to mobilize resources and people and to foster self-organisation.

4.4 Social exclusion and inclusion (University of Maastricht)

There is no overarching consensual view about what precisely constitutes social exclusion, but there is wide agreement that it reaches beyond a description of poverty to provide a more multidimensional, multilayered and dynamic concept of deprivation [Lucas, 2012]. For example, Levitas et al. [2007, p. 9] have identified social exclusion as involving: *"the lack or denial of resources, rights, goods and services, and the inability to participate in the normal relationships and activities, available to the majority of people in a society, whether in economic, social, cultural or political arenas. It affects both the quality of life of individuals and the equity and cohesion of society as a whole.'*

In the UNDP report "Beyond Transition: Towards Inclusive Societies" [UNDP, 2011], the UNDP links the social exclusion/inclusion paradigm, as developed in the European Union context, with the human development paradigm, as articulated by Amartya Sen. It starts from the premise that people value not only consumable goods and services but also things that cannot be consumed—activities and abilities that reinforce human dignity and self-respect. For example, we value employment not only because the income derived increases our purchasing power, but also because it makes us feel like worthy members of society. Human development is about a growing number of people leading lives that they increasingly value. Few of us, however, can engage in all that we value. We find ourselves deprived in one or another dimension. When deprivations accumulate, and especially when they start to reinforce one another, social exclusion occurs.

From a risk-perspective, anybody can be excluded (not only vulnerable groups). Social exclusion is not just a problem for disadvantaged or marginalized populations. It is a concern for everybody, as everybody faces risks. But not all risks produce social exclusion. Whether social exclusion occurs depends how risks interact with 'drivers' such as institutions, norms, policies and behaviours. For example, anti-discriminatory legislation can decrease a disabled person's risk of social exclusion. Legislation banning gay marriage increases a homosexual couple's risk of social exclusion. Peers who don't value knowledge increase the risk of social exclusion for a bright child who is willing to study.

The local context also influences individual risks. Local factors that could augment individual risks and affect social exclusion include available employment opportunities, distance to urban centres, the state of basic infrastructure, or whether a locality has been hit by conflict or environmental degradation or both. In order to achieve social inclusion, concerted interventions targeted at the entire social exclusion chain are necessary.

This concept of social exclusion is broad and relative. A deprivation occurs if an individual does not have the capability of consuming a basic basket of goods, or perhaps even accessing the internet, when this is expected in his or her social environment. While social exclusion is relative, this does not mean that it is subjective, in the sense that individuals perceive themselves to be excluded. Exclusion takes place when people don't have the capability of doing well-defined things. At its extreme, social exclusion becomes marginalisation. This happens all too often for groups, such as ethnic minorities —especially Roma— or for people with disabilities. However, this report does not equate social exclusion with marginalisation; nor does it associate social exclusion with specific groups.

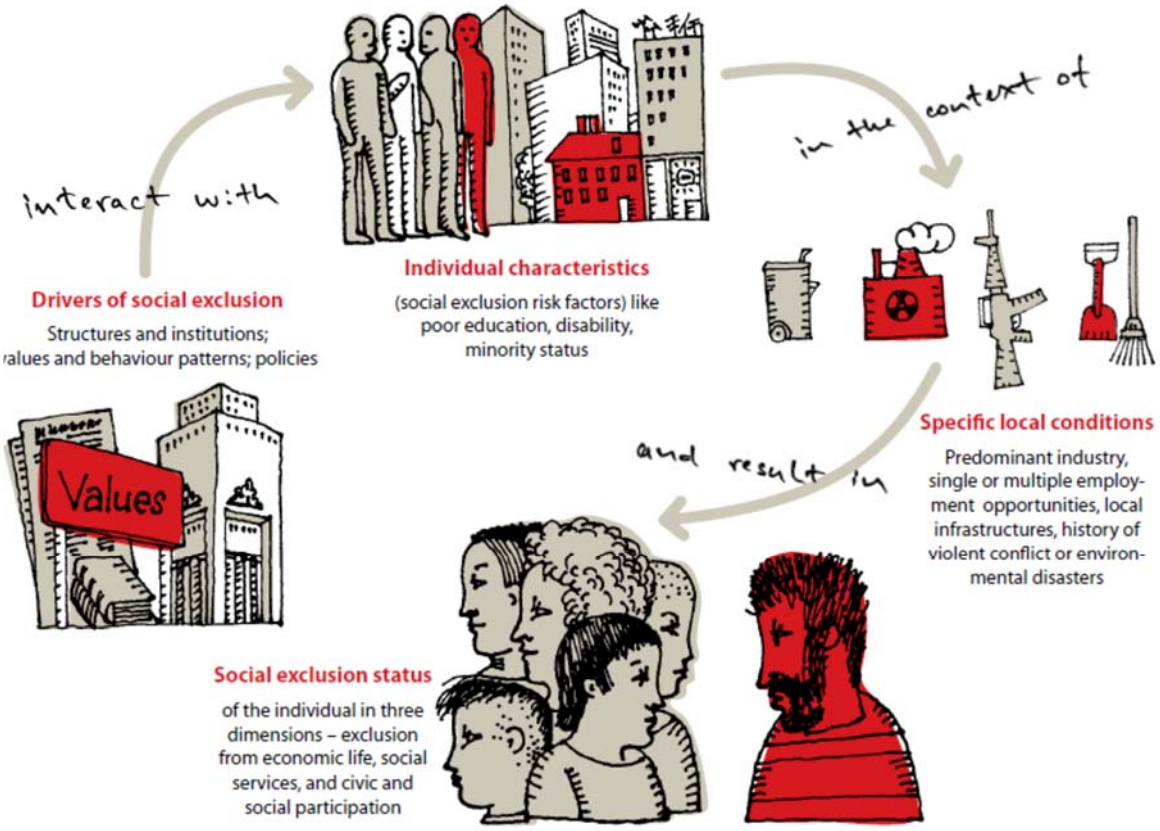

Figure 3: The "*social exclusion chain" (UNDP 2011, p. 13).

The UNDP report captures the complexity of social exclusion through a multidimensional Social Exclusion Index, a measure that is based on twenty-four types of deprivations. The index assesses the status of people and their households along three dimensions: economic exclusion, exclusion from social services, and exclusion from civic participation. The social exclusion index employs twentyfour indicators – eight for each dimension – that reflect the ways in which people are denied access to labour markets, education and health systems, as well as to civic and social networks. An individual is defined as socially excluded if he or she is deprived in at least nine indicators. Since a dimension contains only eight indicators, to be considered socially excluded a person must be deprived in at least two dimensions. The index reflects both the share of people that experience at least nine out of twentyfour deprivations, and the depth (how many deprivations socially excluded people experience on average). The report also makes a convincing case that, in the absence of deliberate and inclusive policies, too many people will become excluded, even if sustained growth returns. The report argues that achieving social inclusion is feasible, but it should be pursued systematically. It requires deliberate, comprehensive solutions that are tailored to specific circumstances, especially in diverse localities. It also argues that the tailoring is best done when those who benefit are included in the policy process. There is no silver bullet.

4.4.1 Exclusion in smart city initiatives

While this discussion is only partially relevant to social exclusion in smart cities, it brings to the fore relevant aspects for understanding deeper elements of exclusion. In the context of smart cities initiatives, a key form of exclusion is that of digitally less-skilled groups from smart services (and Living Labs). Engagement in smart city initiatives and the use of smart services, in fact, requires a certain level of

cognitive and material resources. Citizens lacking these resources will normally not be included as participants and co-creators in Living Labs, nor are they likely to be able to make use of the smart services once these are implemented on a larger-scale [Dutilleul et al., 2010]. The consequence is not only the risk of limited adoption and use of these smart technologies, but also of social inequality and exclusion [Evans and Karvonen, 2013].

In the context of smart city Living Labs, attention for social exclusion can help policymakers, as it does in transport policy debates [Lucas, 2012], to recognize that: a) the problem is multi-dimensional i.e. can be located with both the circumstances of the individual who is affected (e.g. being not engaged in smart technologies) and processes, institutions and structures within wider society (e.g. the way a Living Lab is organized); b) it is relational i.e. disadvantage is seen indirect comparison to the normal relationships and activities of the rest of the population; and c) it is dynamic in nature (i.e. it changes over time and space, as well as during the life time of the person who is affected). In policy terms, the concept also forces a focus not only on the experience of disadvantage but also on the associated economic and social outcomes of this condition.

The implication of this conceptualisation, therefore, is that its resolution primarily rests with the social agencies that are responsible for policy delivery, rather than the individuals that are affected. Policy makers need to consider the abilities, skills, resources, capacities and past experiences of affected individuals in the design of (smart city) policy solutions. Furthermore, the exclusion in the smart city Living Lab is not a problem per se but rather the consequences of this, the 'smart innovations', which may entail (in)ability to access key life-enhancing opportunities, such as employment, education, health and people's supporting social networks. In transport policy debated, this has led to a move away from the traditional systems-based approach to transport provision, towards a more people-focused and needs-based social policy perspective. It asks questions about equality of opportunity to access key services and equity of outcome rather than outputs and also begins to raise the issue of redistributive justice, i.e. the extent to which policy should seek to redistribute transport wealth in the interests of 'fairness' or 'justice' (see Lucas [2004] for more on this).

In the SmarterLabs project we should be mindful that the non-use of a smart mobility option may not constitute a problem for those concerned and should be labelled as exclusion only if part of the target group is not reached. We also should be open to the possibility that the non-use may be positively desired by the non-users. And we should accept that not everyone can be reached by a technology-based approach and that a certain amount of exclusion is inevitable.

The element of exclusion should be considered in a differentiated way (degree of exclusion, nature of exclusion, and the different causes for exclusion (for different mobility users in specific areas). The above discussion helps to do so.

4.5 Upscaling and the politics of scale (University of Maastricht)

In this section our focus is on 'upscaling', which as a concept has been most explicitly theorized in the transition studies literature. The conceptualisation of upscaling has evolved over time, and is still not uniform across different studies. The term was used first in a paper on Strategic Niche Management (SNM [Kemp et al., 1998]), which proposes five steps for 'regime shift': *the choice of technology, the selection of an experiment, the set-up of the experiment, scaling up the (successful) experiment and the breakdown of protection by means of policy*. In other words, upscaling is presented as a phase in a policy for regime shift, without further defining the term. In a subsequent study of SNM on biomass [Raven, 2005], upscaling was broadly used as a synonym of 'niche development', and from the case of biomass in the Netherlands conditions for successful niche development were identified: *niche-internally, continuous development is most supported by broad learning processes (e.g. not only technical, but also policy and social etc. learning), broad expectations (because they trigger actors to*

experiment in different directions), and broad social networks. But not only processes within the niche are important: *niche external developments are important too. For instance, changes in visions and expectations can especially be explained by changes in external conditions (ibid.)*.

Kemp and Van den Bosch [2006] conceptualize upscaling further, stating that during upscaling a new and stable sub-regime is taking shape (i.e. new structures and practices) that can form an alternative to the established regime. In other words, a niche experiment modulates (i.e. changes) into a meso-level development. Kemp and Grin [2009] offer a more precise definition for upscaling, referring to the emergence of a set of new practices (such as new governance practices or mobility practices), learned from practical experiments, with corresponding new structure and culture elements. The aspect of 'expansion' of the new practices is left out of the definition (and included in their definition of 'anchoring'). Van den Bosch [2010] summarized and rephrased these claims by arguing that upscaling basically means the fostering of institutional embedding. This implies that innovative practices (i.e. new or at least not widely established ones) gain a level of stability and affect established regimes so that they can trigger institutional change.

These definitions distinguish upscaling from the replication of experiments (on other locations), growing (i.e. the experiment continues with more actors) or accumulation (i.e. linking to other experiments). Although these dimensions may be part of upscaling in the above sense, they should not be seen as types of upscaling, as, for instance, Naber [2016] does. Figure 4 illustrates how we distinguish upscaling from diffusion and growth.

Upscaling, however, is not just a matter of the local development of meso-level structures that outlast the niche experiments. Upscaling is also related to knowledge transfer in the sense that knowledge travels between locations and that experimental knowledge work in a Living Lab can benefit both from localized learning processes and from experiments in other places (that are close in terms of content, topic). This refers to a complex debate on the possibility of knowledge transfer that we visualize in Table 4.

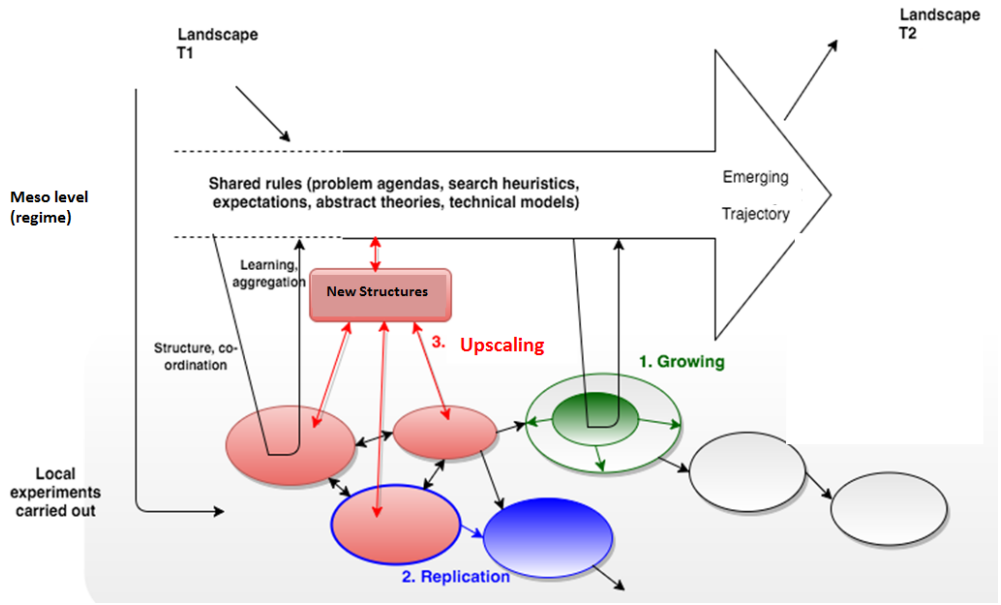

Figure 4: Upscaling, replication and growth (Figure is an adapted version of Naber, 2016[2]; and Geels and Raven, 2006).

[2] This master thesis (supervised by Rob Raven) suggests four types, 'based on previous SNM studies': (1) growing (i.e. the experiment continues with more actors), (2) replication (on other location), (3) accumulation (i.e. linking to other experiments), (4) transformation (i.e. the experiment shapes wider institutional change in the regime).

View on knowledge transfer	Knowledge is contextual	Knowledge is partly contextual	Knowledge is not contextual
Upscaling, replication or growth	Replicating Labs (only)	Upscaling as emergence of new practices	Growth of use (only), including accumulation

Table 4: Views on the transferability of knowledge and relation to upscaling.

On the one hand there are arguments that knowledge and learning is so contextual that solutions developed in one place and among a certain group of actors cannot be implemented in other places (see [Flyvbjerg, 2006], or [Coenen et al., 2010]). In this case the only thing that can be scaled up is the number of Living Labs itself. Every street should experiment itself, to put it to the extreme. On the other hand there are arguments and empirical evidence that geographic proximity is not a necessary condition for learning to take place [Boschma, 2005]. With reference to innovations like smartphones or TomTom, which are successful in many different places, proponents of this view would argue that once a successful solution is created in one Lab somewhere, it is a matter of diffusion and adoption at other places. Our view of upscaling takes broadly the middle ground between these two views (also see [Karvonen and van Heur, 2014]. This implies that solutions co-created in one Lab somewhere can therefore have impact beyond its particular place, or, the other way around: effective Labs anticipate upscaling their impact beyond their particular place and group of participants in the trial. Upscaling as emergence of new practices is of a different kind, although it may involve Lab replication and diffusion of use. It is the emergence of a set of new practices (such as new governance practices or mobility practices), learned from practical experiments, in which the innovative practices (i.e. new or at least not widely established ones) expand and gain a level of stability and affect established regimes (broadly in line with [Van den Bosch, 2010]). So they trigger institutional change.

In literature on social innovation the notion of upscaling is also important. Somewhat like SNM, upscaling (and growing and spreading) is seen a distinct (sixth) stage in the process of developing a social innovation [Gabriel, 2014], after exploring opportunities and challenges, generating ideas, developing and testing, making the case, delivering and implementing, and before the final stage of 'changing systems'. Upscaling is not defined very sharply, and tends to become a synonym for 'spreading'. In these studies, the question of 'what' is scaled up is taken broader than 'new practices' that are in focus in transition studies, and *can be programmes, services, products, organisational models – or more subtly, as ways of working, principles or ideas* (ibid.). The report sketches various options for organizing the upscaling or spreading process for an innovation to other areas, but does not address institutional change. Westley et al. [2014] distinguish 'scaling up' from 'scaling out' and 'scaling deep'. 'Scaling out' refers to 'diffusion': the organisation attempting to affect *more* people and cover a larger geographic area, whereas 'scaling deep' means further development in the own community (so taking geographic place as the main dimension of scaling). 'Scaling up' is reserved for when "*an organisation aims to affect everybody who is in need of the social innovation they offer, or to address the larger institutional roots of a problem* (ibid.)". The paper presents five typical ways of upscaling (volcano, beanstalk, umbrella, LEGO and polishing gemstones) of which examples are provided, but it's unclear how the five categories have been identified from a set of twentyfour cases. In general, the studies on social innovation devote most attention to the organisational aspect of upscaling or spreading. The concepts seem more applicable for cases that do not involve public authorities. They do not address 'co-creation' processes (with often a key role for the government), but processes 'led by the social innovator/entrepreneur' (even though some authors mention a required shift to an 'institutional entrepreneur').

Finally, geography has also paid a lot of attention to the role of scale and processes of rescaling. In contrast to the literature on transition and the literature on social innovation, the starting point of analysis in geography has been a critique of 'flat' histories of globalisation. Emphasizing that globalisation leads not to one global world, but instead to a reproduction and transformation of existing uneven geographies, geographers have highlighted the ways in which globalisation is above all 'glocalisation' [Swyngedouw, 2004] and involves a double dynamic of deterritorialisation and reterritorialisation [Brenner, 1998]. By and large this has been a political economic narrative with most attention paid to how the stretching of capitalist economic relations across global space is enabled by as well as followed by the rescaling of political regimes: in the European context, most clearly an upscaling towards the supranational scale of the European Union and a downscaling towards the subnational scale of cities and regions. This kind of analysis is less immediately relevant to grasp the organisational dimensions of upscaling a particular smart city project or Living Lab, but it does spatialize and make more substantial the often empirically thin descriptions of regimes and landscapes in the transition studies literature. Whereas in the transition studies literature, the empirical focus tends to be on the niche, the geography literature allows us to better understand the political-territorial position of particular niches within a multiscalar state configuration. A sophisticated understanding of this is necessary in order to be able to evaluate the possibility of and limitations to upscaling Living Labs.

Also, geographic work on the 'politics of scale' has extensively investigated the ways in which particular actor constellations (social movements, citizen initiatives, neighbourhood organisations, environmental groups, etc.) have tried to strategically manipulate and change scalar relations. Work inspired by Neil Smith's comments on 'scale jumping' [Smith, 1996] has investigated how social groups move to higher levels of organisation in order to realize their interests. In the empirical literature, there is some overlap with and conceptual slippage between the scale jumping literature and literature that addresses more the 'horizontal' networking of urban actors (sometimes also described as scale jumping, but actually more closely related to what the transition studies literature would call accumulation). Kevin Cox's work on 'spaces of engagement' and 'networks of association' [1998], for example, has paid particular attention to how these spaces/networks are strategically used and developed by actors to increase their own local power and legitimacy. Interesting empirical work has been done on the role of urban protest movements and how their 'local' success depends on linking up with actors both in other cities and on other scales. As Köhler and Wissen [2003] highlight, it is "this complex interplay between institutions and processes on different spatial scales which influences and provokes the search for new forms and scales of resistance" […] Claiming the `right to the city' today means the improvement of material living conditions in cities. […] Thereby, material issues are politicized and linked to the various spatial scales which shape them". In their article, they discuss various examples of this multiscalar articulation of urban protest: from street protests organized in cities worldwide against a world economic summit or the urban actions of local groups that are part of a global network such as ATTAC to the emergence of Local Exchange Trading Systems or cooperative housing movements in cities across South America. For our SmarterLabs project, this suggests that we should not only analyze the local dynamics of Living Labs in order to identify the potential of upscaling. We should also explicitly investigate the multiscalar structuration of our Living Labs as well as the ways in which the Living Lab actors strategically 'jump scales' and develop spaces of engagement in order to impact and transform the local regime.

As our SmarterLabs proposal notes, the current approach of Living Labs to technologies is focused on small-scale performance tests and technology-user interactions, largely ignoring the larger social-institutional context [Karvonen and van Heur, 2013; Karvonen et al., 2014]. In order to deliver some meaningful contribution to sustainability indicators at the urban level, the impact of the LL project needs to go beyond the level of a building, a street or small district. Since urban Living Labs are widely viewed as an instrument to address sustainability challenges that urban areas face, the work of a (successful) Living Lab project should be scaled up to the level of the socio-technical system (i.e. city or urban region). For SmarterLabs, therefore, the definitions of upscaling of Kemp and Grin [2009] and Van den

Bosch [2010] seem to be most applicable, referring to new or innovative practices, learned from practical experiments, that start to shape new (and expanding) meso-level structures. At the same time, we can learn from the geography literature that much of the success of local experiments depends on jumping scales and creating spaces of engagement that shifts the local power balance in favour of the local experiment at the expense of the vested interests of the local regime.

Nevertheless, the upscaling process needs to be defined for each particular case. Which new practices are meant? The following chapters will illustrate how each of the case studies respond to this question. In these 'local definitions' of upscaling we will combine the emergence of new mobility practices with new governance practices. One can argue that SmarterLabs should only focus on new mobility practices (since the logic of the upscaling in the project is that smart innovation is needed on urban level instead of street level in order to have a meaningful positive sustainability impact). However, we argue to focus on the combination of new mobility practices with new governance practices, because, we think these go hand-in-hand when they are 'smart' mobility practices. In SmarterLabs we view 'smart city' as a notion that stresses the role of knowledge in urban governance (more than data only), the role of measurements (in which ICT is an important but not the only way), and with a practice of participatory socio-technical innovation and policy-making (co-creation) to actually translate knowledge into policy (instead of suggesting that data speaks for itself).

4.6 Co-Creation and Living Labs (Vrije Universiteit Brussels)

The term co-creation came into being through the emergence of collaborative or participatory design or creation methods. In comparison to different terms used in literature describing collaborative design approaches such as co-production, co-collaboration, co-design, participatory design and user centred design, co-creation goes a step further as design is becoming a collaborative process where the user him- or herself becomes the designer. The aim of the co-creation process is to:

"[...] achieve a perfect fit between the design and the user needs, but also get a real user buy-in for the design solution. This is particularly relevant in the case of the kind of socio-cultural change process that we deal with within the field of sustainable innovation. Any designed solution is only as good as the amount of stakeholder support, and the quality of the stakeholder involvement" [Maase and Dorst, 2006].

Co-creation involves an element of knowledge integration but also integration of interests. Recent integrative models of the science-policy interface typify various forms of knowledge exchange in a common framework (see [Hoppe, 2005; van Kerkhoff and Lebel, 2006]), such as translation of knowledge from one community to the other(s) by various types of knowledge brokers [Pielke, 2007], exchanging knowledge in participatory platforms, and by forms of knowledge co-production (e.g. [Gibbons et al., 1994; Hessels and Van Lente, 2008]. Having emerged in the business industry, co-creation has become popular in the (urban) public sector and now tries to change the role of the citizens from consumers to active agents in the creation of new public service solutions. A city's complex structure cannot be designed because of its multi layered nature and multiple partial views. Dörk and Molteyne [2011] describe urban co-creation as the active engagement of citizens in shaping their cities. They describe the following characteristics of urban co-creation that can be considered as part of a decentralisation process: multitude of micro transformations instead of master plans, loosening of control, spreading of power, mutual intervention, participation and engagement of professionals and laypeople.

Along with today's increased need for participatory decision processes in sustainable urban development, modern online culture provides appropriate tools that facilitate public participation and co-creation of the social and physical environment of the city. Online culture has a tradition of cultivating collaboration and participatory ethics. These experiences can be used to be applied in the urban realm to coordinate collective action and help solve some of the urgent complex issues that cities are facing

[De Lange and De Waal, 2013]. Living Labs represent an approach to user-centred innovation by engaging stakeholders actively as contributors to the creative and evaluative processes in innovation and development. Therefore, facilitators of Living Labs must ensure to include all relevant stakeholders (as defined based on a stakeholder analysis) and apply a set of different methods that suits all of them. The support by the final decision makers is essential, who need to pre-define the creation freedom and communicate possibilities for co-creation transparently.

4.6.1 Conceptualising Living Labs

Largely developed in parallel to the smart cities debate, Living Labs address similar issues and have become one of the key methods and conceptual tools to approach urban development today. Initially, the notion of Living Labs was coined by researchers at Massachusetts Institute of Technology with the ambition of harnessing modern technology to interact with the daily activities of users in a home setting [Schliwa, 2013]. Over time however, practices built upon the need to address real-life conditions, which invariably pointed towards the human aspects involved with technology diffusion [Evans and Karvonen, 2011]. In this sense, the user assumes various roles, co-produces and tests innovation and replicates real-life conditions in interaction with other stakeholders [Schuurman et al., 2015; Nyström et al., 2014]. Ballon et al. [2005] refer to this version of Living Labs as entailing “an experimentation environment in which technology is given shape in real life contexts and in which (end) users are considered ‘co-producers”. By acknowledging the driving role of individuals and the usage context in which they are situated, the appeal of Living Labs widened towards researchers related to business models and scholars with a particular interest in research infrastructures, actor roles and innovation ecosystems [Eriksson et al., 2006; Juujärvi and Pesso, 2013; Liedtke et al., 2012; Schaffers, et al. 2011]. Common approaches to Living Labs, moreover, have been influenced by three broad developments surrounding ICT: a) the changing of role of users from consumers to prosumers, b) the need for innovators to shorten time between development and going to market and c) the growing importance of ICT in people’s daily life activities [Stahlbröst and Holst, 2013]. Living Labs are now embraced as iterative user-centric ecosystems, through which co-creation is considered an ideal practice [Schuurman et al., 2012].

Multiple qualitative and quantitative research methodologies emerged to support the role of co-production throughout the different innovation phases of ideation, implementation and testing, evaluation and feedback [Veeckman et al., 2013]. Schuurman et al. [2015] contend that as a result of limited theoretical development in this field however, Living Lab research and application has assumed a flexible and multifaceted foci.

4.6.2 Urban Living Lab dimensions

Particularly in the environmental domain, Living Labs are spreading. Cities not only contribute towards the production of greenhouse gases and environmental degradation with far-reaching consequences, but are recognized as frontrunners for sustainability [Bulkeley and Betsill, 2013; Hodson and Marvin, 2010]. This repositioning of the city is also reflected in new waves of urban governance that favour distributed decision-making, political institutions and processes that span multiple scales and levels, and the importance of collective modes of governance [Voytenko et al. 2016; Bulkeley and Castán Broto 2013]. For instance, policy mobilisation has fostered the growth of transnational municipal climate networks [Bulkeley, 2015; Busch, 2015], and the role of local climate change experiments in the city is reinforced by its rapid proliferation [Bulkeley and Castán Broto, 2013]. When combined with the significance placed on ‘the city’ as a forum for climate change and urban action, interest in Living Labs as a form of governance is growing [Baccarne et al., 2014; Evans and Karvonen, 2014]. The pursuit of alternative strategies in urban areas for sustainability, and distinctly multi-faceted approach to urban experimentation associated with urban Living Labs (ULLs), thus ensure an effective leverage for interdisciplinary European research funding [Veeckman and Graaf, 2015; Voytenko et al., 2016].

Running alongside commercial trajectories, urban Living Labs (ULLs) were injected into the sustainability debate and usually situated as a response to the urgency and uncertainty associated with climate change [Karvonen and van Heur, 2014]. They represent a concept, arena and practice of co-creating innovation to tackle societal challenges [Evans and Karvonen, 2014; Voytenko et al., 2016]. The distinctly messy and contingent nature of urban life means that sectoral foci include energy efficiency, food security, flooding, transport and mobility, waste [Voytenko et al., 2016]. Although climate change is often a common point of entry for ULLs, interventions under the banner of urban laboratories also touch upon economic growth, or attempt to co-design or collectively test alternative polices. The ULL concept and Living Lab methodology offer a transdisciplinary approach that cannot be explained fully within one theoretical domain, bringing both strengths and limitations [Evans and Karvonen, 2014; Nevens et al., 2013]. Rather than establishing coherence within one research tradition, the elasticity afforded by ULLs stimulates intersecting research through a various framings and complementary theories [Bulkeley and Castán Broto, 2013; Luederitz et al., 2016]. This is partly a result of the diverse nature of ULL as a practice, and the technical, social and organisational context in which they serve. With practical and conceptual underpinnings, ULLs do however share common properties of: i) situated experimentation ii) diversity and participation, iii) learning, and iv) evaluation [Voytenko et al., 2016; Karvonen and van Heur, 2014]. Each are employed in various ways and to differing degrees.

Situated experimentation

Defined as “sites devised to design, test and learn from social and technical innovation in real-time and in urban contexts” [McCormick and Kiss, 2015, p.45]”, ULLs occur in various different settings and for multiple different local challenges. It is common for ULLs to transpire either as an arena (i.e. a physically bounded space), an approach (a deliberate accumulation of various societal actors), or some combination of both [Schliwa, 2013; Voytenko et al., 2016]. The reason for this lies in the ‘inherently’ urban nature of ULLs as a form of ‘civic innovation’; boundaries can vary greatly in their geographical extent, ranging from a single road towards a regional district in a city. ULLs are exclusively bounded in this sense, affording a space that combines the immensity of sustainability goals with the tangible quality of a real-life setting. They approach local challenges in the context of the relevant institutions and the implications for novel local policy formulation. Therefore, ULLs serve to sustain movements towards local partnership in a city, produce ‘useful’ and ‘relevant’ knowledge from collaboration and create embedded sites of observable change and inspiration [Hellström Reimer et al., 2012]. This is the appealing nature of situated experimentation with ULLs; it trials technological and political novelties, challenging conventional norms and structures at times, in settings that can effect highly visible and radical change.

Diversity and participation

Karvonen and van Heur [2014] argue that experimentation lies not only in the bounded space, but also the role that this space plays in accumulating multiple actors in the pursuit of a common goal. There is consensus that by maintaining a participatory and inclusive character, ULLs place new partnerships and actor arrangements at the core of the urban agenda. By leveraging multi-helix models, ULLs forge industry-university-policy partnerships and combine expertise related to geography, sustainability, innovation and transitions. It is common for research and academic partners to spearhead the development of products or services. In this case, academia is embedded directly within ULL formulation, acting as a hub for attracting related funding alongside the municipality. The approach is far from being homogenous. Rather, ULLs and actor roles are implanted within larger discourses of development, power and diverging interests. For these very reasons, ULLs represent an opportunity through which diverse sets of partners can renegotiate their roles in urban change [Bulkeley and Betsill, 2013]. For instance, this can involve focus groups that facilitate co-design of a specific ULL [McCrory, 2016] or collaborative visioning sessions [Davies and Doyle, 2015], both of which are recognized as fundamental in open-innovation ecosystems [Nyström et al., 2014].

It is commonplace for stakeholders to represent diverging interests, however the way in which these interests are exercised and contested can play a fundamental role in shaping ULL outcomes. For example, Hodson and Marvin [2007] urge caution that urban experimentation can be appropriated for corporate interests, or serve as a test-bed for nascent technology. Furthermore, this reflects a broader movement by big business to capitalize on climate change by testing technology and pushing their agenda seemingly in the quest for a better society [Evans and Karvonen, 2011]. This does not mean that ULLs are inherently negative, but rather they can be adopted to serve corporate interests or reinforce dominant practices. A lack of attention towards the tensions surrounding diverse expectations, or an understanding of the representation of power in ULLs, can undermine the success of local or experimental projects that are in practice.

ULLs in principle not only stress the need for transdisciplinary collaboration, but also one that rejects tokenism and fosters deep engagement amongst actors [Lang et al., 2012]. By doing this, ULLs can serve as an opportunity to exercise flat decision making hierarchies, involve previously sidelined voices, or inspire social innovations and transcend hard sustainability solutions in cities [Dieleman, 2013]. It is imperative to strike a balance between voluntary members and targeted stakeholders, in order to side-step over-powering interests and exclusion of marginalized groups [Luederitz et al., 2016; McCrory, 2016]. For instance, there are empirical examples that suggest the potential to explore small-scale, socially-oriented sustainability solutions through social innovation [McCormick and Kiss, 2015; Dieleman, 2013]. Against a wider backdrop of urban experimentation and the growing shift from 'government' to 'governance', it is argued that this quality positions ULLs as an emergent form of political inquiry; potential sites where roles reconfigure and learning processes occur that can alter the future direction of cities [Bulkeley and Betsill, 2013].

Learning

ULLs can fundamentally be considered learning-oriented strategies. Learning-oriented in that, running parallel to the transdisciplinary expansion of ULLs, there is an emphasis on learning as both a goal, process and/or a directed outcome [McCormick et al., 2016]. Moreover, it is commonly the intention of those involved in ULL development or participation to generate conclusions that can contribute towards 1) broader narratives surrounding urban experimentation, or 2) the transfer of lessons within and across spatial scales.

Whilst it is not in question that learning can be considered inherently desirable in instigating transformative change [Armitage et al., 2008; Feola and Nunes, 2014; Voytenko et al., 2016], there is recognition within the ULL literature that a systematic approach to learning on a case-based level is lacking [McCormick et al., 2015]. ULL literature does not adhere to an overarching definition or conceptualisation; rather, sub-conceptualisations are heterogeneous in their definitions and investigation. This occurs as ULLs: 1) target change on different levels, 2) mobilise multiple actor sets and 3) seek to address a myriad of sustainability-related challenges. As a result, they lack a broad operational scheme that incorporates dimensions of learning into formative design [Luederitz et al., 2016]. A first step must embrace critical questions related to knowledge co-production: e.g. what do we actually want to learn from an experiment? Who should be learning within the lab, and how? What are the unintended consequences of this project on learning? How do we monitor and evaluate tacit dimensions of knowledge co-production?

Evaluation

Typically, learning and evaluation remain rather metaphorical, leading to fuzzy parameters for ULL progress [Voytenko et al., 2016; McCrory, 2016; Luederitz et al., 2016]. Efforts are growing to establish a common platform through which ULLs can be compared and appraised, but standardisation is proving problematic [Voytenko et al., 2016]. Scholars recommend reflexivity in ULLs as it places attention on underlying assumptions of an experiment, the structures within which it is embedded, and envisioning future pathways beyond this experiment [Armitage, 2008; Davies and Doyle, 2015; Raven et al., 2010].

Moreover, remaining attentive to the potential contributions of a ULL will extend beyond a standalone experiment to be conducted, and towards one that is dynamically monitored and evaluated as a viable transformative alternative. Reflexive ULLs enable strategically directed learning opportunities, adjustments and iterations during implementation and from ex-ante evaluation, and ex-post appraisal. In this sense, the aspirations of Living Labs align with those of transition experiments [Nevens et al., 2013] in that they propose directed, real-time experiments that strategically target social learning to realise and envision transformation [McCormick and Kiss, 2015; Voytenko et al., 2016; Bos and Brown, 2013; McCrory, 2016].

4.7 Final remarks: towards “smarter” labs (Vrije Universiteit Brussels and SUPSI)

Both ULLs and more applied Living Lab methodologies have begun to proliferate beyond academia and into application domains with the popularisation of the participatory smart city [Baccarne et al., 2014; Manville et al., 2014], especially after acknowledgement of the importance of human dimensions regarding “people” and “collaboration”. Contemporary initiatives depart from the notion of technological utopia by embracing holistic visions that humanize “smartness”, and in so doing, address tensions surrounding top-down smartness and grassroots governance [Veeckman and Graaf, 2015; Cugurullo, 2013]. Smart technologies are reframed as enablers rather than controllers, and the smart city as a platform [Baccarne et al., 2014], both with the mutual aim of enhancing the quality of life in the city. Furthermore, ULLs seem to play a prominent role in this narrative by directing attention towards multi-level decision making, citizen-driven innovation and visible demonstrations. Furthermore, as asserted by Baccarne et al. [2014], Living Labs in the context of Smart Cities bring a wealth of opportunities regarding the reuse of governmental data, knowledge and networks. For these very reasons, the spatial reduction of smart cities into “smart districts” or “smart streets” is a recent trend, aiming to establish real-time experimentation and accelerate urban planning on a more concentrated level [Fitzgerald and Lenhart, 2016]. Examples such as the Oxford Corridor, Manchester [Evans and Karvonen, 2014], Smart Kalatasama District, Helsinki [Ojo et al., 2015] and the StreetLab, Copenhagen, all serve as prominent examples of such concentrated innovation, aiming to translate Living Labs principles from a flagship neighbourhood and into the core of a wider smart city agenda.

Summarizing the previous discussion on smart cities and Living Labs, it becomes clear that SmarterLabs potentially provide exceptional opportunities to experiment with new governance approaches, as long as organizers strive for including all the main categories of social actors, with a special attention for those who are traditionally marginalized, such as younger, elderly, and ethnic groups, adopt a problem-driven approach and perform both face to face meetings and virtual platforms to share ideas, assessments and counter-proposals [Marsh et al., 2014]. To avoid general rebound effects, SmarterLabs must widen boundaries of action and take into account large-scale and life-cycle analyses when co-designing and co-implementing the path for the evolution of the city. Consequently, SmarterLabs should not opt for heavy technology, infrastructure-led visions, favouring instead soft visions, where technology is directly in the hands of the citizens, who exploit it by means of smartphone and social media [Hill, 2013]. That is: the focus of cities’ actions should move from “smart technologies” to “smart people” and “smart collaboration”. In fact, even when digital literacy is granted, experience shows that digital-based activism is not enough to guarantee interest by individuals for a long period of time: it needs to be nurtured, rekindled and further stimulated by physical, in person meetings and activities. For example, Hill [2013] presents effective governance in smart cities as a combination of social media and “the piazza” (explicitly naming it in Italian: the square, seen as the central urban meeting and discussion place, recalling the ancient Greek “agorà”). The following table summarizes the key limitations confronted by most smart city and Living Lab approaches and points to the strategies to be pursued to overcome these limitations.

5 Retrospective analysis

In the above framework, a retrospective analysis was performed for each city engaged in the SmarterLabs project, with the aim of identifying the specific constraints that affected past transformation processes, particularly with respect to social inclusion and upscaling of the process outcome. In this Chapter we focus on the activities developed by Swiss team: after a brief introduction to urban governance processes in Switzerland, aimed at contextualizing and better informing the retrospective analysis, we summarize the analyses we developed for the City of Bellinzona, based on three case studies. A complete overview of the retrospective analyses developed for the three other SmarterLabs cities by the Austrian, Belgian and Dutch teams is provided in the SmarterLabs Deliverable D3.1.

To guarantee that the retrospective analyses related to each of the four SmarterLabs cities could be cross-compared, and similarities and differences could emerge, they were all developed according to the following four perspectives:

- Overcoming resistance to innovation and innovation achieved;
- Lessons learnt;
- Co-design;
- Openness, reflexivity and public value creation.

For the city of Belinzona, as a first case study we analyzed the process behind the introduction of a regional bike-sharing scheme, aimed at promoting both technological innovation and individual change of mobility behavior. Indeed, the bike-sharing service has not been implemented yet, being instead replaced by long-term rentals of reconditioned bicycles. Even though this latter initiative generated a project of social cohesion and awareness-building around soft mobility, rather than implementing a traffic management solution, the implemented long-term rental was successfully implemented and also generated other related initiatives: it can therefore be regarded as an example of successful amplification, even though it has not yet contributed to an explicit upscaling in terms of bicycle usage and capacity in the City of Bellinzona. The second case study refers to a successful example of tackling individual mobility habits by adopting an inclusive and participatory approach, open to interaction and collaboration with the relevant stakeholders: the process of elaboration and implementation of action plans to favor sustainability and road safety on the way from home to school for primary education children. Success of the approach increases the prospect of an easy upscaling of the plans and diffusion to other contexts in the near future. On the contrary, the third case study shows a governance failure, due to the lack of open-mindedness and willingness to guarantee inclusive decision-making processes. Such a case study is not strictly related to the field of mobility (it refers to land use), however it teaches us a lot about typical urban governance approaches in the City of Bellinzona.

For all these three case studies, the analyses were based on:

- official documentations produced by the involved institutions;
- press material appeared in both in local newspapers and local online news channels;
- interviews with the civil servants of the City of Bellinzona;
- direct experience and involvement as external advisors to the City of Bellinzona.

5.1 Governance of urban processes in Switzerland

Switzerland is a federal state: state power is shared between the Federal government, the Cantons and the Municipalities. In such a three-level government structure, the highest level is occupied by the Confederation. According to the Constitution, its tasks and responsibilities include Switzerland's relations with the outside world, defense, the national road network, environmental protection and

nuclear energy. At the second level stand the Cantons, with equal status and rights. Each Canton has its own constitution, parliament, government and courts. Each Canton determines itself how to share responsibilities with the Municipalities. Usually, responsibilities of the Municipalities include local planning and management, running the schools and social welfare.

Spatial planning, which is crucial for the development of the built environment and the management of the related mobility needs and environmental impacts, is mainly performed by Cantons and Municipalities: the Confederation just develops general framework principles and guidelines, giving the Cantons the responsibility to implement and apply them. Generally, the Cantons then delegate them at the municipal level. Therefore, the limited legislative responsibility of the Confederation leads to a variety of broad policy guidelines, spatial planning concepts and instruments, which leaves Cantons the possibility to adapt them to their specific regional context. Such an approach allows to explicitly take into account different spatial, socio-economic and cultural characteristics [Muggli, 2012], though it might produce a critical fragmentation between Cantons.

5.1.1 The policy of urban agglomerations

Despite the different attribution of competences between the above government levels, however, they need to strictly collaborate among each other. In fact, although spatial planning is a competence of the Cantons, the Confederation has competences on transport infrastructures planning (roads and public transport systems) and environmental protection, two elements which significantly affect land use planning, and vice-versa [Muggli, 2012]. In order to favor multi-level collaboration, since the early 2000s the Confederation developed a new set of policy measures aimed at promoting planning of the built environment at the “urban agglomeration” level – where the “urban agglomeration” corresponds to an intermediate level between the Canton and the Municipalities. Adopting an over-municipal approach, developing larger scale analyses and seeking for effective solutions also beyond municipal boundaries is in fact increasingly acknowledged as the only way to successfully tackle mobility-related issues.

With the introduction of a more regional, urban agglomeration policy, the Confederation also provides new funding opportunities for transport-related infrastructures. Here, conditions for accessing such funds are that regional agglomeration programs present an integrated, multi-sectoral approach to spatial development, taking into account settlement, environment and mobility needs, as well as ensure citizens involvement during the planning process. To develop them, new institutional bodies called “Regional Commissions for Transport” have been created. Such commissions include a representative of each municipality of the agglomeration and are usually supported by scientific and technical external advisors.

5.1.2 Citizens involvement and participation

The Swiss system is often referred to as a direct democracy, that is a form of democracy in which people directly decide policy initiatives – usually, by voting them. Indeed, the correct definition would be “semi-direct democracy”, that is a representative democracy significantly including direct democracy tools [Eschet-Schwarz, 1989; Kaufmann, 2007]. In fact, representative democracy processes are strengthened by the possibility for citizens to advance proposals for laws or policy measures (launch of a “popular initiative”) or to oppose already taken decisions (activation of a “referendum”). Elections of representatives take place every four years, though on average Swiss citizens are invited to vote four times a year, spanning over very different domains: from the local approval of funding for new infrastructures (e.g. schools, transport, museums) or services (e.g. introducing a cafeteria service in schools or activating new bus routes) to foreign policy and international treaties. Both the “initiative” and the “referendum” tools are very frequently used at all government levels, including the Municipal one [Ladner, 2002].

There is a debate whether leaving common citizens final policy and legislation decisions always leads to right and fair solutions [Trechsel and Sciarini, 1998], especially considering votes are necessarily simplified as “yes-or-no” alternatives [Dalton et al., 2001]. Also, very frequently calling citizens to vote might stimulate their disaffection, as the average turnout rates suggest: they are in fact pretty low, around 40 % [Altman, 2013; Blais, 2014]. Finally, there are risks of unbalance in access to resources (especially, money) to campaign in favor of a specific choice, which might strongly affect poll outcome [Parkinson, 2011].

In general, however, Swiss citizens tend to be very proud of their direct democracy processes. Due to the longstanding tradition of such institutional processes, participatory decision-making held outside “initiatives” and “referendum” is not widespread in Switzerland. Strategic plans, programs and policy-making activities are however usually supported by a consultation process, involving the relevant stakeholders and, in limited cases, also the general public. Nevertheless, such consultation activities usually take place at an advanced stage, when all relevant elements have been designed, and possible alternative options have already been rejected, so that stakeholders are mainly allowed to either accept or refuse nearly final proposals, with no room for radical changes.

5.1.3 Peculiarities of today’s Bellinzona

Bellinzona lies in the above governance framework. The City hosts the Canton Ticino government and parliament and it is also part of the “Bellinzonese” urban agglomeration (Figure 5). As a further complexity in such a multi-level governance structure, since the last five years the whole Bellinzonese area has been undergoing a deep restructuring of the local institutions themselves, with a formal administrative aggregation between thirteen municipalities and the creation of a “New City of Bellinzona”.

In 2012, indeed, Bellinzona and other sixteen neighboring towns elaborated a common plan for their reorganization, in the form of aggregation. The majority of them, in fact, were small municipalities, which were no longer able to face the growing needs of the population, and tended to rely on cantonal institutions, instead of providing services by themselves, as the Swiss three levels of government would have required [Fenazzi, 2017]. Going beyond pre-existing jurisdiction borders would have also allowed to advance more effective wider-area services and land use plans, overcoming the barriers associated to past parochial divisions. Settlements are in fact an urban continuum, with a few focal points (a couple of city centers, besides Bellinzona), the rest mainly being low density suburban areas.

The proposal of aggregation was widely discussed at the local level, and local referendum were held in 2015 in each of the involved municipalities. Even though such referendum had a purely advisory role, their results were kept in high consideration by the municipal decision-makers: in thirteen of the involved municipalities, including Bellinzona, citizens voted in favor of the aggregation. In four municipalities, instead, citizens opposed the aggregation project and therefore their political authorities opted for withdrawing from the aggregation. Citizens of such municipalities, mainly located at the borders of the aggregation area, especially feared central communities would have gained all the benefits of the aggregation, to the detriment of the outskirts. Exactly because such municipalities were located at the borders of the whole area, however, their decision to withdraw did not prevent progress of the whole aggregation process: official formalization of the “New Bellinzona” municipality, covering the territory of the thirteen former ones (see Figure 5) took place in early 2017, with the election of the new Municipality and the City Council.

Despite the creation the “New Bellinzona” municipality, complexity of the decision making processes for mobility issues was only simplified, not totally solved. In fact, the “Bellinzonese agglomeration” (the area for which the Confederation incentivizes development of “agglomeration programs”), is still made by a plurality of institutions, still represented in the “Bellinzonese Regional Commission for Transport”: the

“New Bellinzona” and the other four municipalities which rejected aggregation. Therefore, positively concluding decision-making processes at the agglomeration level still requires to reach agreements between different, sometimes conflicting, local institutions.

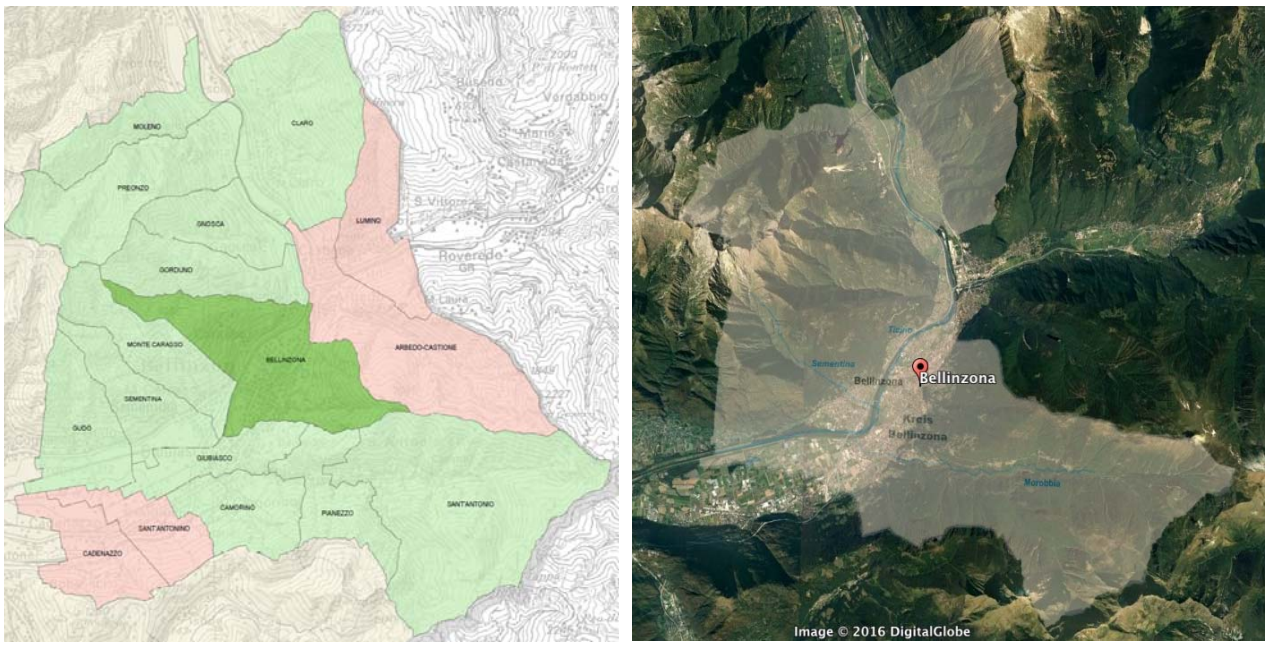

Figure 5: The area of the „Bellinzona agglomeration“ (agglomerato del Bellinzonese). The map on the left shows municipal borders: the „Old Bellinzona” municipality is shown in dark green, while the municipalities which just aggregated into the „New Bellinzona” are shown in light green. Pink represents the municipalities which rejected aggregation. The map on the right shows the spatial distribution of settlements in the valley floor: a continuum of (low density) urbanized areas.

5.2 Case 1: A regional bike-sharing service and the “Ricicletta” bicycles initiative

Like all conurbations, Bellinzona typically presents increased traffic problems due to urban sprawl and consequent intensive (and mainly car-based) commuter travel. Solutions to these problems have been initially elaborated within the context of the Bellinzona Regional Transport Plan (*Piano dei trasporti del Bellinzonese,* PTB) first, then transmuted into the Bellinzona conurbation program (*Programma di agglomerato del Bellinzonese,* PAB). Such conurbation programs were introduced in the late 2000s by the Swiss Confederation to fund transport infrastructures (up to 50 % of the investment costs), provided that they are based on integrated transport and land use assessments at the conurbation level and are coherent with transport land planning strategies at the cantonal level. Such funds are made available periodically over time. The municipalities around Bellinzona (overall 17 municipalities) managed to develop a conurbation program for the second wave of funding (PAB2, 2011) and have just developed an updated version (PAB3, 2016), revising the previous one and integrating a new set of measures.

Among the measures developed by PAB2 to promote slow mobility (i.e. walking and cycling), we focus on the project for a regional bike-sharing system. Classified as a high priority measure to be realized between 2015 and 2018, the new bike-sharing system would have at first involved four municipalities (Bellinzona, Giubiasco, Sant’Antonino and Cadenazzo), envisioning enlargement to other areas in case of success. Investment costs for the realization of the infrastructure were estimated in 260,000 CHF, 40 % of which were asked to the Swiss Confederation, the rest being paid by the four municipalities involved. In spite of the classification as high priority intervention, however, the bike-sharing system has

not been realized yet. After analysis of PAB2, the Swiss Confederation refused funding it, classifying it as a local measure, however asking municipalities to keep it in PAB2 and to fund it by themselves. The result was that it disappeared from the updated PAB3 document, where it is mentioned only in a final table as “suspended project, after an in-depth analysis on its costs and benefits”.

Realization of a regional bike-sharing service was therefore frozen, with no indication regarding how and when discussion about it would restart. In such a framework, the City of Bellinzona decided to independently activate a smaller-scale measure to promote bicycle use. In Spring 2016 they launched the “Ricicletta” project (a wordplay between “bicycle” and “recycle”), offering free long term bicycle rental to all the interested citizens. The City recovered twenty-five bicycles from old, no longer used ones thanks to an employment program in collaboration with the association of Swiss Labor Assistance (Soccorso Operaio Svizzero – Ticino SOS-TI). Citizens were invited to borrow these bikes for an entire year for free, provided that they gave the City of Bellinzona some data about their mobility patterns. Of the twenty-five bicycles available, twenty were soon rented by citizens. The major success of this project, however, lies in the launch of a follow-up project, proposed by SOS-TI and supported by the city of Bellinzona itself: SOS-TI launched the “Ri-pedala” (something like “Re-ride”) pilot project for short term rental of bicycles from a restaurant they manage, located just in front of the Bellinzona railway station. They recovered a number of other *riciclettas*, offering them to very popular prices for a few hours, a day or a whole week, and involved refugees and disadvantaged persons to manage and run the service. The offer was mainly targeting tourists, who could arrive in Bellinzona by train and then move by bicycle across the city and the surrounding areas. The pilot project had a four months duration, from September to December 2016. The pilot project has just been extended for a few months, until Summer 2017. After that period, SOS-TI and the City of Bellinzona will assess whether to reactivate it and offer it on a permanent basis.

Figure 6: The “Ricicletta” flyer developed by the City of Bellinzona (left) and the “Ri-pedala” flyer developed by SOS-Ticino (right).

Figure 7: The City of Bellinzona has recovered twenty-five bicycles from old, no longer used ones thanks to an employment program in collaboration with the association of Swiss Labor Assistance (Soccorso Operaio Svizzero – Ticino SOS-TI).

5.2.1 Overcoming resistance to innovation and innovation achieved

This case study allows us to analyze two processes at the same time: the failure of the regional bike-sharing service and the success of the Ricicletta bicycles.

Regarding bike-sharing, we distinguish two novel practices: the practice of bike-sharing in the field of mobility, with an important infrastructural/technological element, and a general governance practice, related to the collaboration among different municipalities in a mobility sharing system. Municipalities involved in PAB2 had in fact at first opted for a traditional bike-sharing scheme, with fixed pick-up and delivery stations, even though however more innovative schemes are nowadays already available. For example, free-floating bike-sharing schemes offer more flexibility in cities, since bicycles can be freely returned and picked up in any place within a certain area, everything being based on a smartphone app, which allows real-time identification of the bicycle position. Discussion about such technological options was not even contemplated at the time of the elaboration of PAB2, probably because it was thought easier, and less risky, replicating the same traditional bike-sharing scheme already used in other areas of the Canton Ticino. This attitude somehow reflects a low willingness by the project leadership to acknowledge innovation in this field, as well as no consideration on possible future upscaling barriers linked to the choices made, let alone the explicit contemplation of citizens' and travelers' views, needs and expectations in this regard.

Innovation regarding governance refers instead to a change in institutional practices requested to activate and manage the regional bike-sharing service. In fact, the lack of federal funds by PAB2 implied that single municipalities had to pay for both the investment and management costs (maintenance of the bicycles and of the pick-up stations and daily re-balance of the position of the bicycles among the stations). Without a top-down coordination, municipalities would have realized different bike-sharing services, each one on its own district, instead of creating a single, integrated service. This would have been highly inefficient both from the operational and the economical point of view, since it would have

created diseconomies of scale. For this reason, the project was frozen, waiting for the future supposed "Greater Bellinzona", resulting from the aggregation of thirteen neighboring municipalities[3].

Real reasons behind the abandon of the regional bike-sharing project were however likely related to low political priority by political authorities (notwithstanding high priority classification in PAB2). In fact, in other occasions, successful collaborations between municipalities overcoming administrative fragmentation were activated in Canton Ticino, for example to organize police or school services.

In the second case ("Ricicletta"), innovation refers instead to the fruitful collaboration between public and private (non-profit) institutions, which also lead to an additional project: the "Ri-pedala" pilot project. The "Ri-pedala" initiative was proposed by SOS-TI and the City of Bellinzona accepted to support it with 15,000 CHF funding, in exchange with data regarding users of the *ricicletta*s (when every *ricicletta* was rented and by whom, for how long, for what purpose, for what indicative route). Success in the collaboration is probably due to the fact that the project was very simple and solid, results were easy to be measured and it required a limited amount of funding. The risk in the hands of the City of Bellinzona was therefore very low. Also, social implications behind "Ri-pedala" were an additional reason for the City to support it. In any case, however, it has to be kept in mind, that the main target of the "Ri-pedala" project is to simply offer an alternative mobility mode to tourists visiting the City – as such, this initiative does not represent an explicit strategy developed by the City administration to scale up the number of kilometers run by bicycle, nor to increase the number of bicycles used in the City. On the other hand, from this point of view, even the "Ricicletta" project itself had quite low ambitions, since it only aimed at encouraging the twenty-five *ricicletta* renters to go by bicycle more frequently, and, notwithstanding the success of the first year's rentals, did not envision an increase in the *ricicletta* fleet.

5.2.2 Lessons learnt

The failure of the PAB2 bike-sharing measure shows the difficulty of practical collaboration between municipal institutions: though apparently they share goals and actions to achieve them, when it comes to practical activities, administrative barriers are still high. Since Spring 2017, though, the aggregation of thirteen municipalities around Bellinzona into one single conurbation has formally taken place. It is hoped that this new administrative arrangement will provide the right institutional frame for a more coherent regional planning and management of infrastructural needs, especially in terms of transport and mobility.

The "Ricicletta" project was assessed very positively by the project leadership as an awareness-building tool, since it produced visibility to bicycles and was a measure to promote its diffusion at the urban level, under a negligible cost. The regeneration of used bicycles to produce *ricicletta*s overall only costed 2,000 CHF – which was possible since SOS-TI employs personnel whose salary is mainly already paid by cantonal unemployment insurances. However, the "Ricicletta" direct effects on traffic reduction and individual mobility behavior change are negligible as well and there was no explicit strategy to further shape a growth of bicycle kilometers driven or modal share in the future. This rather frail stance taken by the administration in regards to upscaling bicycle use in the City of Bellinzona somehow reflects a rather weak political support dedicated explicitly to the goal of promoting slow mobility practices in Bellinzona. Slow mobility is not officially considered a viable alternative to the prevention of traffic congestion and decrease of private car use – a role that has been still delegated mainly to improving public transport services and park & ride infrastructures (as reflected in the measures contained in PAB2 and PAB3). Even "Ri-pedala" was not expected to produce significant effects on urban traffic, since it only targets tourists, who are not among the main drivers for traffic in that area. Surely, these two

[3] The regional bike-sharing project was in the end realized in May 2019, with the installation of six bike-sharing stations, for a total of 45 bicycles, connected to the same Velospot system already into activity in the Locarno region. Nowadays a fully interoperable bike-sharing system is therefore active throughout the Locarno and Bellinzona districts.

initiatives cannot be compared with the impact a regional bike-sharing scheme would have had on traffic management: their main characteristic is probably that of generating social responsibility and awareness-building around mobility issues, rather than effectively curbing down car traffic.

Nevertheless, the City administration has recently reconfirmed its support to both the “Ricicletta” and “Ri-pedala” initiatives, the latter being re-proposed until mid-July 2017, with an additional 8,000 CHF funding by the City, in order to test it for a more effective impact during the Spring season (since “Ri-pedala” bicycles were mainly targeting tourists, Autumn months are not an ideal period to test the effectiveness of the commercial offer). One interesting aspect that has emerged from the previous experience is the fact that the hiring of the “Ri-pedala” bicycles was more successful whenever the vehicle itself was marked with Bellinzona’s City logo. Consequently, the renewed “Ri-pedala” initiative will now (i) produce a series of additional new *riciclettas*, all bearing the City logo, as well as (ii) enlarge the “Ri-pedala” bicycle fleet with at least part of the existing City-marked “Ri-ciclette” that are being returned by citizens, (iii) include the participation of the main local energy utility (AMB) as a sponsor for future activities. The financial support that has been provided to the “Ri-pedala” project by the City administration in these two pilot phases is substantial (a total of 23,000 CHF) and justified by the fact that the initiative is contemplated as a forerunner project for the collection of data and useful inputs to the formulation of a future bike-sharing program in the City of Bellinzona. As such, even though the “Ricicletta” and “Ri-pedala” projects cannot yet be regarded as an explicit example of successful upscaling, they nevertheless both represent a positive precursor sign for the creation of a future functional and participative bike-sharing system in Bellinzona.

5.2.3 Co-design

The process for the elaboration of PAB2, which included the regional bike-sharing measure, was managed by a group of sector professionals, supported by a commission of six representatives of the 17 municipalities involved and some representatives of cantonal sectors, and included periodical meetings with representatives of all the municipalities. Its elaboration followed therefore a traditional top-down, expert-led approach, where little space is dedicated to bottom-up creation of vision and ideas. Each municipality mainly seized the occasion to include projects they had already envisioned, with the aim of getting funding to cover their realization. Probably, if a more inclusive process had been activated to support identification and design of each PAB2 measure, such as, for example, interviewing travelers and citizens about their experiences, needs and expectations (e.g. station-based or free-floating bicycles), critical aspects behind the project of a regional bike-sharing service would have soon emerged, thus leaving room for the identification of alternative ways to guarantee cost-effective management.

Even the “Ricicletta” and “Ri-pedala” projects themselves, still represent more of a top-down approach, since they started from the initiative of a civil servant of the City of Bellinzona, who had the idea and subsequently activated contacts with an external partner, SOS-TI, and managed to get municipal funding. Nevertheless, this public-NGO partnership has proven fruitful, since it was SOS-TI who later contacted the same civil servant to get the financial support for the “Ri-pedala” activity. So, both projects were co-designed by the two institutions and this is a further ingredient of their success.

5.2.4 Openness, reflexivity and public value creation

As indicated above, the only actors involved in the decision-making process behind PAB2 were the commission of experts and representatives of the 17 municipalities involved. A final consultation targeting the population and local stakeholders was organized only at the very end of the process, just before submission to the Swiss confederation: the final PAB2 program was presented to the population and thirty days were allowed to present any proposal, observation or request for clarification. Consultation opened on September, 17 2011 and closed on October, 17 2011. Considering PAB2 was

submitted to the Swiss Confederation on November, 9 2011, it appears the consultation did not influence any of the decisions already taken. Therefore, the process remained rather sealed and little reflexive in its approach of securing public interest, avoiding inequalities and anticipating and/or tackling possible risks of exclusion.

The “Ricicletta” and “Ri-pedala” projects, instead, were totally developed by the city civil servant, without discussion with other actors apart for the SOS-TI stakeholder. Considering their limited impact both on traffic and on the city budget, it is understandable that no specific participatory project was launched; however, including citizens or other actors in a wider participatory process regarding the future of mobility would have probably guaranteed more success to the “Ri-pedala” project and ensured more effective upscaling conditions. At present in fact, there’s the risk that this initiative might turn into an isolated case, with no long term prospects.

Nevertheless, the “Ricicletta” and “Ri-pedala” initiatives might be considered more as activities of public value creation, rather than of traffic management. The “Ricicletta” and “Ri-pedala” projects indicate in fact an innovative local strategy of community-building and networking promoting social responsibility in terms of both (re-)integrating unemployed/refugees people in the labor market and encouraging at the same time a more ecological, soft mobility in the City. As such, the emerging partnership development between the City department and the SOS-TI non-profit organization is surely a positive and open outcome from the point of view of social inclusion.

5.3 Case 2: Mobility plans for schools

In 2011 the City of Bellinzona adopted a participatory approach to school mobility planning: it launched the “Mobility plans for schools (PMS)” within the so-called “Better on foot” school project (http://www.meglioapiedi.ch/) with the aim of stimulating a more sustainable mobility behavior within the school community (addressing pupils, parents, teachers, school staff) as a mean to promote children’s health and road safety, as well as to reduce traffic congestion and pollution.

Figure 8: Excerpt from the material developed by PMS addressing pupils and parents.

5.3.1 Overcoming resistance to innovation and innovation achieved

The innovative aspect of this initiative is that PMS provide an inventory of existing home to school modal patterns and elaborate possible alternative solutions on the basis of bottom-up inputs received from the school community in collaboration with a professional mobility expert working closely with the public administration. The PMS project has been extended to cover the compulsory school system of the City of Bellinzona, subdivided into 4 city districts. In total, 6 PMS have been elaborated since 2011, involving 12 schools (6 pre-schools, 6 primary schools, 2 middle schools). Up to now, the project has not been expanded to secondary school levels, such as vocational or high schools. This is mainly due to the fact that these kind of schools are not part of the municipality's policy area. Furthermore, mobility patterns of students here change significantly and include a much wider travel area, with pupils travelling in many cases from all over the Canton. As such, any intervention to amplify the initiative would, in this case, necessarily need an integrated planning and management approach harmonizing two different administrative levels (municipal and cantonal). In itself, the PMS is a voluntary measure, not linked to any formal planning processes of the City. Consequently, it does neither rely on a specific budget for the implementation of the proposed action plan, nor is it a binding tool. The recommendations emerging from the PMS and possible interventions are financed by resources derived from other official urban planning tools available to the City, such as the overarching Bellinzona conurbation programs (PAB) or the municipal traffic management plan.

Interestingly, since Spring 2017 the City of Bellinzona is currently experiencing an important transition from a former single municipality to an aggregation of 13 municipalities. Although the project leadership has not yet explicitly anticipated additional expanding of the PMS, the new administrative organization of the city will most probably oblige Bellinzona to address this issue, if it wishes to maintain and extend this innovation process to its wider community. However, in the light of the future, possibly more explicit

expansion of PMS towards an essential governance practice of the City, it might become necessary to include PMS into the framework of mandatory local plans and would probably need a process of formalizing PMS as an official participatory mobility planning tool of the City. In this context, however, political will and priority-setting in regards to a topic that is often regarded of low concern, such as participatory school mobility, might turn into a potential constraint towards PMS's upscaling process.

5.3.2 Lessons learnt

According to the project leadership, the most important achievement of the PMS is to have created a virtuous circle of good practice, mainly fueled by citizens (sensitive parents) that see their fears of traffic and safety and more specific requests taken into account by the local administration. Furthermore, the PMS have triggered new requests from the local community, such as the organization of cycling agility courses for children, the purchase of a bicycle pump-track by the City and the promotion of a "bicycle bus" initiative.

Considering that children are often ignored when designing public spaces, the fact of producing ideas concerning mobility habits and road safety together with the involved key actors, ensured the City department of the creation of new knowledge in regards to the integration of children's specificities into school mobility planning. For instance, the PMS revealed that the dynamics of dropping off children at school and that of picking them up after school involves two completely different behavioral schemes from parents – aspects that have been progressively taken into account in the logistic organization of respective temporary parking areas. As for the evaluation of the project itself, unfortunately, there is no in-depth monitoring system currently in place to evaluate the project by the City department. Main reasons for this are (i) the limited time resources available to the local administration to undergo such targeted analysis, and (ii) the continuous renewal of the school community and change of context having to be monitored.

5.3.3 Co-design

The school project "Better on foot" and the respective PMS act along two lines. On the one hand, it has a top-down approach to promote the collaboration between the different sectors of health, transport and education, as to obtain the necessary local organizational and infrastructural support to promote slow mobility measures at school. At the same time, a bottom-up approach is applied, as to actively involve families, children and school staff in the set-up of new initiatives addressing slow mobility. While the set-up of the PMS action plans and recommendations worked out well in terms of an inclusive, participatory process involving the school community, the most involved actors were mainly parents and, indirectly, their children. At school level, the PMS framework expects that the new awareness created is disseminated across the school and is integrated into the school teaching practices through communication campaigns and promotional material. In the case of Bellinzona, however, this step turned out to be a critical one: integration into the educational programs of the school, in fact, strongly depends on the sensitivity of the single teacher involved, which cannot be taken for granted. Up to now, the City department has tried to overcome this problem by joining other initiatives, such as road safety education programs run by the local police, to combine common goals. However, further possible measures should be considered.

5.3.4 Openness, reflexivity and public value creation

Pupils, parents, teachers and school staff were all involved alike in identifying problems and opportunities, as well as in analyzing possible solutions and producing ideas to improve road safety from home to school. A formal working group, steered by a professional mobility expert, produced the

analysis, results, action plan and recommendations to the City department. As such, the PMS surely takes into account the individuals affected by the policy solutions envisaged to promote slow mobility practices at school. The project remains open and reflexive, as it ensures a meeting between key actors (mainly the parents' assembly) and the City department at the beginning of each school year, with the aim of openly discussing the PMS action plan and recommendations and addressing the work that has been done or is in progress, as well as future prospects. However, in the long term, one typical problem remains that of keeping the attention of key actors alive. Those actors, especially parents, that are already sensitive to the topic, attend the meetings and actively participate. For many parents and school staff, however, it remains an issue of low concern. As such, additional initiatives to raise public interest may be necessary and pivotal for triggering a larger cultural shift towards taking into account both children's needs and, in general, pedestrians' needs into street design and town planning. However, currently the PMS approach is limited to school routes only and has not been extended to other policy domains of the City.

In summary, we find some evidence for upscaling of the practice of children and parents going on bicycle or foot to school. Although direct numbers of trips (or modal shares) are not available, we find that new requests from the local community, such as the organization of cycling agility courses for children, the purchase of a bicycle pump-track by the City and the promotion of a "bicycle bus" initiative, have been triggered. In terms of governance practices, the project shows a novel way to actively involve families, children and school staff in the set-up of new initiatives addressing slow mobility.

5.4 Case 3: Transformation of the Pratocarasso area

The third case study related to the City of Bellinzona refers to the transformation of the Pratocarasso region, a green area of 200,000 m^2 mainly employed for agricultural purposes. Since the first Land Use Plan of the City of Bellinzona, developed in 1967 and finally approved in the Eighties, the area was zoned as a residential settlement, subject to the development of a detailed land planning act. Thanks to an initial project developed in 2003 by some students of the Mendrisio Architecture academy (a well-known university faculty in Switzerland), later taken over by one of them, now professional architect, in collaboration with the City planning office, a detailed development plan was finally approved by the Municipality of Bellinzona in 2006, followed by the approval by the City Council in 2010. The entire compartment was conceived as a low density, speed limit zone, thus utilized by vehicles, pedestrians and bicycles alike. A green public leisure area was also envisioned. Overall, approximately 100,000 m^2 would have turned into residential zoning, the rest being left to roads and farming areas, in equal parts. The City motivated the plan as an occasion to provide Bellinzona with a substantial residential zone, while safeguarding a wise utilization of resources and in respect of present local development activities.

However, in March 2010 the civic party “Bellinzona vivibile” (“Liveable Bellinzona”) and the Green party defined the project as “useless and not of priority to the city”. They collected enough signatures to launch a municipal referendum in regards to the provision taken by the Municipality and Council of Bellinzona. In June 2010 around one third of the citizens with right to vote participated to the referendum and 65 % of them rejected the project. Positions of those who voted against the project were quite diverse: some complained about supposed low quality of the residential transformation proposed (for some, building densification was excessive, for others it was too low and the project would have only contributed to urban sprawl), others criticized the loss of the last wide green area in the city, others finally deplored that such a project had strategic importance for the city, and, whatever the decision, it should have required wider discussion and decision by the entire population, instead of limiting it to Municipality and City council.

Figure 9: Pictures of the Pratocarassso area: a large agricultural land at the outskirts of Bellinzona.

5.4.1 Overcoming resistance to innovation and innovation achieved

After so many years of discussions around the Pratocarasso area, the City was discouraged by the outcome of the referendum and asked for help to external experts of the local University of Applied Sciences (SUPSI). Believing that the proposed transformation of the area was rejected since it was not “sustainable” enough, the City asked such experts to develop a masterplan envisioning the transformation of the area in a “sustainable residential neighborhood”. SUPSI suggested however not to focus on specific contents of the transformation, and to target instead the governance process behind the transformation itself. In particular, SUPSI suggested to go to the root of the problem, proposing the elaboration of a “*Strategic sustainability plan*” for the City of Bellinzona, as a mean to help decision-makers guide development and overcome the conflict arisen with and between citizens and to find a constructive solution. The plan was meant to assist the City of Bellinzona in taking more inclusive decisions, orienting overall local development policies towards more sustainable choices and encouraging local level participation. Somehow, the Pratocarasso case study would thus serve also as a mean to upscale a socially more inclusive and cross-cutting governance approach to all policy areas of the local administration. In particular, the specific aim was to:

- promote the integration of sustainability criteria in future land use planning;
- facilitate citizen participation in the City’s decision-making processes;
- improve the communication channel towards citizens, by encouraging more transparency and a better tracking of local decision-making processes.

In early 2011 the City of Bellinzona rejected the Strategic Sustainability plan proposal and asked for a more focused approach, just dealing with possible development scenarios of the Pratocarasso area. In such a framework, SUPSI suggested to:

- identify, ex-novo, the possible future vocation of the Pratocarasso area and surroundings by means of a participatory process;
- and explicitly assess alternatives for the transformation of the area, according to a multi-criteria group decision-making process.

Vocation, alternatives and decision-making criteria should have been identified in a bottom-up fashion, with the aim of explicitly considering possible conflicting elements among the population and the key stakeholders. Also, the “no-transformation” alternative should have been explicitly considered and compared to the other proposed alternatives, based on their expected effects – that is: the process should have been open to accept any possible outcome, even the revision of the residential zoning of the Land Use Plan, if necessary.

In the meanwhile, municipal elections took place and the new SUPSI proposal was discussed in late 2011, under a newly elected Municipality and City Council (the same in charge until today). Though approved by the new Municipality, the new City Council rejected it, for the following main reasons:

- the left wing believed any decision about the (residential) transformation of the area should have been framed within larger scale, overarching land use plans. Thus, they preferred to suspend any decision about the area and to wait for top-down decisions at the canton or district level;
- the right wing stated not to be receptive to any solutions that did not entail possibilities of constructing in the Pratocarasso area.

After such a decision, the launch of a participatory approach was precluded and then no further proposals were developed for the Pratocarasso area, which still remains a farming land.

Even though the participatory approach itself was not explicitly questioned, the outcome of the Pratocarasso process was quite clear: in regards to future development scenarios of the City, no extra-political interference with the decision-making processes is desirable. Indeed, this case study provides us with some important insights on a peculiarity characterizing the Canton Ticino in regards to urban governance innovations in general and closely related to a specific characteristic of the Swiss democracy, namely: easy accessibility to formal tools for direct democracy, such as the referendum at the municipal level (see Chapter 5.1). Since there is already an abundancy of occasions in place for citizens to vote and express their preferences in regards to local issues, public institutions tend to minimize in general the necessity for additionally more inclusive, participatory tools. However, this attitude prevents politicians and public institutions from acknowledging the thin line existing between top-down and bottom-up built consensus. Whether it is an excuse for not facing the more empowering potential of bottom-up approaches or not, in an open system (=urban environment), where the number of players and the number of variables are not predictable, this attitude becomes problematic in the long term if not inclusive. However, resistance to innovation was even stronger for Pratocarasso than elsewhere. In fact, it was widely acknowledged that the City was facing a deadlock situation. To overcome it, SUPSI, an institution whose value was locally widely recognized, had proposed to somehow “upscale” the level of analysis, going to the root of the problem, instead of focusing on its external outcome. SUPSI believed in fact that conflicts regarding the Pratocarasso area were due to a lack of strategic, shared vision for the whole Bellinzona region, in general, and to a lack of shared vocation for the Pratocarasso area, in detail – and not simply to the choice of the intensity of zoning. According to SUPSI, to exit the deadlock the city should have sought for new ways to stimulate citizens themselves to get engaged and face together the conflictual urban development process. Such a

proposal to innovate local governance practices was however stopped by the lack of familiarity with participatory approaches, which lead institutions to fear public participation would have

- increased decision-making times, without guaranteeing achievement of a shared decision
- and at the same time loosened power and responsibility of the executive and legislative bodies governing the city.

Therefore, the new administration preferred to stick to the formal procedure of representative democracy, thus leaving the conflictual situation unresolved.

5.4.2 Lessons learnt

Unfortunately, this episode seems not to have triggered a change in the way local development projects could be conducted in the City of Bellinzona. First of all, both administrations, old and new, do not seem to have seized the importance of introducing a wider, more strategic planning of the City as to solve specific conflicts, such as the Pratocarasso case. Instead of focusing on developing overarching, long-term goals at the city-level, both administrations seem to remain trapped in a more short-sighted governance approach, reacting in a case-to-case basis. Not surprisingly the old administration opted for a case-specific solution to the Pratocarasso area, instead of trying to analyze the wider context in which the entire matter is situated. Nevertheless, while the old administration acknowledged failure of the traditional *decide-announce-defend* (DAD) approach and had opened up to starting a bottom-up participatory approach to solve the issue, the newly elected administration took a step back on local level participation, preferring no confrontation.

As a confirmation that lessons were barely learned, one may consider the list of the municipal referendum processes activated in Bellinzona after the Pratocarasso one: three other municipal referendums took place from 2011 to 2013 – and in two of them, decisions taken by the City were rejected by the population.

Referendum against	**Year**	**Outcome**
Revision of the Land Use Act for the “Campo militare” lot	2011	The proposed realization of a new technological and scientific center in a green area was accepted by 89 % of the voters
New granite flooring in the old city (“Let’s save the porphyry cobbles”)	2011	The proposed replacement of the old porphyry cobbles flooring with granite flooring is rejected by 76% of the voters
Investments in the electricity company “Repartner” (based in the Swiss Canton Grisons) and less active in renewable energies than the local utility company	2014	Investments in the utility company “Repartner” are rejected by 64 % of the voters

Table 5: List of municipal referendum processes held in Bellinzona between 2011 and 2016.

5.4.3 Co-design

The way this specific Pratocarasso case ended, reflects more of a 'wait-and-see' diplomacy by the City of Bellinzona. However, by rejecting the opening-up to a participatory decision-making process for the Pratocarasso district, without having ready some alternative solutions, nor prospecting the study of new outlooks for the area as a priority, ultimately resulted in “keeping things as they are” for several more years.

In the past, the most frequent blame advanced to the Municipality of Bellinzona was one of being distant from citizens, shut off in its ivory tower, not sharing projects with the outside and not involving key stakeholders. It is this attitude that probably caused the rejection of the proposed Land Use Plan revision for the Pratocarasso district by means of a citizen referendum – a conflict started back in 2003. The old Municipality had opened to the idea of finding new ways of unblocking this conflict situation by trying to involve parties and key stakeholders in finding a common solution, according to the participatory process proposed by SUPSI. However, the newly elected Municipality somehow stopped this opening. Without questioning the validity of a participatory urban planning approach, the main political parties buried this opportunity by either postponing the question to future actions or closing to the idea of a possible "non-development" scenario for the Pratocarasso area, potentially emerging as a result of consulting the local community.

5.4.4 Openness, reflexivity and public value creation

Needless to say, any Land Use Plan is subject to change at any time: as land is developed and the needs of the community evolve over time, periodic updates are necessary to keep the plan current. In the present case study, the urbanization project proposed by the administration based on an initial project developed by external professionals, who closely collaborated with the planning office. As such, it does not seem to have been an open, inclusive process, in which actual needs of the community were taken into account, nor did they further question the usefulness of integrating a bottom-up process to better orient future development choices.

5.5 Concluding remarks

In general, it can be said that the City of Bellinzona is in the process of activating a series of important measures to promote a more sustainable mobility and transport system. At the higher, regional level, by means of the so-called PABs, significant infrastructural investments are currently being made to strengthen especially the local and regional public transportation network with the contribution of federal funds. In this context, even though an upgrading of slow mobility facilities is contemplated as an important priority development goal of these overarching PABs, the actual development and implementation of specific measures is being relegated to the local, municipal level. As PABs are meant to provide the strategic direction to achieve regional outcomes that align with the Canton's interest in land use planning and development, they are by their very nature, a rather traditional approach to planning decision and not particularly inclusive in their generation of contents. Inevitably, innovation in urban mobility strongly depends also on local government planning. However, at this hierarchical level, often, what is missed is, above all, a new development vision, followed by a lack in courage to launch more pioneering solutions. Local administrations, in fact, are constrained with avoiding potential risks, are frequently faced with limited financial resources and are often characterized by the incapacity of overcoming conflicting interests, political priorities, overlapping of contents and procedures. The abandon of the regional bike-sharing project described in case 1 is a common example reflecting this local dilemma. Nevertheless, the "Ricicletta" and "Ri-pedala" pilot projects show that when an innovative idea and the willingness of a few local actors exists, it is still possible to accomplish some innovative mobility initiatives and create new partnerships. Nevertheless, we find it is unlikely that bicycle sharing and use will scale up majorly soon, mainly because there is no political majority to strongly support car alternatives at the expense of car mobility. Also, there were no local bicycle users involved in the development of the projects, although in terms of social impact there was a successful inclusion of unemployed and refugees. Also in case 2, upscaling of children/parents going on bicycle/foot to school is constrained by a lack of political majority to strongly support car alternatives at the expense of car mobility. There was successful inclusion of parents and teachers in developing mobility palms, although most parents were 'the already converted'. This shows that, at City Department level, there is place for

the application of more inclusive governance tools as a mean to encourage the local community to engage more in slow mobility. Instead, case 3, concerning the land use development plan of the Pratocarasso area, though not directly addressing mobility issues, is an emblematic example of how local administrations are often not yet prepared to acknowledging more inclusive governance tools, transversally, in a more strategically way to all of its policy areas. Here, the two main barriers to the upscaling of the novel governance practice are the general aversion of policymakers to interference of stakeholders with their decision-making process, and related to this, the lack of familiarity of a more co-creative approach. A cross analysis of the three case studies with respect to social inclusion and upscaling (and the related capability to produce large scale changes in urban transport systems) is summarized in Table 6. It highlights that in Bellinzona attempts to public participation and upscaling fail when strategic, key urban policy-making and planning are involved. Instead, activities perceived as thematically focused and low-conflict are more successful, though they still remain in their seedbed and do not yet reach a level of institutional upscaling.

	Weak	**Strong**	**Neutral**	**Conclusions**
Social inclusion	- Conurbation plan (PAB2 and PAB3) - Strategic plan for sustainability - Regional bike-sharing service - Detailed land use planning (Pratocarasso)	- Mobility Plans for Schools	- "Ricicletta" and "Ri-pedala"	Citizen participation is precluded in strategic decision-making processes, due to a fear of facing conflicting goals
Upscaling	- Regional bike-sharing service - Detailed land use planning (Pratocarasso) - Strategic plan for sustainability - Mobility Plans for Schools (an explicit upscaling has not yet occurred, though the project has benefited a positive extension)		- Conurbation plan (PAB2 and PAB3) - "Ricicletta" and "Ri-pedala" *(depending on decisions for its permanent activation in summer 2017, it might turn into "strong")*	A first amplification of initiatives is effective only when simple, specific and thematically focused activities are at stake

Table 6: Concluding remarks from a cross-cutting analysis of the three Bellinzona case studies.

6 Action research activity in the Living Labs

Action research in “smarter” Living Labs was performed in all the SmarterLabs cities (Bellinzona, Brussels, Graz, and Maastricht), with the goal of testing ways of anticipating possible constraints on social inclusion and effective upscaling of the Living Lab outcomes. In this Chapter we only focus on the action research activities developed by the Swiss partners in the “smarter” Living Lab held in Bellinzona. Detailed descriptions of the activities developed in the three other “smarter” Living Labs and their outcomes are provided in the SmarterLabs project deliverables D4.3 (Brussels), D4.4 (Graz), D4.5 (Maastricht).

Materials included in this Chapter are partially extracted from the SmarterLabs deliverable D4.2 (available online at https://smarterlabs.uni-graz.at/en/publications-results/): we first introduce the goals and motivations of the lab initiator (the City of Bellinzona), then describe how the lab was organized and structured in order to achieve such goals, and finally we focus on the critical constraints likely to affect social inclusion and upscaling, and on the strategies we designed and put into practice in order to anticipate them. To conclude, we present the Living Lab outcomes, commenting on the effectiveness of the Living Lab in Bellinzona, with respect to its initial goals.

6.1 Promoting individual behaviour change in the field of mobility

The City of Bellinzona is seeking to improve mobility alternatives to cars to counteract local and global problems associated with traffic and energy-intensive lifestyles. In particular, the City recently developed a plan for slow mobility, which led to new cycling lanes and speed limit regulations in many residential areas. Also, improvements in public transport offer (frequency of lines and optimisation of inter-changes) where recently implemented.

However, notwithstanding such structural and regulatory measures were successfully implemented, city managers acknowledged the expected systematic reduction in car use at the population level did not occur. For this reason, they decided to also explore effectiveness of cognitive-motivational tools, relying on ICT and smartphone-based approaches. In such a framework, the Bellinzona Living Lab (LL) experiment aims at assessing capacity of persuasive and gamified tools to stimulate changes in individual mobility behaviour and to support the transition from car-dependency to car-alternatives, in particular cycling and walking. Smartphone apps were identified as the ideal devices to deliver the persuasive messages. In fact, besides providing real time travel tracking feedback to their users, apps allow the City to get real life data on the citizens’ mobility patterns: actively analysing and discussing such data with the citizens opens up possibilities to co-design more effective policies, plans and programmes in the fields of both transport and mobility and also in land-use planning. From this point of view, the Bellinzona Living Lab is therefore endowed with even more ambitious goals, closely connected to the co-design of future mobility scenarios in the Bellinzona area.

Before entering into details about the Living Lab in Bellinzona, in this Chapter we first provide a theoretical framework for behaviour change processes in the field of mobility.

6.1.1 Behaviour change: towards a smart urban mobility

It is widely acknowledged that in many cases human actions are the result of habits and routines, and that individual behaviour does not undergo specific cognitive decision-making processes: frequently people’s actions are automatic, performed without active cognitive processes, being instead supported by repetition and reinforcement of positive outcomes. In a society requiring cognitive attention from an increasing variety of sources, automatically performing actions -so that they become habits and routines- emerges as a survival strategy. This is particularly true in the sphere of personal mobility, where

individual choices (especially those regarding car use) and the car-dependant habits are reinforced. This section illustrates the existing reflections on behavioural change, and in particular on the attempts to effectively support people and society in changing current mobility behaviour towards more sustainable practices.

Supporting changes in individual mobility behaviour requires providing individuals with occasions to *unfreeze* their habits, stop their automatic choice and replace it by reasoned action [Lewin, 1951]. Many tools were developed for this purpose. To introduce them, we refer to the classification developed by Steg and Tertoolen [1999], which specifically refers to "strategies to reduce car use", integrating it with elements by Lehner et al. [2016]. Individual mobility behaviour can be changed either by modifying the *structure* of the situation, that is either making car less attractive or making transport alternatives more attractive, or persuading individuals to change their own preferences, choices and attitudes, adopting *cognitive-motivational* tools; halfway between structural and cognitive-motivational tools lie in leading individuals to automatically perform more sustainable choices, by adopting *nudge* tools. In the following sections we will introduce the three different typologies. There is a general agreement, we ought to note, that applying only one of such tools would probably not be effective to generate tangible and durable changes at society's level and a concerted strategy is needed, capable of addressing more aspects at the same time [Jackson, 2005; Schwanen et al., 2012].

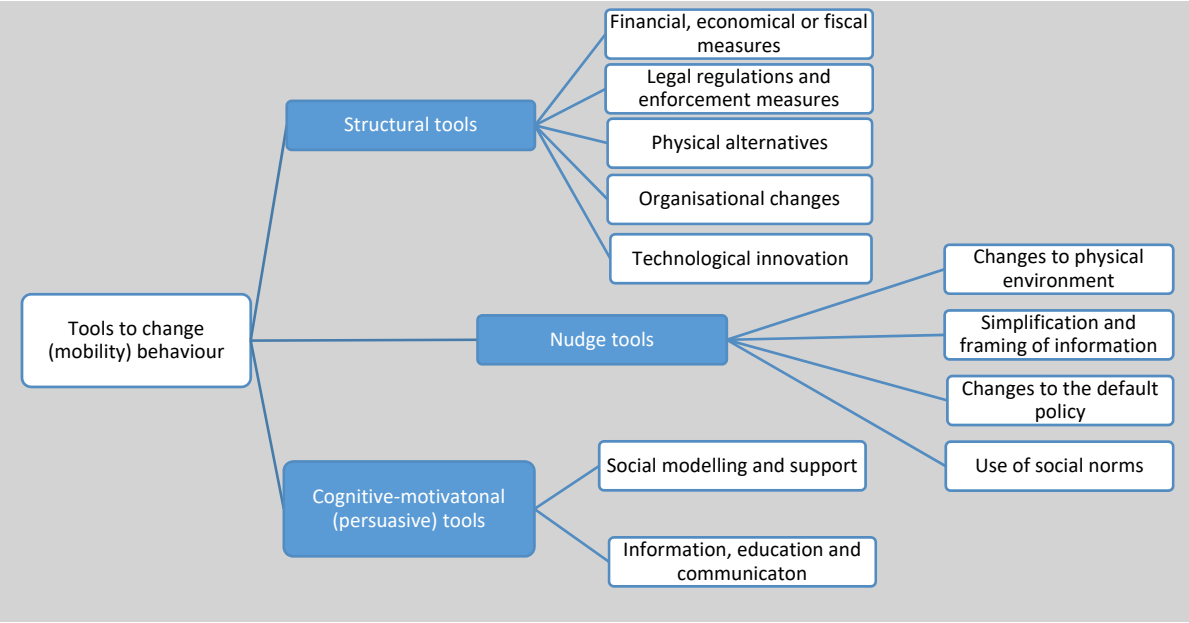

Figure 10: A classification of the tools promoting mobility behaviour change; based on Steg and Tertoolen [1999] and integrated with Lehner et al. [2016].

Structural tools

Modifying the "structure" of urban transportation systems does not exclusively imply infrastructural interventions. Structural changes occur also through a wide set of regulatory, financial, organisational and technological measures. Here we provide some examples.

Financial, economic or fiscal measures. They aim at increasing costs for car use – or at making alternatives to car more convenient. They could either be subsidies, taxes, fiscal discounts or tolls such as congestion charges, and mainly draw from the hypothesis of rational individual behaviour, according to which individuals are utility maximisers; it is widely acknowledged, however, that individuals do not only consider monetary aspects, when taking their decisions. Choice for car, in particular, also depends

on comfort, speed, flexibility [Steg, 2005], which restricts effectiveness of this kind of tools; moreover, measures as urban tolls might not be acceptable from the social point of view, unless they are modulated in order to take into account incomes (from this point of view, ICT might help to develop fair pricing systems).

Legal regulations. They refer to planning urban car-free areas or to introduce speed limits along specific roads: they introduce punishments for those who do not respect regulations, thus forcing individuals to change their behaviour change. Effective regulations require however a reliable and robust control system, and individuals might have tendencies to elude the required behaviour, if control is poor or lacking.

Physical alternatives. They refer to modification of the components of the mobility system, such as the change in urban traffic circulation and its redirection along certain roads, or the shrinkage of the size of the road, to favour decrease in speed. Such interventions are often coupled with other interventions aimed at increasing attractiveness for public transport or cycling, such as the increase in frequency of public transport routes or the creation of new bicycle lanes or bicycle sharing systems. This is done under the assumption that individual choices are largely related to the structure, organisation and planning of physical environments. A favourable physical environment can positively influence individual mobility choices, generating a behavioural shift towards more sustainable lifestyle patterns. Positive effects of many physical alternative measures can largely increase exploiting technological innovation, for example with App-based systems offering free floating bike-sharing services.

Organisational change measures. They refer to changing structures of institutions and organisations so that they can support changes in individual mobility behaviour. Examples might refer to companies allowing their employees to tele-work or co-work from offices closer to their homes or offering them a kindergarten area within the company's premises, it they are well served by public transport, so that they don't need a car to get fast to pick their kids up at the end of the working day. In such cases, however, changes might be precluded because the new organisation patterns might not be coherent with the preferences and lifestyles of the target groups.

Technological innovation measures. They first of all refer to the development of more energy and CO_2-efficient cars. Huge progresses were made in this field, both on powertrains (electric cars and the related recharging networks) and engine efficiency, and on car design, size and weight. However, it is acknowledged that increasing energy/CO_2-efficiency in every single kilometer driven does not guarantee overall reductions in total energy consumptions or CO_2 emissions, since certain amounts of rebound effects might take place, both direct and indirect (see for example [Gillingham et al., 2013].

In the context of smart cities and smart mobility, in particular, example of technological innovation measure include those exploiting ICT to favour use of physical alternatives to car (e.g. digital platforms and App-based tools favouring car, bicycle or ride sharing, often in a multi-modal and integrated systems). Increasingly, many "structural" smart mobility initiatives today are mediated by Intelligent Transportation System (ITS) elements [Viechnicki et al., 2015], that is, the application of information technology to transportation systems - vehicles, roads, traffic lights, message signs, etc.—to become intelligent by embedding them with microchips and sensors and empowering them to communicate with each other through wireless technologies such as real-time traffic information systems, in-car navigation (telematics) systems, vehicle-to-infrastructure integration (VII), vehicle-to-vehicle integration (V2V), adaptive traffic signal control, ramp metering, electronic toll collection, congestion pricing, fee-based express (HOT) lanes, vehicle usage-based mileage fees, and vehicle collision avoidance technologies. This evolution can be partially explained by the fact that most mobility-related activities are shaped by an individual's spatial, temporal, and social constraints. In this context, ITS elements allow for an extremely targeted form of communication.

Cognitive-motivational (persuasive) tools

In addition to the tools aiming modifying the structure of the situation, approaches aimed at persuading individuals to change their behaviour have recently gained wide support in praxis and field experiments. They are particularly suitable to smart city initiatives, since, by exploiting information and communication technology (ICT) and smartphone Apps, they can provide citizens with time and content-appropriate incentives for change. Use of ICT to persuade behaviour changes has been extensively studied by B.J. Fogg, who introduced the term “captology”, as the study of Computers As Persuasive Technologies (CAPT) [Fogg, 2003]. Fogg developed a behaviour model for persuading design [Fogg, 2009], according to which performing some specific behaviour depends on an individual’s *motivation*, an individual’s *ability*, and the presence of a *trigger* that prompts the individual to actually perform the behaviour.

Such a model argues that, if motivation is high, a change in behaviour can be achieved, even if it is difficult. Conversely, if motivation is low, even easy changes in behaviour can be difficult to achieve. Behaviour can either be extrinsically or intrinsically motivated: external motivation can be generated by environmental, social, or cultural events, while intrinsic motivation is produced by a number of mental processes, in particular one’s goals, expectations and the self. Ability refers to an individual capability to perform some behaviour and is determined both by individual skills and by the context. Triggers are anything that stimulate users to perform a certain behaviour: they can either increase motivation (*sparks*, in Fogg’s jargon), for example by providing awareness on the consequences of one’s actions, or ability (*facilitators*, in Fogg’s jargon), for example by providing information on how to perform a certain action. Fogg’s persuasion appears therefore as a process that supports individuals in changing their behaviour by active cognitive processes: the desired behaviour is the result of new convictions by the individuals [Bell et al., 2010] and requires their active engagement [Mols et al., 2015].

General mental processes that occur when persuading individuals to change can be explained by the Transtheoretical model developed by [Prochaska and Velicer, 1997], which recalls the routines *unfreezing-refreezing* process proposed by Lewin [1951]. Individuals start from a *pre-contemplation stage*, during which they have low motivation and/or ability for change. By providing (framed) information or pointing to social norms, their awareness is raised, so that they move in a stage in which they *contemplate* change. If they are stimulated this way for a sufficient period of time, they enter the *preparation* stage, during which they develop a plan, and then actually start changing their behaviour. The following stage (*maintenance*) is of crucial importance and individuals need to be kept motivated, and actively stimulated as in the first stages, so that behaviour is constantly performed, until it is internalized, with the creation of new habit. When this happens, people go back in the *pre-contemplation* stage.

Effective persuasion techniques

Froehlich [2015] and Anagnostopoulou et al. [2016] summarize the most effective persuasive techniques that can be used to stimulate pro-environmental behaviour:

- provide information: if the information refers to one’s own direct behaviour, and especially if it is provided in nearly real-time, is as close as possible in time and space to the relevant choice, is easy to be understood and to be remembered, it can actually largely increase user awareness and motivate them for change. Very effective is also providing information on available alternatives targeted to the individual’s needs, interests or living context;
- provide occasions for social comparison: offer the individual the opportunity to compare his/her choices and performances with the ones of other people or groups and that he/she perceives as somehow similar and comparable to him/herself – that is, members of the same community. This would generate both a peer-pressure and a desire for emulation, motivating to change;

- provide goal setting opportunities: if targets are really challenging to the individual, self-setting goals can have powerful effects, because it creates a self-competitive setting in which the individual strives for personal progress and mastery (intrinsic motivation for change);
- provide feed-back: since it gives individuals a baseline to assess their performances, it is complementary to and essential for goal setting activities;
- provide rewards (incentives) or punishment (disincentives): they can be either tangible or intangible, expressed in monetary terms or in physical units, and reflect an intrinsic or extrinsic motivation for change. Provided as an outcome of the individual's performances, they can either reinforce individual motivation to adopt a certain behaviour (reward of good performances) or stimulate her to further engage to get behaviour change, in case of poor performances. Use of punishment is however controversial [Foster et al., 2011], since it might have the unwanted effect of demotivating users.

In such a framework, persuasive approaches frequently exploit *gamification* techniques, namely the "use of game design elements in non-game contexts" [Deterding et al., 2011]. Typical gamification mechanics and elements are, respectively, competition and cooperation and assignments, quests, goals, points, levels, badges and leader boards [Weiser et al., 2015].

In the mobility field, persuasive techniques were effectively adopted to reduce vehicle speed by means of radar dynamic speed displays along roads, exploiting the combined effect of feedback, social norms and peer pressure (see for example Rose and Ullman [2003] and Veneziano et al. [2010]). More recently, they are adopted in App-based initiatives aimed at promoting reduction of car use or at favouring eco-driving styles.

Critiques of persuasion

The persuasive approach towards behaviour change received some critiques. First of all, some authors notice it relies on a *technology paternalistic* vision [Huber and Hilty, 2015], according to which the designer of the persuasive system would know what is good and correct, while individuals would not. This recalls of the elitist assumption that ordinary people tend to make wrong decisions, while experts are always able to make the good ones [Mols et al., 2015].

Also, certain practical applications of persuasion principles highly exploiting gamification elements are criticized since they do not acknowledge that there is no *one size fits all solution* [Huber and Hilty, 2015]: for different individuals, good and correct actions turn out to be different, therefore different triggers should be activated and different target behaviours should be promoted. To avoid such negative outcomes, authors suggest that individuals are explicitly called to define their own goals for change and to share them with the persuasive system and tools [Huber and Hilty, 2015; Froehlich, 2015]: doing so, individuals would be allowed to autonomously decide if, and how much, relying on them, while the persuasive system would simply be a useful tool to support and motivate individuals to achieve the change they have autonomously set for themselves: individuals need to be allowed to self-set goals, instead of trapping them in pre-defined and unique paths for change. Also, offering tailor-made suggestions and challenges, identified based on the data collected on each individual's behaviour and the context where the individual lives, would definitely improve persuasion effectiveness [Anagnostopoulou et al., 2016].

Nudge tools

A further approach to promote individual behaviour change based on non-structural interventions is the *nudge* approach, where nudge tools are defined as "any aspect of the decision-making process that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" [Thaler and Sunstein, 2008]. Formalized by Thaler and Sunstein in 2008, it gained wide popularity in the recent years. Its proponents argue *nudges* can effectively be used to favour

changes in individual behaviour in all those situations in which individual cognitive processes fail, for example due to inertia, presence of habits or loss aversion. According to them, in fact, it is possible to influence processes which lead to individual automatic behaviour, by developing targeted *nudges.*

Nudges might appear related to Fogg's *triggers*. However, many authors argued that persuasion and nudges are profoundly different, since under influence of the latter, individuals are generally not explicitly aware that they are lead to behaviour change. Nudges in fact tend to favour a change in the architecture of the choices available, so that individuals intuitively or unthinkingly opt for the option offered by the system, without active reflection neither on the choice they have taken nor on its consequences [Mols et al., 2015]. For example, to stimulate car speed reduction, persuasion techniques might provide users with a feedback on their speed, by means of interactive and real-time sensors, both in-car and along the road, while nudges might create artificial restrictions on the road space, therefore forcing users to decrease speed. However, distinction among the persuasion and nudge approaches is not always straightforward, and much overlapping probably exists, up to the point that [Mols et al., 2015] emphasize that some experiments presented in literature to prove effectiveness of the nudge approach are actually not nudges but attempts for rational persuasion (for example, provision of additional information or appeal to emotion), since they supply the individual with reasons why they should activate a certain behaviour, letting the individual freedom of action [Hausman and Welch, 2010].

Critiques of nudging

Some authors criticized the nudge approach because it prevents individual empowerment and might not be as effective as persuasion in stimulating enduring behaviour change [Goodwin, 2012; Mills, 2013; Mols et al., 2015]. The latter, in fact, is more likely to occur when individuals are actively and consciously engaging in new actions: that is, nudges cannot guarantee that behaviour change persists after nudging stops. For this reason, approaches for behaviour change only focusing on nudge tools are judged less effective in driving effective changes at the society level. Moreover, even authors endorsing such an approach, acknowledge it should mainly be used to support and back up other policy-making tools and strategies [Mills, 2013]: it is suggested to embrace more deliberative models of citizen‘s engagement, even better if they also foster collective engagement and favour citizens to get together in order to solve large-scale problems.

Other authors criticised it as immoral and unfair, due to its lack of transparency when influencing habits, which are the result of non-deliberative, automatic processes of whom people might not be aware. The degree of freedom left to the individuals would in fact be very narrow and the whole process might result in a manipulating exercise, which, as a final consequence, might endanger democratic decision-making processes or divert individuals from politics [House of Lords, 2011; Goodwin, 2012]. Moreover, as already noticed for persuasion, ethical concerns might appear: who decides what to nudge? [Mols et al., 2015]. If they are not built by participatory approaches, some types of nudges might be scarcely compatible with a democratic society.

Limits and potentials of behavioural change approaches

Different scholars from the social sciences critically highlighted that overreliance of governments on *individualistic* approaches of behavioural change as a mean to achieve more sustainable mobility choices at the society level poses some major challenges. To date, in fact, policy-makers very often still take a purely individualist or structural perspective as to interpret and predict behaviour change for sustainability governance thus overseeing the interrelatedness of daily behaviour with social context, conventions, infrastructure and shared routines [Shove, 2010] and [Spaargaren, 2011]. However, as Ingram et al. [2007] put it, by referring to Social Practice Theory (SPT), individuals and objects are rather the 'carriers' of certain routines, ways of doing, understanding, knowing how and desiring. Conceptually, this shifts the focus of attention from the individual behaviour or the relevant technology or infrastructure, to 'practice' itself, making the latter the ultimate unit of analysis.

Regarding mobility, in particular Schwanen et al. [2012] and Barr and Prillwitz [2014] highlight that i) mobility is embedded in social practices and consumption settings; ii) practices of (un) sustainable mobility are related to the structure and organisation of physical environments; and iii) and solutions for sustainable mobility are framed through narrow political lenses that fail to address the potential social transformations needed to tackle climate change. Thus, for a more complete understanding and governance of social change, environmental and transport policy need to recognise this mutual influencing and co-shaping of individual behavioural factors with social context and infrastructure. In such a framework, it becomes evident that change in practices are to be sought within wider society.

Any behaviour change tool could in fact benefit if it builds on interactions of individuals within a community or groups of individuals sharing some aspects of life, such as, for example, schoolmates or people working in the same company [Huber and Hilty, 2015]. Promoting group and community exploration of alternative actions might in fact positively enhance possibilities that such alternative actions are adopted and, consequently, that a change in habits and behaviour takes place. This is because fostering community engagement activates the power of social norms and further motivates behaviour change [Jackson, 2005]. As Mols et al. [2015] argue, if individuals internalise social norms and use them as a driver to guide their own choices, it is more likely that long lasting behaviour change occurs. In order to reach this stage, involvement of stakeholders and creation of occasions for participatory problem-solving and learning by doing are of vital importance - not only the transport-related ones, but the whole set of stakeholders connected to urban decision-making.

Finally, the global effectiveness of non-structural behaviour changing techniques has however to be put in perspective, in order to acknowledge its general limitations. Using Fogg's jargon, it might in fact happen that individuals have high motivation to change, but their ability to do it is significantly affected by the lack of practical alternatives. For this reason, as already indicated in the introduction of this chapter, non-structural behaviour change approaches definitely need to be coupled with other types of intervention, working at different scales, with the aim of activating a system-level change, in a socio-technical transition framework. If system-level conditions for more sustainable choices are created, unfreezing of past mobility habits is then expected to take place spontaneously. According to [Shove, 2010], instead of asking individuals to change their own behaviour, societies should seek for a comprehensive system transition, so that sustainable mobility practices (such as use of the bicycle, for example) become "normality", normal and usual practices automatically put into practice by citizens. Schwanen et al. [2012] provide a very effective example for this, with reference to the wide diffusion of bicycles in the Netherlands. They remark it is not the result of explicit individual choices; instead, it can be seen as the natural outcome of a whole system favouring such a choice: from land planning and availability of infrastructures to marketing approaches to cars and car owning, up to education and learning by doing: it's the whole Dutch socio-technical system favouring individuals to choose the bicycle.

By merging bottom-up, subjective consumer actions on the one hand, and related, top-down technological infrastructures and objects on the other hand, the present SmarterLabs project aims at integrating the paradigm of SPT and implicitly aims in this way to attain a more effective upscaling of behavioural change in the mobility domain.

6.2 Use of apps to persuade behaviour change: a literature review

Due to their promising potential, a fast growing body of literature studied the effects of coupling persuasion and gamification techniques with information and communication technologies (ICTs). ICTs in fact allow to apply these techniques in an effective and timely manner, often providing users with real-time, bi-directional interaction possibilities. In particular, smartphone apps are increasingly being used to stimulate electricity and water savings, in parallel with the systematic roll-out of smart meter devices

to measure real-time electricity and water consumptions, frequently performed in a smart city framework [see for example Darby, 2000, 2006 and 2010; Fischer, 2008; Burgess and Nye, 2008; Faruqui and Sergici, 2010; Hargreaves et al., 2010 and 2013; Weiß et al., 2010; Fischli et al., 2011; Schleich et al., 2011; Degen et al., 2013; Tiefenbeck et al., 2013a and 2013b]. Many of such apps already provide users with a number of the key elements for effective persuasion identified by Froehlich [2015]: not only they deliver feedback information on consequences of individual choices (usually, energy consumptions and CO_2 emissions), but also they allow users to define personal goals for change, engage in challenges, and interact and compare their performances with virtual communities of users, frequently addressing the users' social network relationships by direct interaction with Facebook [see for example Mankoff et al., 2007, 2010; Foster et al., 2010, 2011; Froehlich et al., 2010; Lehrer and Vasudev, 2011; Petkov et al., 2011; Weiß et al., 2012; Bull et al., 2013; Foster and Lawson, 2013; Wemyss et al., 2016].

As said, persuasive apps for electricity and water savings rely on fixed metering infrastructures, which provide consumption data. Automatic monitoring of individual mobility patterns, instead, is much more complex, since static monitoring systems are not sufficient: flexible tracking systems, able to follow individuals along their movements, are necessary. Since around 2010, however, pilot projects aimed at automatic mobility data tracking were developed, frequently exploiting smartphone apps and GPS devices embedded in smartphones [see for example Schüssler and Axhausen, 2009; Jariyasunant et al., 2012; Nitsche et al., 2012; Kiukkonen et al., 2010; Ythier et al., 2012; Yuan and Raubal, 2012; Yuan et al., 2012; Cellina et al., 2013]. Thanks to fast progress in the quality of automatic mobility tracking, soon after apps aimed at favouring mobility behaviour change started being developed. For a general overview, one can refer to [Shaheen et al., 2016] or [Anagnostopoulou et al., 2016]; a selection of apps aimed at reducing individual car use is instead presented in Table 7.

App	Reference
UbiGreen	Froehlich et al., 2009
Tripzoom	Bie et al., 2012
SuperHub	Wells et al., 2013
MatkaHupi	Jylhä et al., 2013
Peacox	Bothos et al., 2014
GoEco!	Cellina et al., 2016; Bucher et al., 2016

Table 7: List of persuasive apps developed in the mobility field with the aim of reducing individual car use.

6.2.1 Limitations of persuasive apps and suggestions to overcome them

Even though their diffusion is rapidly increasing, development of persuasive apps is still a young discipline. Experiments assessing their effectiveness are in fact often based on small samples of volunteer users, sometimes even biased as mainly university students, involve short periods of time and often lack a control group [Hamari et al., 2014; Anagnastopoulou et al., 2016]. This implies that: results cannot be generalized to the whole society; long-term behaviour change cannot be measured; and possible changes in their mobility behaviour cannot be univocally attributed to the app alone, since they might also be influenced by other external factors. However, analysis of the available literature suggests useful recommendations to follow when exploiting app-based persuasion in order to stimulate individual behaviour change. In particular, suggestions are available regarding the key *SmarterLabs* research

questions on how to overcome barriers to social inclusion and guarantee effective upscaling at the society level (Table 8).

Limitations and Barriers emerged in app-based persuasion experiments	**Suggestions for *Smart-er cities***
Digital divide might preclude social inclusion – which is especially critical if persuasive apps are also used to automatically collect mobility data to develop plans, policies and programmes.	Back-up digital-based activities with in-person activities. Reduce digital divide by offering free computer science courses and negotiating cheap mobile tariffs with Internet providers.
Citizens might refuse using persuasive apps fearing their privacy is negatively affected.	Develop fully transparent user agreements explaining how personal data will be treated by the apps and which types of active data protection are guaranteed.
Self-selection procedures to recruit apps users tend to mainly stimulate *innovators* and *early adopters*, who already performed behaviour change, instead of mainstream citizens ("preaching to the converted").	Offer prizes and tangible incentives to apps users and, during user recruitment campaigns, exploit already existing real life groups and communities, for example targeting schools and companies.
Individuals tend to early quit using apps.	Anchor use of persuasive apps in already existing real life groups and communities (schools, companies, associations): due to real-life relationships among them, they are more likely to keep their commitment in using the apps.
Flaws in mobility tracking infrastructure and tools might preclude apps effectiveness and reinforce users' tendency to quit using apps.	Apps developers cannot overcome such technical problems. However, they need to keep apps as plain and simple as possible, limiting interactions with critical elements.

Table 8: Limitations and barriers to social inclusion and uptake at the society level and suggestions to overcome them.

Overcome the digital divide

A thorough diffusion of such apps to the whole society will, by definition, be impossible. In general in fact apps target a specific segment of the population, namely individuals with a certain level of digital literacy. Therefore, when using such kind of apps, reaching the whole population is definitely no goal, and they are explicitly targeted to a specific segment of the population (individuals aged between 25 and 44, generally highly educated): apps are in fact additional tools that support, but not exclude, other tools promoting individual behaviour change. A different situation occurs when public institutions exploit data monitored by such apps also with the aim of developing new policies, plans and programmes in the mobility sector. In this case, relying only on data tracked by the apps would create a significant bias, since they would not represent needs and mobility patterns of average citizens, but average needs and mobility patterns of a specific segment of citizens (younger, highly educated and maybe even endowed with higher income, allowing to afford the costs of Internet connection data packages). In other words, there is the risk to amplify social exclusion phenomena already due to digital divide [Shaheen et al., 2016]. If so, fairer policies could be guaranteed by opting for the following interventions: devising integrated mobility data collection and assessment strategies, exploiting both innovative, automatic, ICT-driven collection and traditional, static data collection strategies, by means of surveys and interviews

and in-person discussions; in parallel to the launch of the apps, also offer free courses to increase computer literacy and competences of the segments of the population traditionally secluded; negotiate with Internet providers in order to get reduced costs for mobile services.

Overcome privacy concerns
Inclusion of a wide variety of citizens is also limited by privacy concerns [Shaheen, 2016]: individuals might in fact prefer avoiding using mobility tracking apps since they have not enough guarantees about the way sensitive information on their own mobility patterns will be treated. In addition, in some cases data are even shared between apps. Even though this might be explicitly mentioned during the app installation process and requires formal user agreement, such data sharing customs might not be fully transparent to the users. As this causes dropouts – or reduces from the very beginning the number of active and engaged users – app developers are called to take particular care in drafting user agreements: plain and easy to read on mobile devices languages need to be used, so that users are reassured on who and how will use, and eventually access, their personal data.

Stimulate mainstream car drivers
Another critical element refers to the recruitment of users of such mobility behaviour change apps: with the aim involve voluntary citizens, experiments described in literature performed advertising and communication activities exploiting mass-media, social networks or in-person flyering throughout the city. The result is that app users were self-selected: whoever was interested in participating, entered the experiment and was provided with the app. It was noticed that when such self-selections are performed, applicants tend to be already environmental aware individuals, who sometimes have even already performed the behaviour change stimulated by the app [Cellina et al., 2016; Wemyss et al., 2016]. Such open calls for participation might in fact mainly stimulate *innovators* and *early adopters*, according to the definitions proposed by Roger in his theory of “diffusion of innovation” [Rogers, 1962]. They would in fact look for a public confirmation of how good their behaviour is, while mainstream citizens (*early majority* and *late majority)* citizens would simply ignore invitations to take part in the experiment. In other words, there is the risk of “preaching to the converted”.

Favouring self-selection might thus be a barrier to social inclusion. However, in the end self-selection is the only possibility a city can adopt, since no obligations to use persuasive apps can be put into force. Therefore, solutions to overcome these limitations need to come from the recruitment strategy itself. One strategy might be to provide app users with prizes and monetary, or however tangible, incentives, aimed at raising the interest of the *early* and *late majority* individuals. Prizes should however be attributed only to those who remain active for a sufficiently long period of time, which first allows to unfreeze their present mobility patterns, and then to freeze again their new, more sustainable, mobility patterns.

Another strategy would be to exploit social relations already existing in society and to explicitly target them during the communication campaign for user recruitment. For example, use of the app might be proposed to schools, companies or even formal networks such as those by sport clubs [Moser et al., 2016], besides to individual citizens: managing to involve whole school classes (that is a number of students and their families), whole companies/company departments (that is a number of colleagues) or groups of friends active in the same sport club would in fact allow to start with a wider level of diversity in attitudes and behaviour.

Keep interest alive for a sufficient period of time
All the experiments so far developed are characterized by the short duration of the mobility monitoring period, limited to a few weeks. This is critical for two reasons: on the one hand, collecting data for short periods of time might lead to include too many non-systematic mobility patterns, such as for example holidays performed exactly in the tracking periods, which might influence correct understanding of the baseline mobility patterns. On the other hand, it does not allow to assess the long-term effectiveness of

the apps in driving long-term behaviour change, namely after direct influence of the intervention. In some cases, however, this is not a flaw in the experimental design, but a consequence of individuals quitting use of the app and high dropout rates [Anagnastopoulou et al., 2016; Cellina et al., 2016]. In all such cases, this might happen because individuals soon get tired of the novelty produced by the app and they are not motivated enough to feel morally obliged to remain in the experiment.

If dropping-out occurs so frequently in research experiments, one can expect that use of behaviour change apps in real life would be flawed by even stronger dropout rates, which would prevent attaining any tangible benefit in mobility problems at the city level. Again, a strategy to avoid this might be to anchor use of persuasive apps in already existing in real life groups and communities, thus explicitly exploiting the power of social norms. As indicated above, apps might in fact be tailored for use within groups of colleagues in companies or groups of students in schools or friends in sport clubs. Once individuals will be included in such groups of users, presence of other real-life relationships among them is more likely to keep their commitment and interest in using the app – at least until they manage to unfreeze their present mobility routines and to freeze them again in more sustainable mobility ones.

Improve mobility tracking infrastructure and tools

Other barriers for effective behaviour change mentioned in literature refer to technical and logistics implementation aspects [Shaheen et al., 2016]: physical problems might in fact affect quality of the mobility data tracked, with a twofold negative effect: providing decision-makers with low quality data and reinforcing individuals‘ tendency to dropout, due to a lack of trust in the data gathered by the app. Poor mobility tracking might be due to poor quality of GPS signals and poor and low speed Internet connection, which might be particularly critical in less urbanized areas. Also, specific operating systems and specific phone models might negatively affect quality of user interaction with the app – in fact, use of the same app might produce different quality data depending on the smartphone operating system or even on the smartphone specific model, since not all GPS devices offer the same level of accuracy in data tracking. Old operating systems might even preclude possibilities to install certain mobility tracking apps or their upgrades. Overcoming such kind of technical barriers cannot be performed by the developers of the app alone; they are however called for keeping their apps, and their software code, as plain and simple as possible, in order to limit critical interactions with other mobility tracking infrastructures and tools.

6.3 Goals and motivation of the Living Lab in Bellinzona

Inspired by the continuous evolutions in the field of mobile application services offered by municipalities, the mobility and transport department of the City of Bellinzona decided to engage in the development and testing of a mobile app solution to reach citizens in a new way, and promote more sustainable travel modes within the area of Bellinzona. Ultimately, this outcome created the opportunity to capitalise on the above lessons learnt from previous persuasive, app-based interventions developed worldwide.

In order to promote effective use of a persuasive app beyond participants to a Living Lab, therefore upscaling its diffusion among the wider population, the above literature review suggested that it was essential to focus on overcoming the following critical elements:

- participants to LL activities using smartphone apps in the mobility domain are generally not representative of average citizens: they are often characterized by a high environmental awareness which has already lead them to making significant changes in their behaviour, reducing car use (“preaching to the converted”);
- level of engagement of participants to LL activities using smartphone apps tends to decrease over time and participants frequently abandon using them before sufficient quantitative data are gathered and they are lead to modify their mobility routines.

The first strategy that was identified as a solution to overcome the “preaching to the converted” limitation was to encourage inclusion of population segments that are not particularly sensitive to mobility issues through extrinsic, tangible rewards. App users would be provided with prizes and monetary, or however tangible, incentives, with the aim of raising the interest of the *early* and *late majority* individuals (mainstream citizens) who otherwise would not show any interest in the app. Prizes would however be only attributed to those who remain active for a sufficiently long period of time, allowing first to unfreeze their present mobility patterns, and then to freeze again their new, more sustainable, mobility patterns.

Thus, at least partially, attribution of prizes would also address the problem of early abandon. However, acknowledging that the City budget would not allow to consider expensive prizes, we opted for sustaining the prizes strategy with another, even more innovative, one. Instead of envisioning the Living Lab as a test-bed for the app, we opted for directly engaging potential users in participatory design workshops aimed at promoting innovative mobility services for the City: workshop participants would first be involved in the co-design of the app key functionalities, and later in testing them.

Opening-up the design of the app main contents to the citizens themselves, in a Living Lab fashion, was expected to favour empowerment, retention of interest, and enduring engagement towards using it. The underlying hypothesis was that, if they owned the tool, they would have been stimulated to use it for a longer period of time and to promote its diffusion among their circle of family and friends. Lab participants were in fact not seen as just app testers: a user-centered approach would have favoured their empowerment and assimilation of the knowledge developed during lab meetings, so that they can transfer it to future users.

Also, provided that citizens joining the lab included different perceptions, attitudes and mobility behaviours, thus reflecting the current society composition both regarding socio-economic parameters (gender, age, education, job, ecc.) and mobility patterns, the resulting app functionalities were expected to better speak to “mainstream” citizens and increase app attractiveness, with respect to apps developed under a traditional expert-driven, top-down approach. This would have avoided external experts defining “their problem” and developing “their solutions”, favouring instead the creation and sharing of knowledge in a collective learning process, as well as increasing individuals’ intrinsic motivation to keep using the app. Finally, such an approach would have offered opportunities for upscaling and later engagement in the co-creation of future mobility scenarios for their city.

Practical lab advantages from a local authority’s point of view were identified as follows:

- co-designing the app in the lab lowers the risk of failure, since a user-centred design approach better guarantees that the innovation produced suits actual needs of citizens;
- the lab creates a new, bi-directional communication channel between authorities and citizens;
- having the possibility to explore the potential of collecting georeferenced mobility data through a smartphone application as an innovative, more accurate and up-to-date support for future spatial planning by city authorities.

Even though past attempts to run participatory processes in the City of Bellinzona were opposed by city managers (see Section 5.5), who feared to lose power and control over public decision-making, in this case the proposal of activating a Living Lab process was easier to be accepted. In fact, city managers mainly perceived the lab as a technology innovation testing ground, focused on a very practical, technology-oriented and low-conflict topic, such as the app development and testing.

Moreover, the activated process was expected to be beneficial for an additional reason: the app co-design trigger was in fact expected to activate a much wider process, targeting urban sustainable mobility at a larger scale, and, further beyond, also urban policy-making and governance processes.

In particular, adopting a multi-level perspective (MLP) [Geels and Schot, 2008; Geels, 2012], a niche addressing personal lifestyles through persuasive information and peer influence was expected to act as a leverage to mobilize key transport actors to challenge the current mobility regime and promote a regime shift. In fact, the overall challenge towards enduring low-carbon and more sustainable mobility choices cannot by achieved by just addressing changes in individual lifestyles. Though openness to such changes is needed, for them to be performed and sustained over time, concurrent radical changes in infrastructure provision, regulation and taxation regimes are required as well [Schwanen et al., 2011].

Ultimately, the aim was to successfully turn targeted groups of citizens into change agents or catalysts adopting new life styles, making use of the new pedestrian lanes and bicycle infrastructure provided by the City of Bellinzona, as well as offering constructive input on strategic improvements to mobility in their City. However, as to ensure the transition from *niche* to *new regime*, ultimately also a multi-level process of upscaling at the institutional plane needed to be initiated. Consequently, from discussion on an app, with a limited group of citizens, activities in the Bellinzona Living Lab were designed to evolve to discussion on future mobility scenarios, involving the relevant stakeholders at the city and regional level: this would imply enlargement of the scope, complexity and conflict level of the issues under discussion.

A further upscaling possibility was related to the replication of the Living Lab participatory approach, methodologies and practices in other fields of intervention than transport and mobility: the City might in fact adopt the new set of procedures also for policy-making in other domains of intervention, such as for example waste management or land planning. Such replications might result in very incisive outcomes on government processes at the City level, with the institutionalisation of new participatory practices.

Furthermore, the lab was as an opportunity for developing new models of public participation and governance. As defined by Vreugdebhil et al. [2010], being a pilot project, it could also work as an “advocacy tool”, aimed at convincing, demonstrating, accumulating evidence and lobbying for adoption of different governance models, once the pilot phase had finished.

6.4 Organisation of the *Bellidea* Living Lab

The Bellinzona Living Lab was called “*Bellidea*”, where “Belli” refers to both an abbreviation of the name of the city and the Italian word “bella” which means *good*, and “idea” has the same meaning in Italian and English. Its name was intentionally generic and did not refer to transport and mobility, so that the City might use it in the future also for additional governance processes in other fields.

Four types of actors were given an active role in the Living Lab: public institutions, no-profit associations, universities and the public. The City of Bellinzona formally owned the lab, and actively promoted its activities, by supporting recruitment of participating volunteers and following lab progress over time. ProVelo followed all lab activities, by both supporting recruitment of lab participants and providing the project with specific expertise on soft mobility, advancing innovative ideas and assessing technical feasibility of the proposals by the participants. Ultimately, SUPSI were the lab managers: they planned, coordinated and managed activities within the lab, as well as professional app development, also offering scientific support based on their research activity in past, related projects. Finally, and pivotal for this process, there were citizens, with their personal experience, ideas and suggestions towards sustainable mobility.

Figure 11 summarizes the plan of activities in the Living Lab, which were organized into three major phases. In *Phase 1 – Bellidea app co-design and test,* lab participants co-design and test the *Bellidea* app aimed at persuading individual behavior change (reduction in the use of private motorized means of transport); once available, the app is offered to the whole population in the area of Bellinzona. In *Phase 2 – Mobility scenario building,* lab participants are invited to reflect on the specific barriers and opportunities towards sustainable mobility they found while designing and testing the *Bellidea* app, and,

together with lab promoters and managers, to brainstorm the "*Bellidea* charter of principles for sustainable mobility in the Bellinzona area": a participatory document to be discussed with the relevant stakeholders and city managers and aimed at informing future policy-making and land and mobility planning activities. In *Phase 3 – Evaluation*, a general evaluation of the developed activities is performed, regarding both effectiveness of the *Bellidea* process in stimulating individual behaviour change and effectiveness of the *Bellidea* process in activating new participatory governance practices.

Phase 1 entirely dealt with the co-design of app contents and later test of the app prototype functionalities. At the end of such activities, when a bi-directional communication channel between the City and its citizens engaged in lab activities was activated, discussion in the lab was broadened: participants to the lab were invited to take part in a workshop aimed at a wider discussion on possibilities to change mobility patterns in the Bellinzona area, namely on co-creating future mobility scenarios and discussing their implications (Phase 2). First, their perceptions on current barriers and opportunities towards sustainable mobility choices in Bellinzona were explored; then, they were asked to brainstorm a set of measures aimed at enhancing opportunities and overcoming such barriers for change – that is, to co-create scenarios and measures for future land-use and transport plans and policies. Finally, the outcome of such a creative process was planned to be brought to discussion with a wider set of stakeholders and the whole population, during a final open workshop aimed at discussing and assessing concrete possibilities for more sustainable mobility behavior choices, aimed at informing future mobility plans developed for the Bellinzona and its surroundings (Plan for slow mobility, School mobility programme, Agglomeration plan for the Bellinzona area, ecc.). Enlarging the base of involved citizens, opening to individuals, associations and institutions that had not been directly engaged in app co-creation and testing in Phase 1, was of strategic importance: the final outcome of the *Bellidea* lab in Phase 2 should not have simply reflected needs, perceptions and interests of specific sub-groups of the population; instead, it should have been expression of a representative group, which would facilitate larger consensus.

6.4.1 An action plan for successful upscaling

In the above framework, three types of upscaling were identified, as summarized in Figure 12:

- *Upscaling 1* takes place in the short-term, when the City of Bellinzona launches the *Bellidea* app to the whole population, including it among the policy tools adopted to reduce traffic congestion. It is therefore related to guaranteeing a sufficiently large number of users and sustained use over time;
- *Upscaling 2* takes place in the short-term as well: from the discussion on an app, with a limited group of citizens, activities will evolve to discussion on future mobility scenarios and related implementation measures, involving the relevant stakeholders at the city and regional level. It is therefore related to enlargement of the scope, complexity and conflict level of the issues under discussion with the lab;
- *Upscaling 3* takes place in the medium-term, after the conclusion of lab activities, and refers to institutionalisation of the new set of governance practices and tools and to their replication into other decision-making fields.

Note that a success in Upscaling 1 was expected to reinforce possibilities of success for Upscaling 2. In fact, real-life mobility data collected by a large number of app users would provide the City of Bellinzona with "smart", segment-oriented, real-life mobility data. Indeed, the *Bellidea* system was thought to serve in future as a crowdsourcing tool for city planners: by means of web portals, such data could be made openly accessible to citizens and stakeholders, and then actively analyzed and discussed with the citizens themselves, thus spontaneously evolving the type and content of discussion into the lab itself, and bringing additional energies, ideas and points of view into the design of future mobility scenarios.

Overall, the above conceptualization shows that *Bellidea* upscaling impacts were expected to go well beyond the mobility and transport field: in fact, if the whole *Bellidea* approach proved successful, the City would have been endowed with a new set of governance practices, applicable to future decision-making processes in other fields, such as for example waste management or land planning.

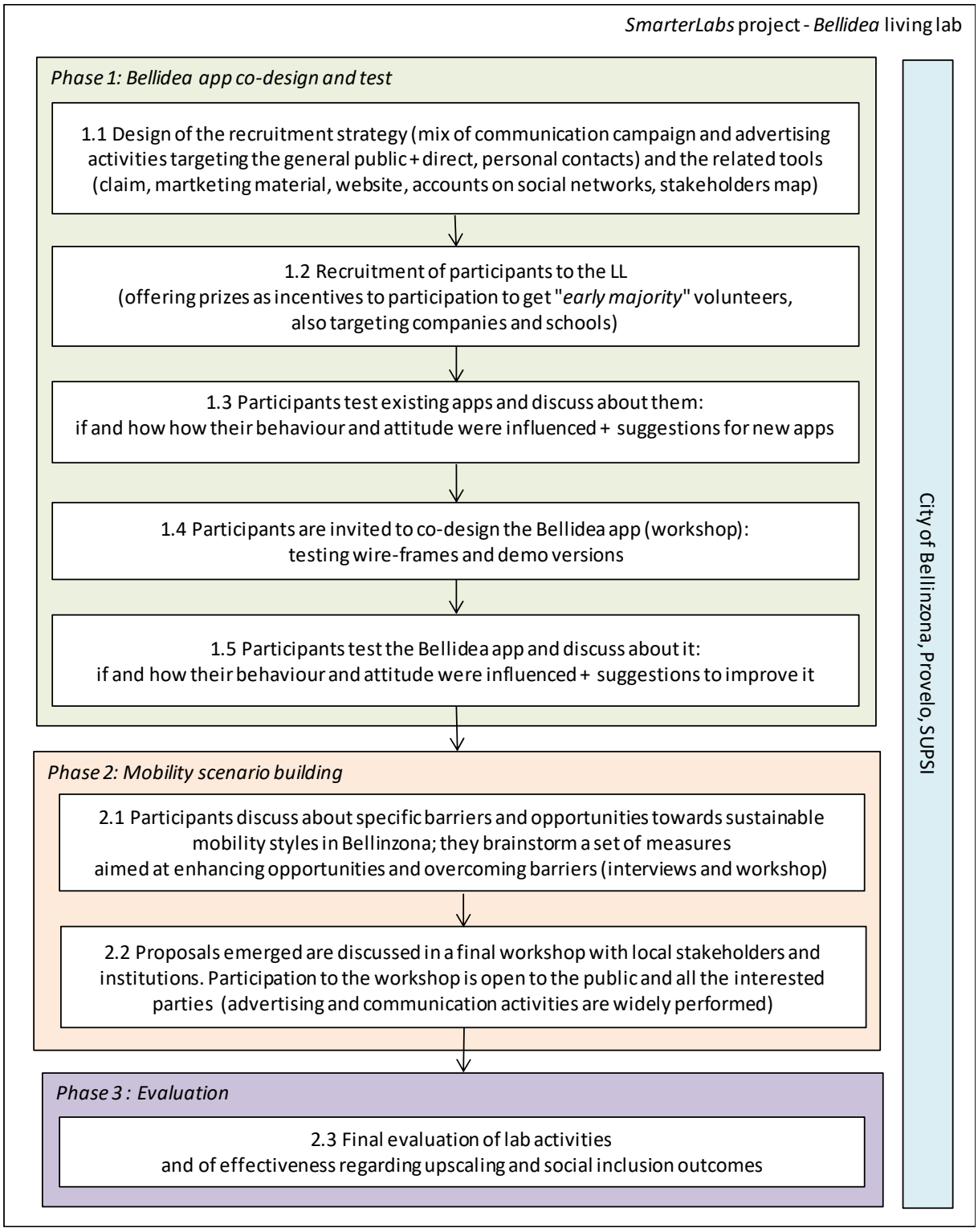

Figure 11: Plan of activities of the *Bellidea* Living Lab.

Figure 12: Upscaling and social inclusion in the *Bellidea* Living Lab.

6.4.2 Turning *Bellidea* into a "smarter" Living Lab

In the above sections we indicated how the *Bellidea* Living Lab was organized, in order to achieve its mobility behaviour change goals, and we also indicated which types of upscaling were identified as particularly relevant for that specific Living Lab. To achieve the SmarterLabs goals and therefore effectively address the problems of social inclusion and upscaling of project outcomes, we first identified the relevant constraints affecting this specific Living Lab. Then, we designed targeted measures to address them (anticipating strategies), and implemented them in the Living Lab process, to test their effectiveness. The constraints were directly identified following the retrospective analysis performed for the Bellinzona area (Chapter 5), and were summarized as follows:

- Relevant stakeholders are not engaged;
- Citizens lack financial, intellectual and time resources;
- Limited learning;
- Limited consensus at the political and societal level;
- Low institutional receptiveness;
- High institutional fragmentation.

	Upscaling 1	Upscaling 2	Upscaling 3
Relevant stakeholders are not engaged	X	X	X
Citizens lack financial, intellectual and time resources	X	X	X
Limited learning	X	X	X
Limited consensus at the political and societal level	X	X	X
Low institutional receptiveness		X	X
High institutional fragmentation			X

Table 9: Key constraints identified to affect upscaling of the Bellidea Living Lab outcomes.

Discussion on how these constraints were expected to affect the outcomes of the *Bellidea* Living Lab, on the anticipation strategies we designed, and on their effectiveness is performed in Chapter 8, where we discuss overall results of the SmarterLabs project.

6.5 Results of action research in the *Bellidea* Living Lab

The *Bellidea* Living Lab app was launched to the public at the end of January 2017, with a press release and the start of direct contacts to engage interested citizens. All the activities performed and the material developed within the lab were described and made publicly available in a dedicated website, which will also be regularly kept updated after the end of the SmarterLabs project: http://www.bellidea.ch/ (in Italian, relevant material is available in the “Documenti” and “News” sections). Within this Final Report, activities aimed at recruiting Living Lab participants are presented and discussed in details in Sections 8.1.1 and 8.2.1.

6.5.1 Social inclusion in the *Bellidea* Living Lab

Overall, 46 citizens answered the call and joined the first meeting of the *Bellidea* Living Lab, that took place on early March 2017. Afterwards, *Bellidea* meetings were held once a month until February 2018, with a break during Summer months. A decrease in participation was noticed over time, with a core group of 16 citizens actively attending all of them (“regular lab participants”).

Figure 13: Pictures from the *Bellidea* meetings.

To assess if the *Bellidea* group was sufficiently diverse, which was essential for “Upscaling 1” (if the lab was only attended by already “converted” people, how could we design an app targeting mainstream “car dependent” people?), at subscription *Bellidea* participants were asked to fill a questionnaire in, asking about their mobility patterns (stated perceptions) and basic socio-economic data. The collected data are reported in Figure 14, which shows lab participants based on the means of transport they use and the means of transport they own (for public transport, owning of a season ticket was considered equal

to owning the means of transport). The charts both show the characteristics of all participants at the start of lab activities (n=46) and the characteristics of those who regularly participated to lab meetings (n=16).

In both cases, there is a clear prevalence of people using (and owning) a mix of available means of transport, while the "converted" (those who do not use or own a car) have lower weight, especially if only regular lab participants are considered. Notwithstanding "car dependent" people (those who only use and own a car) played a very limited role within the group of lab participants, the level of social inclusion in the lab was nevertheless judged as satisfactory, as the presence of people used to all means of transport, capable of appreciating the opportunities and the limitations of each mode, prevailed.

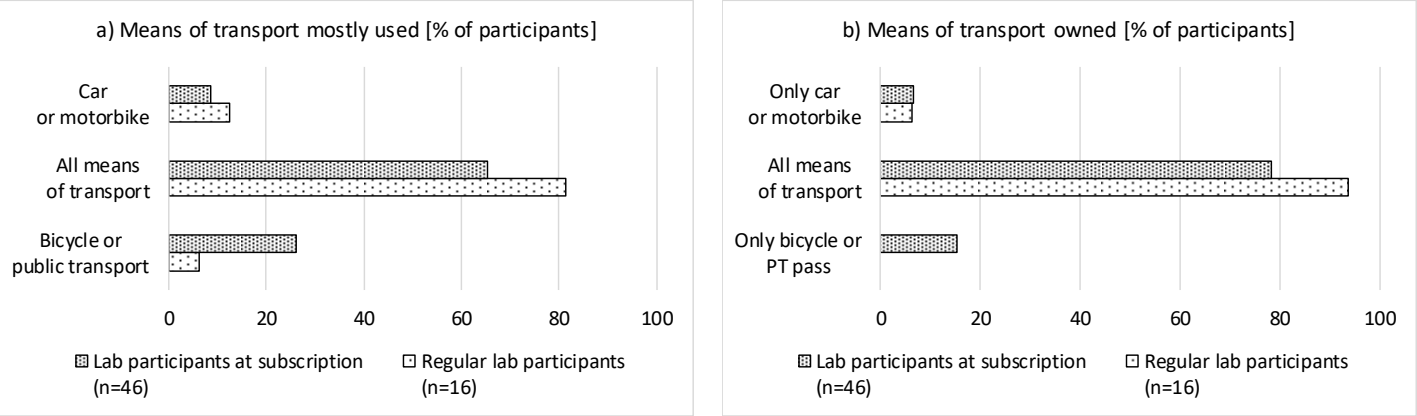

Figure 14: Characteristics of the participants to the *Bellidea* Living Lab, with respect to their mobility patterns: all lab participants at subscription (n=46) and regular lab participants (n=16).

Also, we investigated whether Living Lab participants were already used to join community-level initiatives, either in terms of political activism or previous involvement in NGOs: more than three quarters of them, both considering the set of participants at subscription and regular lab users, had no previous similar experience. This shows that the Living Lab framework was able to trigger individuals that were used to a more individualistic approach, to dedicate themselves to a community-level cause: fresh energies were therefore brought into policy-making activities at the urban level.

From the point of view of social inclusion, the socio-economic parameters investigated in the questionnaire refer to gender, age range and education level. Data reported in Figure 15 shows a predominance of male participants (maybe related to a supposed larger affinity with smartphone apps and ICT technologies in general) or, in general, to less available free time to join other activities, besides job and family care. The analysis of age ranges shows that the group of lab participants at subscription (n = 46) was characterized by a pretty diverse group, including both representatives of younger and older generations. Instead, the group of regular lab participants (n = 16) is much more polarized towards older generations, the large majority of participants being older than forty years old. Finally, education levels of lab participants were pretty diverse in both groups, however with a common tendency towards highly educated people, and a lack of participants who only concluded compulsory education cycles.

Specific efforts were performed to anticipate barriers due to "Citizens' lack of financial, intellectual and time resources to participate in the lab". Actually, larger efforts were dedicated to engaging elderly people and migrants, while we had expected students to be easily stimulated, by simply following invitations by their school teachers, thanks to their natural inclination to interact with the digital world. Resulting numbers suggest instead that in any of such cases the performed activities were not enough to favour their significant participation. For instance, while young generations are the most inclined with

technological innovation, they are also less used to participation and engagement in public processes. Therefore, *Bellidea* results suggest further effort might have been dedicated to specifically outreach students, without intermediary persons such as school teachers. Actively engaging elderly people would have probably requested stronger in-person contacts, instead of just relying on flyering mediation. In fact, even though flyers specified that no specific computer competences were needed, they probably were not as convincing as a person would have been. Regarding migrants, we had on purpose chosen to rely on third-party mediators (officers of the local association), to exploit the trust relationships already available between them and favour empathy creation. However, this was not effective with migrants, who were not convinced they would have been explicitly supported in case of language problems: people from the *Bellidea* team should have probably needed to back the mediators up and reinforce the message.

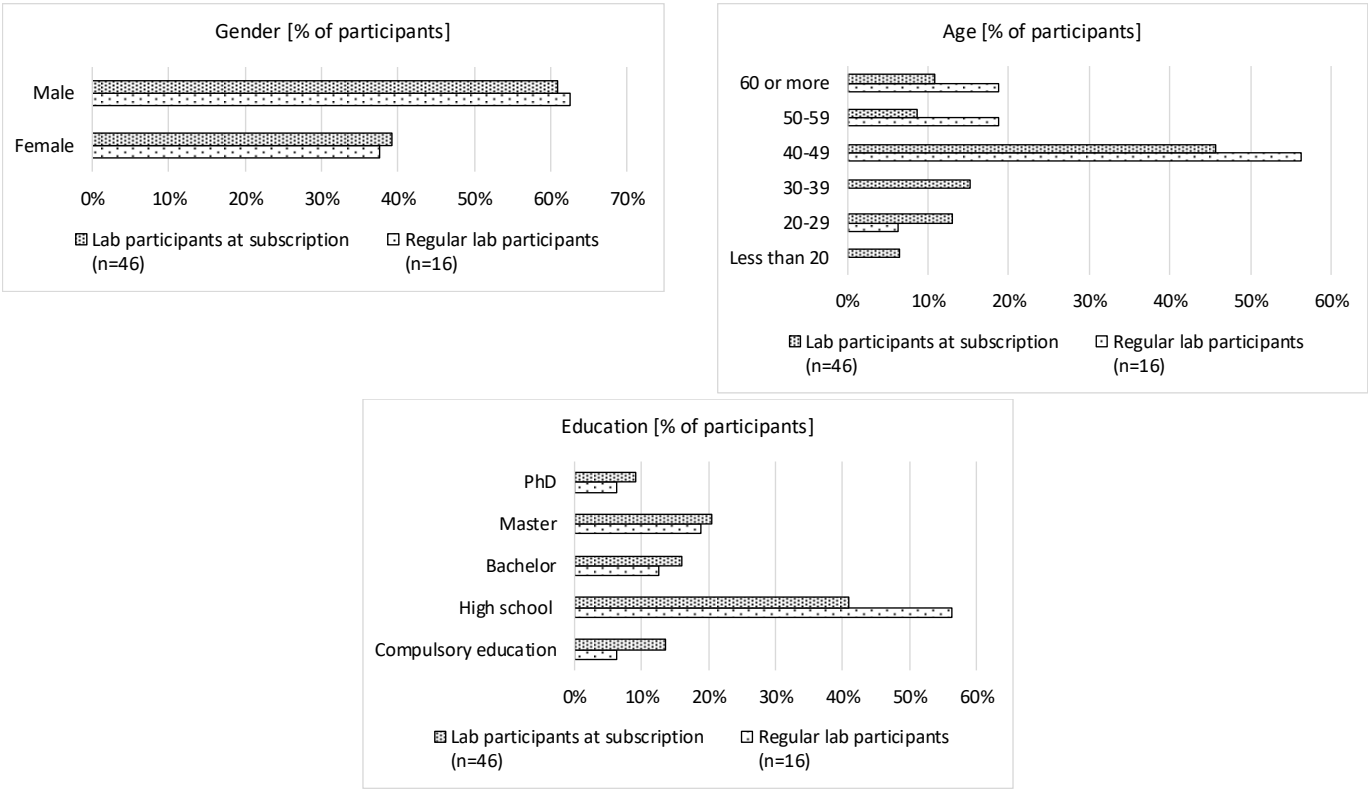

Figure 15: Characteristics of the participants to the *Bellidea* Living Lab, with respect to main socio-economics variables (gender, age range and education): all lab participants at subscription (n=46) and regular lab participants (n=16).

6.5.2 The *Bellidea* app

First lab meetings were organized as co-creation workshop, aimed at identifying the key functionalities to be included in the *Bellidea* app, as well as designing the rules behind them. Later meetings were instead conceived as test-beds for the app prototype, as long as professional software developers were translating lab proposals into pieces of software code. Funding for software development were guaranteed by the City of Bellinzona, while SUPSI funded the strictly related research activities regarding algorithms for automatic detection of the transport mode.

The outcome of co-creation in the lab (Figure 16) was an app that, exploiting another activity tracking app named *Moves*, performs automatic detection of the transport mode, provides users with eco-feedback on their individual mobility patterns, stimulates them with mobility-related challenges and

invites them to collect points, which depend on how they move and which transport mode they use – the higher the weekly percentage of travelling time by public transport, bicycle or walking, the higher the amount of points collected. Points allow for a comparison between the users, by means of a weekly leaderboard, and can be redeemed for prizes such as discounts on energy bills and vouchers for local stores and/or activities (cinema, theatre, museum, swimming pool, ecc.) and public transport tickets. For the first year, points are offered by the City of Bellinzona and a few public partners, such as the local public transport operator and the utility company. For the next years, the City was thinking of widening the network of partners, also including local private companies. An idea they were exploring was to launch a public call, open to any interested local commercial activity, to join the "*Bellidea* network". Members of such a network would be required to contribute to prizes for the *Bellidea* users, such as for example vouchers or discounts, and in exchange for this they would get the opportunity to retain already existing customers and to attract new ones. Ideally, such a process would activate a virtuous circle for the local economy, with *Bellidea* points becoming a sort of local currency accepted in local shops and services, as it happened in a similar social innovation experience in the Netherlands, with the Ring-Ring mobile app and community (https://ring-ring.nu/).

Since real prizes are offered, detection of the mode of transport is crucial for *Bellidea*. Requesting users for a validation, as in many mobility tracking apps, would leave room for cheating. However, current automatic detection capability is limited, with peaks in detection accuracy only reaching 75% of trips [Harding et al., 2017]. Improved algorithms based on a previous app SUPSI had created [were thus developed, to implement a mixed configuration: a short training period requires validation for all trips, providing no points; then, validation is only asked when estimated probability of the mode of transport falls below a certain threshold. The underlying assumption is a relationship of trust between the app and its users.

Lab participants decided to introduce community prizes as well. To this purpose, *Bellidea* also offers community challenges, to be periodically launched throughout the year, such as «This month, let's use the bicycle for at least 20% of our overall travelling time». If app users achieve such a challenge, the community as a whole gets a prize, such as for example discounts on public transport season tickets, public transport excursions for school classes or cargo-bike transport services for elderly people. Such a mechanics is expected to further motivate people to keep level of activity high, since it builds on both their feeling of belonging to the local community and on their desire for attractive prizes.

Finally, discussion in the lab also addressed how to properly manage and protect the collected individual sensitive data. Though in general lab participants were not worried that their personal data were recorded and stored, they critically feared external third parties could access them. Therefore, to guarantee the respect of stricter Swiss privacy protection regulations than cheaper servers abroad, they asked (and obtained) that *Bellidea* data were safely stored in a server machine directly operated by the City of Bellinzona, through the local municipal utility company.

More details on the features of the Bellidea and on its performances regarding automatic mobility tracking and detection of the transport modes are presented in Appendix 1, which consists in a manuscript presented at the Swiss Transport Research Conference STRC 2018 in Ascona (*"Outcomes of a smart city mobility Living Lab prompting low-carbon mobility patterns by a mobile app"*).

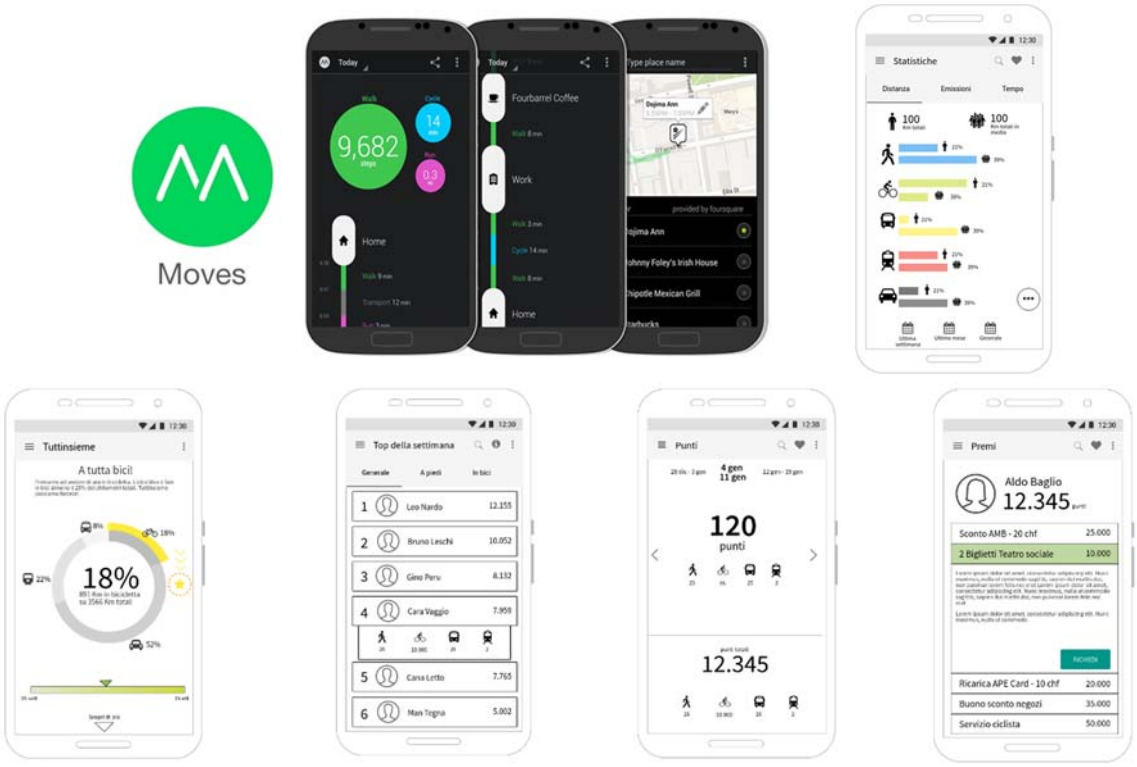

Figure 16: A selection of screenshots of the *Bellidea* app. Basic activity tracking is performed by the commercial Moves app.

6.5.3 Progress towards “Upscaling 1”: diffusion of the *Bellidea* app at the City level

The *Bellidea* app was launched on April, 25 2018 to the whole population of the Bellinzona area, by means of a joint press conference by the City of Bellinzona, SUPSI and Provelo Ticino. From that day on, interested citizens living, studying or working in Bellinzona could download and start using it whenever they liked.

Thanks to the communication efforts and the specific activities performed to favour large diffusion of the app among the wider population (“Upscaling 1”), *Bellidea* became pretty popular. Overall, between April, 25 and July, 31, 721 accounts were registered in the *Bellidea* app, and 207 users collected at least two full weeks of data. While communication activities to support wide diffusion of the *Bellidea* app were ongoing, in July 2018 we received the unexpected news that the *Moves* app, on whom *Bellidea* was relying to perform all the basic mobility tracking activities, would have been closed by the end of the month. Such a decision to discontinue *Moves* was communicated with very limited advance, so that no reliable alternative was found. Therefore, at the end of July 2018 we had to temporarily stop all *Bellidea* activities, freezing them until an alternative to *Moves* was found. This was promptly and openly communicated to both Living Lab participants and the *Bellidea* users, and the *Bellidea* app was replaced by a “light” version, allowing to redeem previously collected points, but no longer attributing new points. At the time of writing (May 2019) we are still exploring possible alternatives to replace *Moves*, by taking into account already existing commercial and research apps, and especially assessing costs and feasibility to internally develop it. The goal of all actors involved in *Bellidea* is in fact to restart as soon as possible, towards the full achievement of the envisioned upscaling benefits.

Even though present results just refer to the short-term activity of the *Bellidea* app, data collected during these three months offers us elements to assess both progress towards “Upscaling 1” and effectiveness

in overcoming limitations of previous app-based interventions, namely “early abandon” and “preaching to the converted”.

Beyond “early abandon”?

Figure 4 shows the evolution of the weekly number of *Bellidea* app users, from the launch of the app to the end of July 2018. To avoid possible biases in the collected data, we opted for excluding from our analysis data collected during the last three weeks of July, when the temporary suspension of the *Bellidea* app, due to *Moves* discontinuation, was notified to participants. Thus, only data collected from April, 23 2018 to July, 9 2018 has been considered. During this period, on average we accounted for 180 (SD ± 28) active users per week, each of whom regularly interacted with *Bellidea* for a bit less than 5 weeks. Overall, such figures suggest that “Upscaling 1” regarding the number of app users started to take place in a tenfold order of magnitude: from the 16 citizens who regularly attended lab meetings, the average number of *Bellidea* users grew around 10 times. Since we acknowledge that achieving a critical mass of app users requires time to create a network of users and produce a word-of-mouth effect (Czepiel, 1974), these figures were viewed as encouraging, but not fully satisfactory. In fact, figures also showed a decreasing trend over time in the number of active users. To counteract this phenomenon and correspondingly increase the number of users, further communication activities were put into practice. For instance, on early June *Bellidea* was presented and discussed on a radio programme, which had the immediate effect of increasing the number of active users, as shown in Figure 4.

Stronger communication and engaging activities were planned for early September 2018, after the summer break, with the launch of the first *Bellidea* collective challenge during the European mobility week. However, with the temporary suspension of the *Bellidea* app, scheduled activities aimed at increasing the number of app users and sustaining their use over time have been postponed as well. Effectiveness of collective challenges as a tool to favour user retention and engagement will therefore be assessed within future research activities.

Beyond “preaching to the converted”?

To check whether “converted” users were dominant among *Bellidea* app users, we analyze their mobility patterns, based on data collected via the app. On average for the first two weeks of use, *Bellidea* only tracked the performed trips, without providing any feedback, points or inviting to join challenges (training period). Individual data collected during such two weeks can therefore be regarded as “mobility patterns baseline”, while data collected during the following weeks is “*Bellidea* influenced”. By comparing such baselines with data of the 2015 Swiss Mobility and Transport Census (SMTC, FSO-ARE, 2015), which can be taken as representative of the average “mainstream car driver” in the Swiss region of Canton Ticino, an indication about representativeness of *Bellidea* users is therefore obtained.

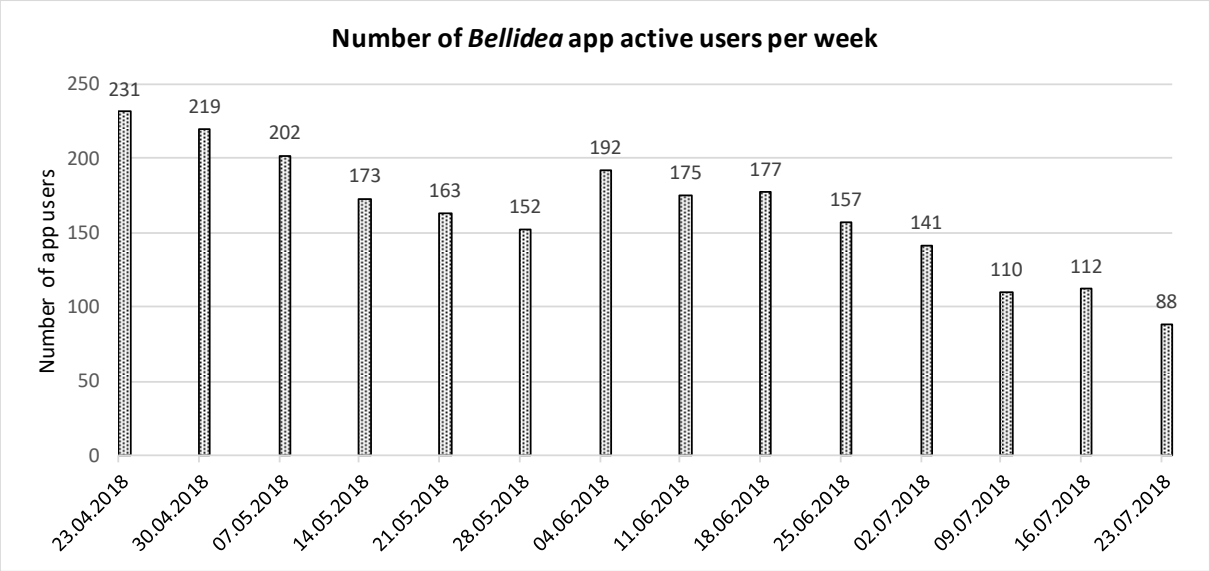

Figure 17: Evolution of the number of active users of the Bellidea app, between its launch and its temporary discontinuation at the end of July 2018.

Consistently with the indicator used to attribute points in *Bellidea*, which is travel time by each transport mode, we consider the average daily total travel time and the average daily travel time by car, and focus on the following two sets of users:

- "dropout" app users (n = 55), namely those who abandoned *Bellidea* quite soon, interacting with it for a maximum of four weeks;;
- "loyal" app users (n = 106), namely those who were actually engaged by app mechanics and showed a sustained app use over time, by interacting with *Bellidea* for at least eight full weeks.

Comparing average daily travel time of the set of 55 "dropouts" with 2015 SMTC data (Figure 18 and Table 10), statistically significant differences appear: *Bellidea* "dropout" users travel for shorter periods, both in total and by car. Therefore, based on such travel time data, on average the set of *Bellidea* users who collected a maximum of four weeks of data can be regarded as "converted" citizens, characterized by more sustainable mobility patterns than average 2015 SMTC "mainstream car drivers". Instead, if we consider the set of 106 "loyal" app users, who kept interacting with *Bellidea* for a longer period of time (Table 11 and Figure 18), no statistically significant differences between their average travel time and 2015 SMTC values are found. It seems therefore that users with higher *Bellidea* retention rates tend to be more "mainstream car drivers" than "converted" individuals**.** In other words, "loyal" app users seem to actually coincide with the *Bellidea* target group, that is, those citizens that most need to change their mobility patterns. Citizens with less need for improvement, instead, seem to have interacted with the app for a while, but then to have stopped using it, since they do not need it.

Though related to a short-term observation of *Bellidea* app use and based on aggregated, average data of all *Bellidea* users, these figures are encouraging, suggesting that the strategic design choices aimed at overcoming the "preaching to the converted" and "high abandon rates" limitations produced positive outcomes, with respect to previous experiences.

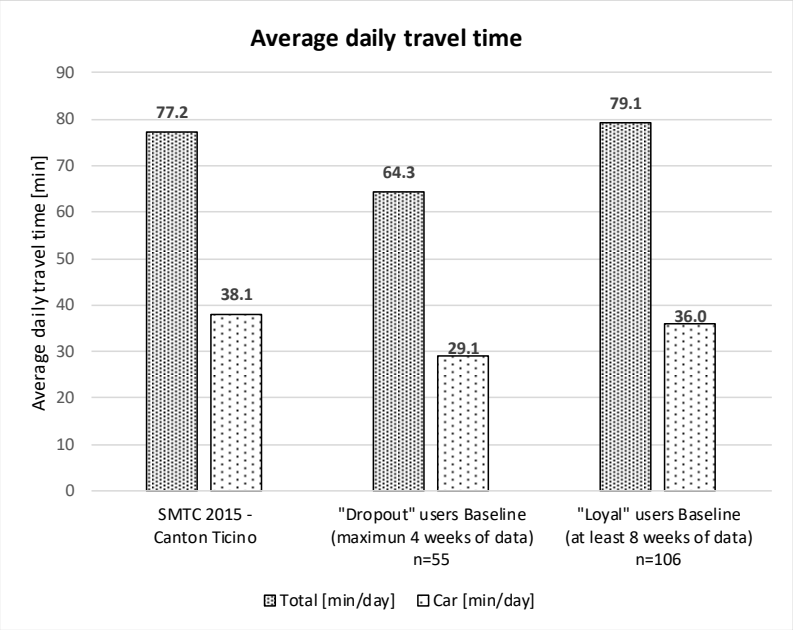

Figure 18: Comparison between baseline mobility indicators of Bellidea users (both “droputs”, n = 55, and “loyal app users”, n = 106) and the Swiss mobility and transport census.

Dropout app users (at least two weeks of data, n = 55)		**SMTC, 2015**	**Baseline (n= 55)**	**One sample t-test**	**p**	**Statistical significance of differences**
Daily travel time	Average total [min]	77.2	64.3	2.0768	.043*	Statistically significant
	Average car [min]	38.1	29.1	2.0287	.0474*	Statistically significant

* significant at .05 level

Table 10: Differences between baseline data of “dropout” app users (those who collected at least two weeks of data), and the 2015 SMTC data regarding average Canton Ticino population.

Loyal app users (at least eight weeks of data, n = 106)		**SMTC, 2015**	**Baseline (n= 106)**	**One sample t-test**	**p**	**Statistical significance of differences**
Daily travel time	Average total [min]	77.2	79.1	.625	.533	Not statistically significant
	Average car [min]	38.1	36.0	1.312	.192	Not statistically significant

Table 11: Differences between baseline data of “loyal” app users (those who collected at least eight weeks of data), and the 2015 SMTC data regarding average Canton Ticino population.

Socio-economic and mobility characteristics of app users

Coherently with the analyses aimed at investigating characteristics of lab participants, also characteristics of app users were analyzed, both in terms of key socio-economic variables and mobility patterns. Data on socio-economic variables were collected by an online survey, directly accessible from

the *Bellidea* app, that app users were invited to fill in. Answering the survey was not compulsory nor it was rewarded in any way. Overall, 280 app users answered the survey. Data collected (Figure 19) shows characteristics of app users based on such answers. To provide a realistic picture of who app users are, the figure both shows answers of all 280 respondents (which refer to people somehow interested in the *Bellidea* app, no matter how long they used it), and answers by those who used the *Bellidea* app for at least eight full weeks (which we regard as "loyal" app users, that is those who were actually engaged by app mechanics and showed a sustained app user over time), namely 75 app users.

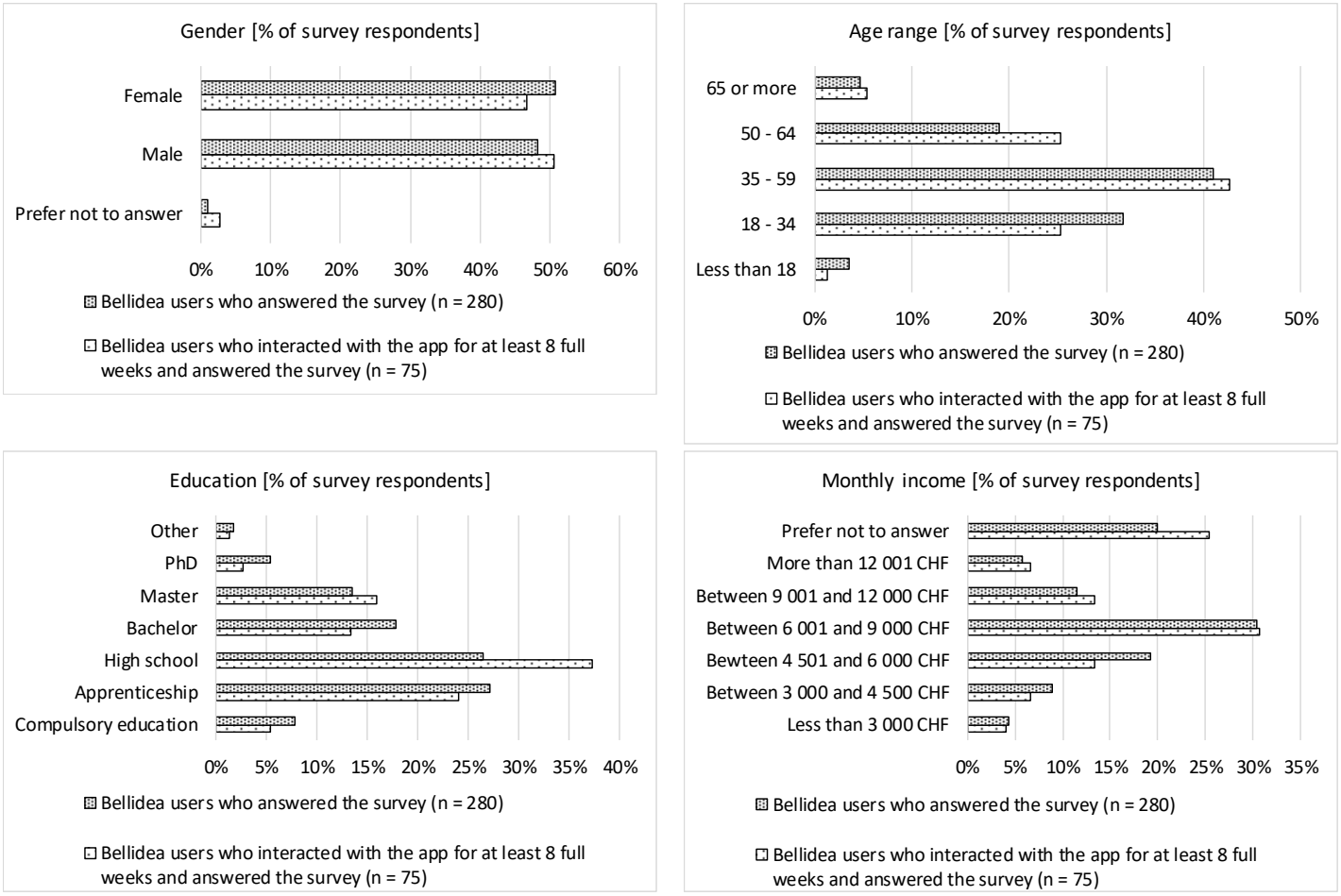

Figure 19: Characteristics of *Bellidea* users who answered the survey (n = 280) and *Bellidea* users who answered the survey and interacted with app use for at least 8 weeks (n = 75), with respect to main socio-economic variables (gender, age range, education and income). Answering the survey was voluntary.

Did the *Bellidea* process manage to guarantee inclusion of different socio-economic categories of citizens? Partially. In fact, gender and age group composition were satisfactorily diversified, though there was a tendency to attract medium to highly educated and medium-high income people (average income declared by those who answered the survey, based on income categories shown in Figure 19: around 7'200 CHF/month considering all 280 respondent users, 7'700 CHF/month considering the 75 users who regularly interacted with *Bellidea* for at least 8 weeks). These figures indicate that further efforts will be needed to increase the amount of lower income and education app users, when *Bellidea* will be re-activated.

Evolution of individual mobility patterns

Mobility data collected by *Bellidea* app users has been analysed in order to understand their evolution over time, and detect possible impacts of the *Bellidea* app. Such analyses acknowledge that, lacking a control group, any change in individual mobility patterns cannot be univocally attributed to the *Bellidea* app. Also, baseline data are weak, since they are collected over a period of just two weeks, which do not necessarily encompass the variety of individual current mobility needs. Nevertheless, exploring the evolution of individual mobility patterns over time, with the aim of identifying potential tendencies somehow related to app use, was a key activity within Phase 3 evaluation of the outcomes of the *Bellidea* Living Lab.

To assess *Bellidea* impact, the same mobility indicators used above were considered, related to both average daily travel time and distance. For instance, a comparison over time was made, to explore if and how baseline data (namely, those collected during the first two weeks of app use) evolved over time. To this purpose, a two-week time step was used, and at every time step average data regarding to the previous two weeks were considered. This guarantees comparisons are made between similar quantities.

Figure 20 and Table 12 show such a comparison, by accounting for “loyal” users who collected at least 8 weeks of data (n = 106). This provides insights on the impact on users who actively interacted with the app for a sufficiently long period of time, allowing to start detecting possible changes in behavior. Data shows a slight reduction effect regarding total and car-based travel time (and on the related percentage), though such reductions are not statistically significant [respectively, $t(105)=.696$, $p=.488$; $t(105)=1.451$, $p=.150$; $Z = -1.592$, $p= .111$].

For this reason, an additional evaluation was performed, by considering the difference between initial individual mobility patterns (the *Bellidea* baseline, accounting for the first two weeks of collected data) and mobility patterns at the end of the period during which the *Bellidea* app was used. Length of such a period was not fixed, and depended on the single user: some of them quitted app use a few days soon after installing it, other kept using it until it was disabled due to *Moves* discontinuation. Therefore, no matter when quitting app use happened, for each user the last two weeks of app use were looked for, and compared with their baseline data. To perform such an analysis, the only requirement we set was to only consider users with at least four weeks of data, so that homogeneous amounts of data (the first two-week baseline data and the last two-week “*Bellidea* influenced” data) could be compared. This implied only considering data for n = 167 users, as shown in Figure 21 and Table 12.

Such a comparison shows a decrease in the considered indicators, related to travel time. Particularly, for average car travel time a reduction of 3min6s (±23min30s) was observed, with respect to the baseline, and a decrease in the percentage of car travelling time was found (reduction of 1.8%). Even though, such results are not statistically significant, and accounting for the above limitations related to the lack of a control group and to the weakness of the values we consider as baselines, these figures suggest that use of the *Bellidea* app could actually have an effect, at least in the short term. Available data however do not allow to assess whether such an effect was sustained over time, or, after quitting app use, users reverted to their previous mobility patterns. A longer series of data, produced by a larger number of app users would be needed to assess the long-term effects, which, once more, calls for reactivating the *Bellidea* app as soon as possible.

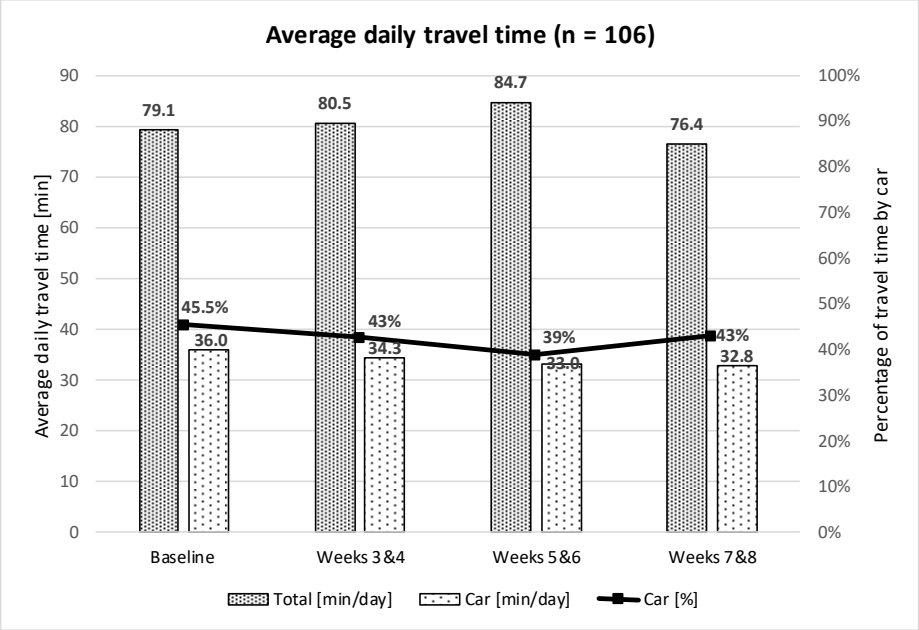

Figure 20: Evolution over time of key mobility indicator (average daily travel time) of *Bellidea* users: first couple of weeks of app use (baseline data) against the following couples of weeks. Only "loyal" users who collected at least eight weeks of data are shown (n = 106).

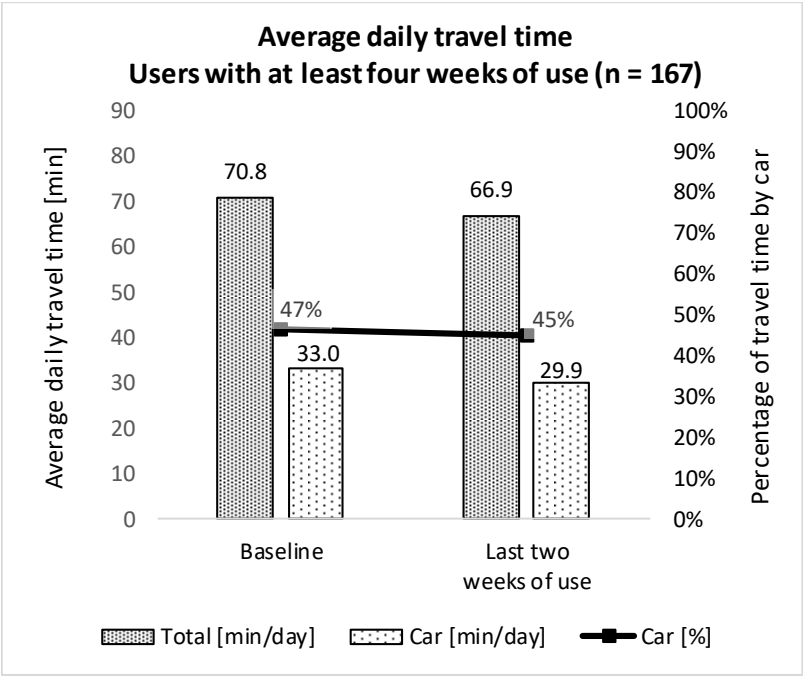

Figure 21: Evolution over time of key mobility indicator (average daily travel time) of *Bellidea* users: the first two weeks of app use (baseline) against the last two weeks of app use (which differ depending on the user). Only users who collected at least four weeks of data are shown (n = 167).

Users with at least 8 weeks of data (n = 106)		Weeks 1 and 2 (baseline)	Weeks 7 and 8	Pair t-test	*p*	Wilcoxon Test (Z)	*p*	Statistical significance
Daily travel time	Average total [min]	79.1	76.4	.696	.488	-1.218	.223	Not statistically significant
	Average car [min]	36.0	32.8	1.451	.150	-1.655	.098	Not statistically significant

N/A – not applicable

Table 12: Comparison between *Bellidea* baseline data (first two weeks of app use) and average data after 8 weeks of use (average of weeks 7 and 8 data). Calculations only consider users with at least 8 weeks of data (n= 106).

Users with at least 4 weeks of data (n = 167)		Weeks 1 and 2 (baseline)	Weeks 7 and 8	Pair t-test	*p*	Wilcoxon Test (Z)	*p*	Statistical significance
Daily travel time	Average total [min]	70.8	66.9	1.372	.172	-1.699	.890	Not statistically significant
	Average car [min]	33.0	29.9	1.703	.091	-1.815	.690	Not statistically significant

N/A – not applicable; * significant at .05 level

Table 13: Comparison between the first two weeks of app use (baseline data) and the last two weeks of app use (which differ depending on the user). Only users who collected at least four weeks of data are shown (n = 167).

6.5.4 Progress towards “Upscaling 2”: co-design of future mobility scenarios

While final bug testing of the *Bellidea* app was performed and just before its launch to the whole population, discussion in the Living Lab was upscaled from the app to future mobility scenarios for the area of Bellinzona (“Upscaling 2”). To this purpose, the last meeting of the Living Lab was organized as a discussion workshop, aimed at first performing a shared SWOT analysis of the current mobility system in Bellinzona (strengths, weaknesses, opportunities and threats), and then at identifying the most suitable measures to favour transition to a more sustainable mobility, with the final aim of drafting a “Charter of Principles for sustainable mobility in Bellinzona”.

The workshop was held on February 2018, and was attended by all regular participants to lab activities (n = 16). Outcomes of the meeting were then summarized into a two-pager policy brief published on the *Bellidea* website (http://www.bellidea.ch/wp-content/uploads/2018/04/SWOT_La_mobilit%C3%A0_a_Belllinzona_FINALE.pdf, see also Appendix 2, in Italian), aimed at stirring discussion at the city level with the wider network of stakeholders, citizens and policy-makers, within a further workshop, initially programmed for Autumn 2018, and now postponed after the restart of the *Bellidea* app. This deferment implies final achievement of “Upscaling 2” outcomes can only be reported in future works. However, we welcome as an encouraging signal the fact that the policy brief was publicly released and is accessible on the project website.

An additional element encouraging the engagement of City officials in activities committed to the co-design of future mobility scenarios once the *Bellidea* app will be unlocked, is related to the possibility of crowdsourcing mobility data thanks to this georeferenced application. In fact, a large scale use of the app would provide the City with “smart”, segment-oriented, real-life mobility data, to directly inform city planning. To exploit such data, the City had two options: either keeping it closed, and internally analyzing it, or conveniently anonymizing it through common techniques, such as decreasing the spatial resolution

and cutting off trajectories before they reach user homes, and making it openly accessible to any interested citizens and stakeholders. Embracing an open data approach, the City opted for the latter option, envisioning an interactive online dashboard representing maps, tables, indicators, etc., such as for example https://empowertoolkit.eu/evidence-database/dashboard/ or https://www.ciclogreen.com/smartcities. Such a dashboard would further promote public discussion on the future of mobility and urban settlements in Bellinzona. Particularly, the discussion could be channelled within the *Bellidea* Living Lab, thus keeping it open beyond the initially envisioned phases, letting it evolve as long as it gets more mature over time: additional workshops and lab meetings could be organized to co-analyse and discuss insights provided by materials on the *Bellidea* online dashboard, thus further contributing to future scenarios co-design.

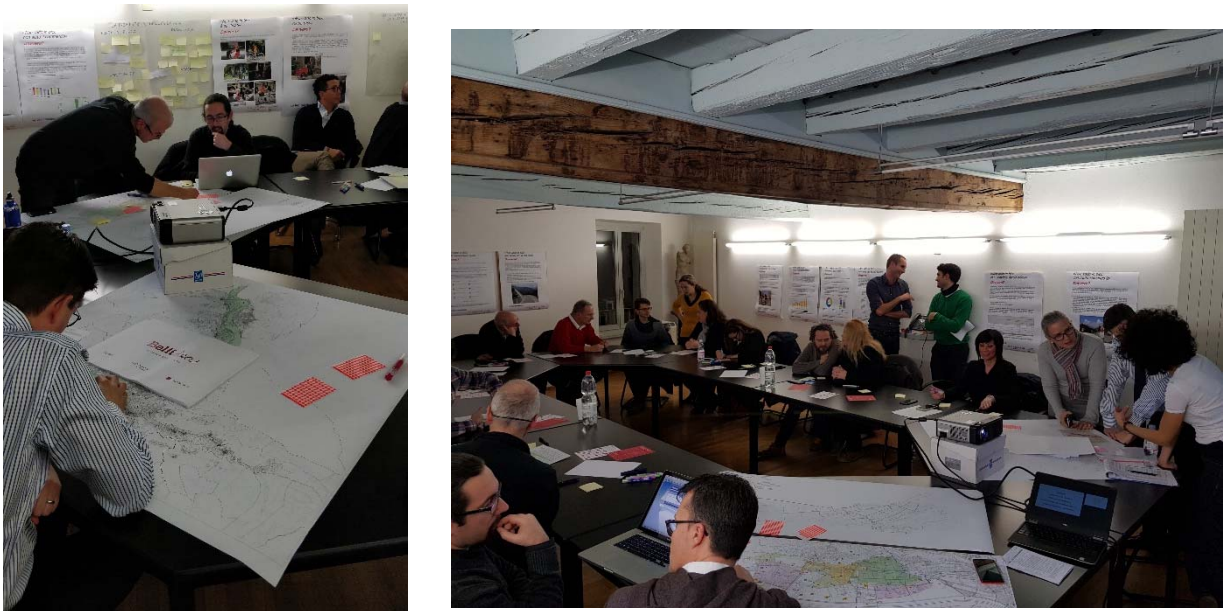

Figure 22: Pictures from the scenario workshop with *Bellidea* lab participants.

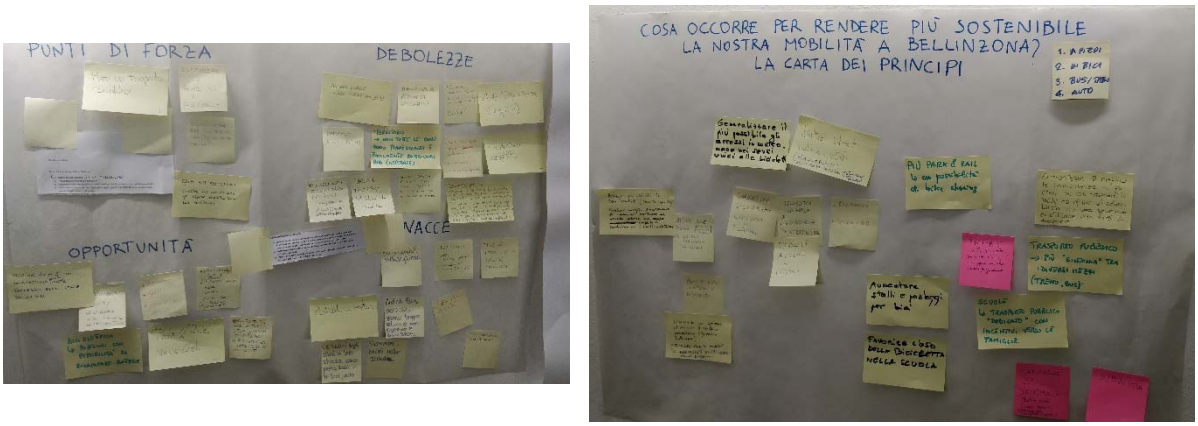

Figure 23: Results of the discussion on the SWOT analysis and the measures to promote sustainable mobility in Bellinzona.

6.5.5 Progress toward “Upscaling 3”: towards new institutional decision-making practices

The notification of *Moves* closing down and the consequent blocking of the *Bellidea* app compelled to also partly freeze those activities aimed at evaluating the effect of the Living Lab process in terms of new decision-making and governance practices, that were designed to stimulate collective learning and discussions towards “Upscaling 3”. In fact, the survey to evaluate Living Lab outcomes from the participants’ point of view was postponed, to avoid biased evaluations, related to the interruption of the *Bellidea* process soon after its launch. Similarly, the interviews that had been planned with City policy-makers and the workshop that was aimed at overcoming the current institutional fragmentation, by presenting the *Bellidea* approach to other city departments and discussing project outcomes, problems and potentials, were put off as well. However, the action research we performed during lab meetings allowed us to interact with lab participants and civil servants and thus to collect evaluation elements regarding our expectations about the *Bellidea* process. When feeding it, in fact, we were hoping the Living Lab would serve as a success story to draw local authorities nearer to participatory decision-making processes, triggering their interest for future city planning and other activities. In other words, like many other projects, *Bellidea* was meant to serve also as an “advocacy tool”, aiming to convince, demonstrate, accumulate evidence and lobby for adoption of different governance models, once the pilot phase would finish [Vreugdenhil et al., 2010].

Regular lab participants showed wide appreciation of the process and Living Lab approach, as well as of the specific attempt to address mobility problems from a different perspective, with respect to the past. Particularly, they enjoyed the possibility of becoming key players of the future mobility policy of the City, which is why they regularly attended project meetings and kept interacting with the process for about one year, without falling into temptation to abandon halfway. Instead of simply being requested to vote in favour or against measures elaborated by someone else, they liked being offered an active and creative role in addressing problems of their community.

Regarding civil servants, not only they were satisfied for having reached their initial goal of launching an innovative tool to address mobility-related problems – though it could not produce tangible impacts. Most importantly, they acknowledged the whole *Bellidea* process inspired them to rethink their working methods. Being responsible for mobility and transport issues in the city, they explained before *Bellidea* they were striving to analyze them with the eyes of the citizens, by first observing them and then trying to reproduce their decisions, putting themselves in their shoes. However, thanks to *Bellidea* they realized that directly interacting and creating a dialogue with them would be much more fertile: they got practical suggestions to address specific problems they were working on, and particularly appreciated the creative energies of their citizens, that allowed them to develop solutions from a different perspective. Also, a fruitful channel of interaction was created between the City of Bellinzona and the Provelo NGO, favouring development of shared projects also in the future.

Therefore, even though no institutionalization of governance practices has taken place yet, there are encouraging indications of a progress towards more inclusive and participatory daily practices of urban management, as envisioned by “Upscaling 3”.

7 Results

As already indicated, in parallel to action research in the *Bellidea* Living Lab, action research activities took place in the three other cities of the SmarterLabs project, within “smarter” Living Labs. In Brussels citizens were involved in participatory measurements of air quality, with the aim of increasing collective awareness on the impact of urban traffic flows on local air pollution and of mobilizing them to call for political measures to limit traffic-based air pollution. In Graz citizens and local stakeholders were engaged in the “smart” redesign of Griesplatz, a large square in the centre of the City, especially important as a traffic hub. Similarly, in Maastricht a series of focus group meetings exploiting a web-based design tool were held to engage stakeholders in co-designing the renovation of the central station area.

All activities in such Living Labs were designed and managed with the aim of addressing the specific constraints affecting social inclusion and upscaling that had both emerged through literature review and retrospective analyses in each city, and were appearing throughout the life of the Living Lab itself. Namely, in our “smarter” Living Labs we field tested a number of possible strategies to anticipate the identified constraints.

Such Living Lab processes were analysed throughout their course of development; also, we analysed their outcomes, always with the aim of evaluating effectiveness of the anticipating strategies and learning from such experiments (both from success and from failure activities). Such analyses were at first independently developed by the research groups managing each Living Lab, and afterwards comparative analyses across the four Living Labs were performed. Particularly, the periodic project meetings and the three dissemination workshops that also involved external policy-makers and practitioners (Helsinki - FL, Istanbul - TK, Santander - ES) provided the occasion to follow progress in Living Lab activities, sharing evaluations, gathering common understandings of the specific constraints in each context, and developing common and shared strategies to anticipate them.

Namely, the comparative analysis allowed to take into account:

- differences among specific topics addressed in each Living Lab experiment;
- differences in the social, economical, political and cultural contexts of the cities;
- differences in background competences of the SmarterLabs project partners;

thus allowing to gather a deeper and diverse learning on typical constraints affecting Living Labs and smart urban transformations, and to develop more robust and effective anticipation strategies.

As a result of such a process, we identified a number of recurrent constraints that affect inclusion and upscaling, and we learnt which of the anticipating strategies that we had tested in the four Living Labs were better suitable to generalization. This allowed us to develop the expected outcome of the SmarterLabs project, namely the guidelines to support policy-makers and practitioners in the development of “smarter” Living Lab processes. Such guidelines were created and refined as long as we were learning from action research in the Living Lab processes, and were tested and improved in the above-mentioned dissemination workshops. During such a process, some of the constraints we had identified at the end of literature review and retrospective analyses were reworked and aggregated, and new ones were introduced. Eventually, we identified a list of ten constraints, and accompanied each of them with a number of suggestions regarding how to successfully anticipate them in the design and management of the Living Lab.

The final version of the SmarterLabs guidelines was presented to the public at the final SmarterLabs conference, that took place in Utrecht (NL) on March, 7 2019. Since elaboration of these guidelines is the result of a collaborative learning process and the guidelines were collectively developed by all the

partners involved in the project, we cannot distinguish the contribution of each single partner: in this Chapter therefore we report the project results as a whole.

7.1 Ten constraints on upscaling and social inclusion in Living Lab experiments

The final set of the identified constraints affecting upscaling and social inclusion in Living Lab experiments is summarized in Table 14 (constraints on social inclusion) and Table 15 (constraints on upscaling). Table 16 instead indicates in which SmarterLabs Living Lab each constraint was particularly relevant, therefore summarizing which anticipating strategy was tested where.

		Typical constraints in Living Lab experiment	**Ways to anticipate these constraints**
*Exclusion **FROM THE Living Lab***	**#1**	**Citizens lack financial, intellectual and time resources to participate in the Living Lab** *To participate meaningfully, citizens need time, energy and commitment, a certain level of understanding of the issue at stake or of the technology in use, and sometimes also specific economic and intellectual resources or skills. Certain social groups may therefore tend not to participate in Living Lab initiatives.*	• Apply stakeholder and requirement analysis tools (in relation to desired outcomes of the Living Lab) to identify types of exclusion, their motivations and coping strategies • Include all Living Lab participants in such a reflection (not only the "institutional" initiators), across the Living Lab stages • Strategically design Living Lab micro-practices, such as informative and educational material, choice of venue and schedule of meetings, language, provision of technological support to reduce digital divide
	#2	**Relevant stakeholders remain out of the Living Lab** *Certain groups might not be interested in joining Living Lab activities, since they do not share the urgency to discuss the issues at stake and take action, or even have conflicting attitudes or goals. The Living Lab may thus become a low conflict circle of people sharing priorities, attitudes and goals, while the large majority of citizens would ignore it.*	• Stakeholder analysis allows to identify the relevant target groups and the reasons why they might/might not be interested to join Living Lab activities • This suggests how to frame Living Lab activities in public communication campaigns aimed at recruiting participants and to identify the specific actions needed to also raise the interest of less intrinsically motivated target groups
	#3	**Groups and impacts outside the Living Lab context are overlooked** *The Living Lab project may lack or be poor of representatives from the larger urban context,, though they might be impacted by the project. Likewise, effects beyond the Living Lab boundaries may be neglected (e.g. decrease of cars in one district shifts traffic to another).*	• Explicitly consider the project's indirect and cross-scale effects in the broader urban context, by reflecting on the multiple scales relevant to the Living Lab and on the actors that might be included/excluded at each scale • Adopt adequate logistic arrangements and outreach strategies to help minimize exclusion, such as convening Living Lab meetings at different locations and being open to reframe meetings to achieve a shared vision and increase motivation

*Exclusion **IN THE Living Lab***	**#4**	**Existing power structures are reproduced inside the Living Lab** *The Living Lab setup and applied methods may not guarantee that any group or participant has equal opportunities for participating in the discussion, so that every voice is heard and seriously taken into account. For example, the Mayor, technical experts, or simply male Living Lab participants, may be given more weight than other participants.*	• Regularly perform a stakeholder group dynamics analysis, in order to understand group structure and leadership relations among group members • Particularly, identify any dominant position among Living Lab participants, due to already existing institutional roles outside the Living Lab (political responsibility, lobbying activity) • Design a communication and management strategy to address all identified target groups, keep flexibility, favour development of activities along different tracks, allowing each group to adapt to their speed of progress

Table 14: The final set of constraints precluding social inclusion and the related ways to anticipate them.

		Typical constraints in Living Lab experiment	**Ways to anticipate these constraints**
Related to Living Lab **DESIGN**	**#5**	**The Living Lab's potential for learning is underexploited** *If the lessons offered by Living Lab activities are not explicitly monitored, understanding of the innovation process, of its implications and its consequences, may be low. In this case, only limited transfer of learning is possible, thus precluding the diffusion of innovation across spatial scales.*	• Develop a comprehensive learning strategy aimed at capturing and monitoring knowledge creation in the Living Lab (collective knowledge co-production) and transferring it to all relevant actors outside the Living Lab • Knowledge exchange can be favored by people-to-people real-life interactions (i.e. physical meetings), which make learning more rewarding and comprehensive to all and also ensure tacit knowledge to emerge
	#6	**The Living Lab is disconnected from broader societal debate** *The Living Lab experiment may lack coordination with the social, economic, cultural and political conjuncture. In such a case, the policy climate may not support the adoption of the innovation pursued in the Living Lab. The broader public may either not share the Living Lab's goals and outcomes or find them irrelevant.*	• Design and manage Living Lab activities with great care for the local conjuncture: consider broader socio-economic, cultural and political aspects, ensure links with the existing public debate, with what a community considers to be its priorities, and what stakeholders consider to be feasible • Maintain a certain flexibility throughout the Living Lab, be ready to adapt to changing conditions in the outside social and political agenda. Ensure that both Living Lab objectives and its framing can be adjusted and continuously re-defined by all actors • Place citizens at the core of the process and actively coordinate with other societal developments and initiatives related to the content of the Living Lab

Related to Living Lab **CONTEXT**	**#7**	**The Living Lab consensus is not reflected in policy and society** *Even if the topic addressed by the Living Lab is a proiority of the social and political agenda, persistence of conflicts on specific topics may preclude reaching agreements, either inside or outside the Living Lab. The outcomes of the Living Lab may therefore lack wide consensus, support and political majority.*	• Open to participation as much and as early as possible and regularly update the stakeholder analysis whenever external conditions change, in order to avoid the exclusion of any relevant stakeholder group • Favor emergence of any conflicting goals within Living Lab participants and between Living Lab participants and possible external stakeholder groups not actively engaged and manage conflicting goals by multi-criteria decision-making techniques • Always emphasize and give weight to potential community-level benefits of the options under discussion, against personal or partisan benefits. To this purpose, exploit already existing networks and coalitions and seek for new and unexpected alliances between groups of stakeholders, trying to build relationships with successful initiatives already developed by other actors
	#8	**Stakeholders and institutions are highly fragmented** *Fragmented institutional arrangements between and within institutions ("silo compartments") may preclude clear distribution of responsibilities among the actors involved in Living Lab activities, and effective cooperation between them.*	• Foster transparency and collaboration between administrative units, organizations and stakeholders, right from the beginning of the Living Lab process • Create occasions for them to interact and become familiar with the process, discussion topics and proposals emerging within the Living Lab
	#9	**The urban assemblage is sticky and locked-in** *Technical, infrastructural, legal or financial aspects, such as long-term contracts or legal lock-ins, may cause obduracy of the urban assemblage, thus precluding possibilities for practical implementation of the outcomes of the Living Lab.*	• Activate a dialogue with relevant actors as soon as possible: by developing future visions with stakeholders and crucial decision-makers, the potential of more structural changes can be highlighted • Local actors might be empowered by teaming up with supra-urban actors, such as municipalities with provinces or local NGOs with their national counterpart (scale jumping)
	#10	**The Living Lab meets low institutional receptiveness** *Local governments and other actors involved in the Living Lab process might be unfamiliar with, or open to, co-creation approaches, favoring instead expert-driven way of thinking and agreement with powerful lobbies. If so, institutions may not have real commitment to implement Living Lab outcomes.*	• Seek for early inclusion of policy-makers and local institutions • Provided that Living Lab organizers show genuine commitment and give voice, role and responsibility to diverse groups of citizens, civil society organizations and experts, institutions might start appreciating the approach and its benefit • Carry out multiple successful pilot processes • Build on existing practices and procedures of representative democracy to promote dialogue between stakeholders

Table 15: The final set of constraints precluding upscaling and the related ways to anticipate them.

		Typical constraints in Living Lab experiments	**"Smarter" Living Lab**
Social Inclusi	Exclusion from the Living Lab	Citizens lack financial, intellectual and time resources to participate in the Living Lab	Bellinzona, Brussels, Graz

		Relevant stakeholders remain outside the Living Lab	Bellinzona, Brussels
		Groups and impacts outside the Living Lab context are overlooked	Brussels, Maastricht
	Exclusion in the Living Lab	Existing power structures are reproduced inside the Living Lab	Graz, Maastricht
Upscaling	Related to Living Lab design	The Living Lab's potential for learning is underexploited	Bellinzona, Maastricht
		The Living Lab is disconnected from broader societal debate	Brussels, Graz, Maastricht
	Related to Living Lab context	The Living Lab consensus is not reflected in policy and society	Bellinzona, Maastricht
		Stakeholders and institutions are highly fragmented	Bellinzona, Maastricht
		The urban assemblage is sticky and locked-in	Graz, Maastricht
		The Living Lab meets low institutional receptiveness	Bellinzona, Brussels, Maastricht

Table 16: The final set of constraints precluding social inclusion and upscaling and the "smarter" Living Labs where each constraint was identified and the related anticipating strategies were tested.

Based on the above set of constraints and ways to anticipate them, the key output of the SmarterLabs project, namely the guidelines for policy-makers and practitioners, was developed. The policy and practitioner brief guidelines were organized in the following three-fold material:

- a video, mostly targeting policy-makers and potential Living Lab initiators, focusing on the reasons why "smarter" Living Labs are needed and they could be beneficial to urban development processes;
- a "fan-style" policy brief, targeting both Living Lab initiators and Living Lab managers, meant as a promotional material to raise the attention on the key constraints affecting Living Lab processes ("light" version of the guidelines);
- a practitioner's brief, made of a series of information sheets, focusing on "how to" favour upscaling of inclusive Living Labs, mostly targeting practitioners involved in launching and managing Living Labs ("full" version of the guidelines).

Both the video and the "fan-style" policy brief work as teasers to stimulate interested actors to access the full version of the SmarterLabs guidelines document, that describes the constraints and the anticipation strategies in more details, and presents examples ("stories") from the SmarterLabs experiments.

These three materials are respectively provided as Appendix 3 (storyboard of the video), Appendix 4 ("light guidelines") and Appendix 5 ("full guidelines") to the present report. Here instead we shortly introduce them.

7.2 Video: why are smarter Living Labs needed?

The video introducing the need for activating "smarter" Living Labs aims at intriguing policy-makers and potential Living Lab initiators and at raising their awareness about potential pitfalls in current approaches

to urban development, even when those already framed in a smart city concept and exploiting Living Lab approaches. To this purpose, we opted for a short animation video (2 minutes long, 200 words script).

We opted for developing a story and to deal with a character, which nicely fits with the idea of the animation. Also, we carefully aimed at overcoming gender stereotypes, such as male Mayors civil servants. In total, we developed four alternative proposals for the script, as documented in Table 17. Proposals 1 and 2 were rejected by the SmarterLabs research team, since they focused on too specific examples of urban problems, which could largely restrict the amount of interested people in the target audience. Proposal 3 was assessed as too close to an "academic" point of view, and proposal 5 was assessed as too didactic: in both cases, they would have failed in raising the interest of policy-makers and urban practitioners. Proposal 4, instead, was assessed as sufficiently general, though focused on practical everyday problems by policy-makers and practitioners, and therefore was selected for implementation in the video.

Alternative "scripts" for the SmarterLabs video	
1	**Story focusing on social exclusion** Laura is a young engineer, who has just been appointed councillor of a medium-sized city. She strives for introducing smart innovations in her city! She has just been contacted by a local company, offering a totally automated, smartphone-based payment system for public transport. They would bear costs of the technological infrastructure, just asking for an annual fee for service exploitation. She is so excited! Why not activating it as soon as possible, once for all forgetting about those old-fashioned paper tickets? Her civil servant Bob, however, is a bit scared. He is not into mobile technology – what would happen to citizens in his conditions? He suggests to open up a discussion, involving other institutions, practitioners, associations, and –especially– citizens. Together, they would look for a compromise to introduce innovation, while not producing social exclusion. Laura acknowledges Bob is right. So, the city launches a "Living Lab" process, inviting a group of well-known local "opinion-leaders" to test and discuss the new ticketing system. After a few lab meetings, they propose to roll-out the new system at the city level, maintaining the traditional one for a one-year long phasing-out period. In the end, the new system is not that complex! People will definitely get used to it. Therefore, the city deploys the new public transport ticketing and payment system. However, after one year, the large majority of citizens is still relying on the old system. Fearing mass dismissals, the trade unions, who had not been involved in the lab, in fact have widely boycotted the initiative. Laura and Bob realize activating a Living Lab does not guarantee successful upscaling of innovation! If you are planning to activate a Living Lab process, take a look at the SmarterLabs guidelines. You will get suggestions on how to successfully anticipate possible constraints affecting the upscaling of your innovation.
2	**Story focusing on low institutional receptiveness** Jane is the Mayor of a medium-sized city, dealing with the revision of the Masterplan for local public transport services. It is a hot topic, with highly conflictual visions and goals. Will she manage to make it more sustainable? Her civil servant Mike, definitely an expert in her field, has a clear vision of what needs to be done. However, Jane is aware that top-down solutions risk of being unpopular, nowadays. Therefore, she decides to activate a Living Lab to co-design future mobility scenarios for the region, and personally invites all the relevant institutions. The lab is a success! Jane counts more than twenty active participants to lab activities and is happy to see some of her friends of environmental NGOs. On general visions, all lab participants agree; however, when discussion goes into practical measures, differences between them arise. Since the conflict between a bunch of NGO representatives and other participants seems difficult to be solved, Jane proposes to vote between two alternatives. One is the project that Mike had worked on for the previous months: it is very detailed, realistic, and well-documented. The other one is an idea that had just

	emerged during lab meetings: it is a bit superficial, and still in its seeds – though particularly innovative and sustainable. Voting is overwhelmingly in favour of Mike proposal. Mike is very satisfied for the green light for his project! However, his satisfaction does not last for long: a local referendum is launched to oppose the Masterplan, and indeed citizens mostly vote against it. Mike's project failed to consider a number of relevant aspects to them. The project is therefore cancelled from the political agenda, and the whole Masterplan is stuck at the starting blocks. Jane realizes activating a Living Lab is not always sufficient for putting sustainable transitions into practice! If you are planning to activate a Living Lab process, take a look at the SmarterLabs guidelines. You will get suggestions on how to successfully anticipate possible constraints affecting the upscaling of sustainable transitions.
3	**Story addressing upscaling** The 'Smart City Living Lab' is an emerging approach in European cities. Jane, the Mayor of a medium-sized city, has adopted it too. She tests new ways of addressing urban problems with a diversity of stakeholders. But after enthusiasm around a range of Living Lab experiments that she started, critics are asking her: what is actually the practical impact of them? Jane responds that they have created innovative solutions, but admits that they often remain rather small. Her city council had suggested to 'roll-out innovations across the city' after successful experiments at the level of a building, street or small district. Jane has experienced, however, that in practice this process of upscaling is rather difficult and often fails. Her council erroneously sees upscaling as just the wider adoption of products over time. Unfortunately, this is what often happens. The SmarterLabs project has developed an approach to effectively anticipate two major risks to successful, widespread implementation of smart innovations. These two risks concern (1) unforeseen constraints to large-scale change in socio-technical systems, and (2) exclusion of social groups not matching the required 'smart citizen' profile. The SmarterLabs brochure discusses ten typical constraints on upscaling or inclusion, and also ten strategies to anticipate on these.
4	**Story addressing problems affecting Living Lab experiments (selected script)** Lisa is a civil servant in a medium-sized city, dealing with urban development. She has to re-design a congested avenue to improve the quality of life in the neighbourhood. It is a hot topic, with no straightforward solution and highly conflictual visions! She knows that nowadays a top-down decision risks to be unpopular, however an agreement that makes everybody happy will be difficult to achieve. She then hears about the Living Lab approach, a new way to address urban problems. Living Labs are spaces where multiple actors work towards a shared understanding of a problem and experiment solutions in a real-life context. This approach seems particularly relevant for her case: in a Living Lab she could engage all relevant stakeholders, from public administration and politicians to business, academia, and citizens. Together, they could address the many relations between environmental, social, technical, and economic impacts of the project, and find innovative solutions. She wants to try out this new approach. However, experimenting is risky and Living Labs do not always work out as intended. Fortunately, she learns about the SmarterLabs guidelines, which help her to avoid common pitfalls, such as results not being used outside the Lab or relevant stakeholders being excluded. If, just like Lisa, you are interested in creating a Living Lab to address urban problems, take a look at the SmarterLabs guidelines. They will help you to anticipate pitfalls and set up a successful Living Lab.
5	**Didactic text** Living Labs are an emerging approach, bringing together policymakers, businesses, researchers, and citizens to develop and test smart solutions to urban problems, by directly operating in real-life settings. Living Labs provide possible solutions to urban problems in a protected environment, where their pros and cons can be better explored from a variety of perspectives and tested in a real-world context, thus enhancing a collective learning process and the emergence of innovative solutions. Innovative solutions emerging from a Living Lab, however, might fail to produce a relevant impact, when trying to upscale them at city level. A number of barriers can in fact preclude emergence and diffusion of innovative practices (namely new ways of doing something) in a particular urban area, since these would require changes in the larger and institutional context as well.

	For example, the diffusion of a new app-based peer-to-peer ridesharing service, cannot be taken for granted, even though groups of enthusiast hipsters spent nights in the lab in co-designing and testing the related app features. Upscaling such a new mobility service would require tangible political support, as well as involvement of all the affected actors, particularly those mostly bearing unintended negative effects, such as taxi operators, in a common effort towards developing a suitable set of accompanying measures, such as regulations, incentives, or taxation schemes. By anticipating possible constraints on successful upscaling of innovation at the city level, and addressing them from the start, "smarter" Living Labs can turn into effective tools to foster sustainability transitions. If you are planning to activate a Living Lab process, take a look at the SmarterLabs guidelines! You will get suggestions on how to successfully anticipate typical constraints emerged in case studies across Europe.

Table 17: The five scripts developed for the "Why" SmarterLabs video.The selected script is story number 4.

Besides the script text, also the material reported in Table 18 was developed, to accompany the video, in the shape of a FAQ (Frequently Asked Questions) information sheet. Currently the video is only available in English, though we are exploring feasibility of translating it into other languages (German, Italian, Dutch, French, and Spanish), by either totally replacing the audio or introducing subtitles.

The graphical part of the "why" video was developed by the Belgian Pixileon video-makers (www.pixileon.com). The full video storyboard is reported in Appendix 3.

The final video has been published on Youtube (https://www.youtube.com/watch?v=XkDRgQf5QVo), it is available on the SmarterLabs project website (https://smarterlabs.uni-graz.at/en/publications-results/smarterlabs-guidelines-video/) and it was also disseminated through communication channels of the project partners. The video is in currently only available in English; subtitled versions are being developed in German, French, Italian, and Dutch.

What is a Living Lab?	A Living Lab is an open, real-life arena where citizens, academia, business and representatives of the public sector meet to address local challenges and co-create ideas, tools and technologies to solve them together in an iterative way.
Why should a city, developer, practitioner or citizen, activate a lab? What are the benefits?	Embedded in everyday life, multidisciplinary Living Labs make it possible to gain a better insight into the complexity of social, economic and environmental issues that surround society and urban areas in particular. At the same time, they allow to experiment, test and evaluate possible solutions (testbeds), while maintaining a multi-stakeholder perspective and remaining grounded to real-world needs and expectations. This approach ultimately increases chances of public acceptance of the innovation at stake, thus increasing also its social impact, large scale adoption and success.
Become a change-maker/ Be the change Lead innovation/ Creating innovative services	Make the difference! Be prepared to embrace concepts and strategies that are cooperation-oriented and that empower others to drive change. To "become a change-maker"/"Be the change"/"Lead innovation"/"Creating innovative services" requires shared leadership, knowledge, skills and the relationships that will enable you to anticipate societal changes, convey solutions and make informed decisions. The "SmarterLabs" project guidelines in particular, will help you address upscaling barriers of innovation processes lead by Living Lab methodology that may stem from resistance to large-scale change in socio-technical systems or from social exclusion.

The key to success	As social and environmental issues become ever more pressing, we all would like to see our efforts impact and drive positive social change. However, attaining such a goal implies achieving a large-scale adoption of the proposed innovation solution. As such, anticipating possible upscaling barriers becomes ultimately the main key to success. Indeed, as examined more in depth in the "SmarterLab" project, by incorporating groups at risk of exclusion into the Living Lab process and by anticipating possible resistance to change by specific stakeholders, the chances of a successful uptake of the end result are enhanced, better scalable and more robust in terms of value creation for the wider society.

Table 18: Additional material developed to accompany the "Why" Smarterlabs video, in a FAQ fashion.

7.3 The fan: the light SmarterLabs guidelines

The policy brief aims at raising the interest by policy-makers and possible Living Lab initiators, such as NGOs, groups of citizens, universities, private actors, or a combination of them. To this purpose, it was organized as a very compact document, with limited use of texts. Instead, we opted for presenting the constraints to "smart" Living Lab processes through thought provoking cartoons, developed on purpose. The document is organized as a fan, with 10 A6 cards, each of whom is dedicated to a single constraint, plus an additional cover. The front of each card shows the name of constraint and the cartoon depicting it. The back of the card, instead, shows the suggested ways to anticipate those constraints. Cards related to "social inclusion" constraints are coloured in yellow, while those related to "upscaling" are coloured in blue. Texts in both the front and the back are organized as bullet items, with short and direct sentences, to keep the document compact and make it more appealing for the reader. Figure 24 provides an example of such cards, for constraint number 10 "The Living Lab meets low institutional receptiveness".

The cartoons were developed by the Austrian artist and illustrator Jörg Vogeltanz (www.vogeltanz.at), while the graphical layout was developed by the Swiss Laboratory for Visual Culture (www.supsi.ch/lcv) at SUPSI.

Such a document (English version) was printed and distributed at the final SmarterLabs conference in Utrecht and available for further distribution in other local events. It is also available on the SmarterLabs project website (https://smarterlabs.uni-graz.at/en/publications-results/smarterlabs-guidelines-video/) and entirely reported in Appendix 4. We are also translating it in all the languages of the SmarterLabs partners (German, Italian, French, Dutch), and also in Spanish (the language of one of the members of our advisory board), for distribution to any interested actor in each country and further dissemination of the project results. Finally, it was advertised in the project partner's websites, through a final news announcing the end of the project and the release of the project outputs.

Figure 24: Excerpt from the light SmarterLabs guidelines policy brief – Constraint number 10 “The Living Lab meets low institutional receptiveness”.

7.4 The information sheets: the full SmarterLabs guidelines

The practitioner briefs is the major output of the SmarterLabs project: it presents constraints to development of inclusive Living Labs, suggests ways to anticipate them and presents stories from the SmarterLabs cities, to provide practitioners with practical examples and suggestions for “smarter” Living Lab processes (stories from “smarter labs”). Such examples are all taken from the experience within the SmarterLabs Living Labs; as such, instead of limiting to present examples of success, in some cases such stories also present failures, in the belief that, properly commented and put into perspective, failure can teach as much as success.

Since practitioners launching and managing Living Labs are the target of such a document, it is designed to be compact and easy to read, as well as graphically appealing, and it is made of a series of information sheets:

- one sheet briefly introducing key concepts regarding Living Labs, smart cities, and related risks;
- one sheet summarizing the identified constraints and ways to anticipate them, through a table;
- two sheets introducing the “smarter” Living Labs in our four cities;
- ten sheets each discussing the identified constraints and anticipation strategies;
- one sheet providing a glossary.

Overall, it is a thirty-page document, though each page can be read independently: interested practitioners can either read the full document from the beginning to the end, or they can just browse through it and identify the information sheets that are most relevant to their own context, problem, or experience. Texts are simple and concise. The cartoons already introduced for the policy brief are used as well, to help the readers focus on the topic of the sheet, and invite them to read through. As shown in Figure 25, the front of each of the ten constraint sheets shows the problem and general suggestions to overcome it (through a cartoon and texts), and the back shows stories from smarter labs. The cartoons

were developed by the Austrian artist and illustrator Jörg Vogeltanz (www.vogeltanz.at), while the graphical layout was developed by the Swiss Laboratory for Visual Culture (www.supsi.ch/lcv) at SUPSI.

The document (English version) was printed and distributed at the final SmarterLabs conference in Utrecht and will be available for further distribution in other local events. It is also available on the SmarterLabs project website (https://smarterlabs.uni-graz.at/en/publications-results/smarterlabs-guidelines-video/) and entirely reported in Appendix 5. Finally, availability of such a document was advertised in the project partner's websites, through a final news announcing the end of the project and the release of the project outputs.

7.5 The final SmarterLabs conference

The final SmarterLabs conference took place in Utrecht (NL) on March, 7 2019. The programme of the event is reported in Figure 26.

The conference hosted a keynote speech by Jos van den Broek, focusing on learnings from Living Lab experiments in various areas such as water management, agriculture and developmental aid. The conference was organized in collaboration with platform31 (www.platform31.nl), a Dutch network of practitioners and consultants active in the fields of urban development, mobility, energy, and sustainability, which enabled us to connect the SmarterLabs project to three other Dutch research consortia, which are also exploring the challenges of upscaling inclusive urban experiments (Smart Cycling Futures, R-Link and Mobiele Stad). This offered the opportunity to bring together state-of-the art findings of four different research consortia and share experiences from our cities of Brussels, Bellinzona, Graz, and Maastricht, together with those from Utrecht, Zwolle, Groningen and Den Bosch.

Figure 25: Excerpt from the full SmarterLabs guidelines practitioners brief – Constraint number 10 “The Living Lab meets low institutional receptiveness”.

Figure 26: The programme of the finale SmarterLabs conference.

8 Discussion of results

As already indicated, the SmarterLabs guidelines were developed thanks to the learning from action research activities in the four “smarter” Living Lab experiments activated in Bellinzona (CH), Graz (AT), Brussels (BE), and Maastricht (NL). Action research in these Living Lab experiments allowed us to first identify the most recurrent and significant constraints affecting social inclusion and effective upscaling the Living Lab outcomes. Then, these experiments allowed us to learn which anticipation strategies were effective and which not, and to draw the SmarterLabs guidelines, namely the set of ten constraints affecting upscaling of inclusive Living Lab experiments and the related ways to anticipate them (see Table 14 and Table 15).

In this Chapter we discuss the SmarterLabs guidelines at the light of the practical experience in the “smarter” Living Labs we run in the cities involved in the project. Note, in fact, that not all the anticipating strategies we tested in our Living Lab experiments were effective – and, indeed, we collectively learned even more from the failures we met, than from the lab success stories. Such a discussion on the guidelines implies that we also refer to the other Living Lab experiments than *Bellidea,* as long as they are useful to provide insights on the constraints and/or the ways to anticipate them. Therefore, also in this Chapter we summarize materials and discussions that were collaboratively developed by the SmarterLabs partners as a whole, thus also including material developed by non-Swiss partners.

Coherently with the choice to organize the SmarterLabs guidelines around the list of ten constraints on upscaling inclusive Living Labs, the discussion here is also performed constraint by constraint.

8.1 Citizens lack financial, intellectual and time resources to participate in the Living Lab

Living Labs can be complex and long lasting. To participate meaningfully, citizens need to have time and energy, a certain level of understanding of the discussion and sometimes also specific economic and intellectual resources. Minorities and vulnerable social groups risk being excluded from Living Lab activities. People with no, low or very discontinuous revenues might be excluded from the Lab, since earning their living can leave little space to other activities. Also people with precarious employment or residential conditions might lack the possibility to plan for long term and therefore commit to participate in a Lab. People responsible for taking care of elderly or children, as well as people working during non-office shifts might lack the material time to join the Lab. Foreigners and new-comers can be excluded because of their limited proficiency in the language. In addition, people lacking a minimum understanding of the issue at stake or acquaintance with the technology used in the Lab (e.g. because of low education level or age) are also at risk of exclusion. Socially marginalized groups may tend not to participate in community initiatives due to a lack of self-determination, of financial or educational resources, or both.

While it is virtually impossible for Living Labs to be inclusive of all relevant groups, it is desirable to minimise exclusion throughout its lifetime. Barriers to broad inclusion in a Living Lab can be of many different kinds and require a fully-fledged strategy to be addressed. It is important to reflect on desired outcomes and apply stakeholder and requirement analysis tools to identify potential types of exclusion and adequate coping strategies. While this exercise is primordial in the design phase, it requires to nourish an ongoing reflection at different stages of the Living Lab. All Living Lab participants need to participate in an explicit reflection concerning the causes and outcomes of exclusion, and in the identification of solutions.

Overall, the micro-practices of the Living Lab need to be strategically designed and then jointly orchestrated. These range from the choice of venue and schedules of the Living Lab meeting, to the

language and the style of Living Lab moderation, to the time spent in all sorts of capacity building. Other methods to ensure broad inclusion include targeted calls for participants, through the channels that are more likely to be used by the target group or technological fixes, to provide the tools to all (e.g. purchase of smartphones or computers).

For example, efforts to minimise exclusion were at the core of the Brussels Lab since the beginning. Different adjustments were also made in progress, to cope with unexpected circumstances. At very early stages, the organizers (one of the local universities, and a network of neighbourhood committees) identified potential barriers to inclusion and opted for establishing different sub-groups, precisely to include the broadest variety of population. Throughout the process, regular outreach efforts were made towards groups at potential risk of exclusion, also relying on a 'focal person' identified in each group. For instance, venues and schedules for each group were strategically selected: for EU officers, meetings were convened in EU premises at lunch time, for groups of parents and shopkeepers, small meetings were organised in the early morning (just after leaving the children in school/before opening the shop), for young professionals, meetings were organised at early evening in a central neighbourhood. Several smartphones were purchased to ensure everybody could still take part in the Lab, as well as tablets, used for demonstrative purposes. Less acquainted people with smart technologies where dedicated more training time. In some cases, however, these efforts were not enough to bridge the gap, resulting in participants not using the technology. Exclusion from the Living Lab was also part of the reflection that the participants engaged in. In a focus group interview on the topic, they were invited to identify potential drivers of exclusion, the possible implications, as well as suggestions for coping strategies.

Similarly, the City of Graz aimed to take action in a district with challenging circumstances: high proportion of migrants, various cultures and ethnics, education levels and incomes below average. The strategy to reach out to marginalized groups such as migrants, elderly people and children was to offer different formats of LL activities: workshops, social safaris, online questionnaires, mental maps, etc. Lab organizers did not wait for people to show up, but actively approached them on the street, literally bringing the Lab to the people. By repeatedly offering possibilities for stakeholders to participate and actively approaching them, over a long period of time also marginalized groups were included.

8.1.1 The constraint and the anticipation strategies in the *Bellidea* Living Lab

In the *Bellidea* Living Lab, through a stakeholder analysis social groups at risk of exclusion were identified in elderly and young people and migrants (see also Table 19). To favor their participation, a targeted recruitment strategy was applied. Flyers introducing Living Lab activities were distributed at places where computer literacy courses for elderly people are offered, and personal contacts with high school teachers and a local association supporting migrants (SOS Ticino) were established. The aim was to exploit the already existing formal (computer literacy courses, teacher-pupil relation) and semi-formal (local migrant association) social networks to capitalize on the existing trust relationships, as well as to provide specific assistance (e.g. language mediating support). Considering the young generation's natural inclination to interact with the digital world, it was expected that students would be the easiest segment to include. Resulting numbers suggest that the performed recruitment strategies were not enough to favor a significant participation of the groups at risk of exclusion. For instance, while young generations are the most inclined with technological innovation, they are also less used to participation and engagement in public processes. The limited engagement of students (two out of around forty participants, but not in a continuative way) suggests that further efforts could have been dedicated to specifically outreach students directly by means of informal networking, instead of involving intermediary persons such as school teachers. Providing also stronger in-person contacts to elderly people would probably have helped to trigger more active engagement than just relying on flyering mediation. In fact, even though flyers specified that no specific computer competences were needed, they probably were not as convincing as a person would have been. As for migrants, the contact person of SOS Ticino was

offered practical, tactful support for any migrants. However, though interested in *Bellidea* activities, they were reluctant to join the lab due to a lack of fluency in the Italian language. Even in this case, a more direct interaction and personal invitations (face-to-face or telephone) could have reinforced the supportive action and thus engagement.

Target group	**Contact association/institution**
Migrants	Department for Social services of the City of Bellinzona
	Soccorso Operaio Svizzero SOS
Students	High School and Commercial Institute in Bellinzona
Elderly people	Uni3 (Courses for third age computer literacy)

Table 19: Key traditionally marginalized target groups at risk of exclusion and institutions and associations engaged during the *Bellidea* recruitment campaign.

8.2 Relevant stakeholders remain outside the Living Lab

Due to the intrinsic innovation nature of Living Labs, large shares of the population and the relevant stakeholders might not be interested in joining them (or remaining active within them for a long period of time), because either they do not share the sense of urgency to discuss the issues at stake and take action (they have different priorities), or they even have conflicting attitudes or goals. As a consequence, the group of Living Lab active participants risks being monopolized by people with strong personal commitment to the issue at stake and/or people already used to (critically) interact with public authorities and institutions.

Ultimately, the Living Lab might become a low conflict circle of people sharing priorities, attitudes and goals, while the large majority of citizens would simply ignore the Living Lab process. Dissenting groups might also explicitly opt for keeping themselves out of the Living Lab, in order to be able to later criticize its outcomes and the introduction of policy measures based on them, according to a well-experienced and more comfortable to them “Decide-Announce-Defend” (DAD) framework. In both cases, level and intensity of debates within the Living Lab would be trivialized and upscaling possibilities of its results would be strongly inhibited.

In the process of setting up a Living Lab fundamental questions need to be clarified, above all the objectives and who could effectively contribute and therefore should be involved in order to be able to define clear goals and guarantee transparency and an open communication inside and outside the Living Lab. In particular, a stakeholder analysis should be performed in order to identify the relevant target groups, together with the reasons why they might (not) be interested to join Living Lab activities.

Analyzing the reasons against a participation in the Living Lab helps to define:

- how to frame Living Lab activities in public communication campaigns aimed at recruiting participants,
- and specific actions in order to also raise the interest of less intrinsically motivated target groups and achieve their active engagement in Living Lab activities.

Aiming to involve a variety of people, special attention needs to be paid to their individual demands and desires. The objectives of the Living Lab have to be negotiated in order to prevent mismatching expectations between the Living Lab and its potential participants, as well as to avoid the possibility of generating misleading information (e.g. from Living Lab opponents). This is important to attract people

in the first place as well as to keep them active in the process. Ultimately, transparent communication helps the Living Lab to obtain the right motivation and loyalty from its participants.

For example, in Brussels, an initiative for “Smart Mobility” was reframed by Living Lab initiators as one where air quality and people health were at the core. Adopting the right problematization approach favored raising commitment also among those citizens who would not engage in a smart mobility-related process, perceiving the topic as outside their own priorities. Instead, they genuinely and very proactively engaged in an air pollution-related process, since their cared very much for their health, and especially the one of their kids. Reframing the focus of the Living Lab helped reaching out to a rather broad variety of citizens, with different geography, and socio-economic, demographic, cultural background. Overall, though, participants could not be considered as a representative sample of Brussels population, with an overrepresentation of the educated and socially active middle class as opposed to other groups.

8.2.1 The constraint and the anticipation strategies in the *Bellidea* Living Lab

In the City of Bellinzona, the challenge to include all the relevant stakeholders was addressed through a combination of activities. The *Bellidea* Living Lab was in fact largely at risk of just attracting people who had already reduced their car use, thus resulting in a very polarized sample of participants possibly jeopardizing the efforts made to keep the Living Lab as open as possible to the entire population. Particularly, there was the risk to mainly involve only cyclists, since the local association lobbying in favour of regular bicycle use (Provelo Ticino) was among the Living Lab initiators, and participation to the Living Lab was open to any interested citizen, on a voluntary basis. However, how could a group of urban cyclists have been able to co-design an effective smartphone app targeting reduction in car use among mainstream car drivers? It was clear that the lab should involve a variety of participants, sufficiently differing in their mobility patterns and socio-economic characteristics, so as to reproduce diversity within the local society. Failing to include them would have for instance precluded a large scale diffusion the app (Upscaling 1), but also reduced representativeness, and thus overall social and political consensus on any scenarios resulting from Phase 2 (Upscaling 2), also hampering later diffusion of similar governance practices (Upscaling 3). Therefore, to favour large diversity and high representativeness of the local population among the Living Lab participants, Living Lab organizers opted for a hybrid recruitment campaign, relying on both bottom-up and top-down activities.

To start with, a stakeholder analysis was performed, in order to identify the key target groups to be engaged. As a result, commuters, car drivers, bicycle riders and public transport users were identified and the relevant associations representing their interests were involved, with the aim of mobilizing them in the outreach of Living Lab participants (see Table 20). Then, a process claim and main motivational message for the communication campaign were identified and a dedicated webpage on the City’s website was created. Distribution of flyers was planned within already existing public events, such as the traditional Saturday market of Bellinzona, and local newspapers and magazines were expected to widely amplify the *Bellidea* communication material, soon after a scheduled press conference. Posts in the newsletters and articles in the bulletins of the above associations were then developed, to amplify and support the press release delivered by the City of Bellinzona at the launch of the public campaign for lab recruitment. The emphasis was put on co-creation activities, and on the key idea behind the app, that was rewarding citizens with tangible prizes, if they opt for (more) sustainable mobility patterns. Explicitly addressing prizes (extrinsic motivational factors) was supposed to raise the interest by mainstream commuters and car drivers up to the level of already intrinsically motivated bicycle riders and public transport users.

To reinforce and integrate such bottom-up, spontaneous self-applications, a top-down selection of diverse and overall representative citizens was also made. By referring to their wide network of personal contacts, city authorities identified a set of around fifty citizens to be personally invited to join the Living Lab, being sufficiently diverse in socio-economic characteristics as well as mobility patterns, to be

considered representative of the variety and differences among the whole population. Not all of them accepted the invitation, but, together with the totally self-selected participants, the group of participants in Living Lab activities was sufficiently diverse to avoid typical “preaching to the converted” limitations. It is to be remarked, however, that the top-down selection of the citizens to be invited was performed by the City civil servants and policy-makers themselves. Notwithstanding reassurances on their good faith, opting for a fully transparent selection process, or maybe even for a random selection process, such as the “citizen jury” or “planning cell” participatory techniques, would have endowed the whole process with additional fairness and reliability, further attracting other participants.

Target groups	**Contact association/institution**
General citizens	Gym associations
	Carnival groups and associations
Commuters	Canton Ticino Administration - Human resources
	Hospital - Human resources
Car drivers	Touring Club Switzerland TCS
	Automobile Club Switzerland ACS
Bicycle riders	Provelo
Bicycle riders and public transport users	Associazione Traffico e Ambiente ATA

Table 20: Key target groups involved and related institutions and associations contacted during the Bellidea recruitment campaign.

8.3 Groups and impacts outside the Living Lab context are overlooked

Living Labs are experiments situated in a specific geographic context, ranging from a building block to a neighbourhood, a municipality or a whole urban area. While there is a certain flexibility in choosing the scale within which to operate, any choice implies the definition of boundaries excluding people living beyond them. While this exclusion happens sometimes by design, it is more often due to self-exclusion: people living outside or faraway the project context might relinquish to join the Living Lab either because it takes too much of an effort to go to the locations where the Living Lab meetings are held, or because – though they might be impacted by the project – they do not feel immediately concerned.

This constraint represents also a barrier to successful upscaling of the Living Lab, as replicating pilot projects in the broader urban area can be prevented because generated knowledge is very much related to the specific context of the Living Lab or because the whole Living Lab process only focused on the pilot project, neglecting or forgetting the effects beyond its boundaries, namely lacking a system perspective.

To address this constraint, one should adopt a systemic approach and consider that exclusion based on participant residence can be either a matter of logistic, or of personal concern with the stakes of the Living Lab, or both. In both cases, it is important to reflect on desired outcomes and apply stakeholder analysis and requirement analysis tools to identify potential types of exclusion and adequate coping strategies. In other words, this implies a thorough reflection on the multiple scales relevant to the Living Lab and on the actors that might be included/excluded at all scales. In the former case, adequate logistic arrangements can help to minimize exclusion. Living Lab meetings can be convened at different locations, to target different audiences. One might in fact opt for going to the people, instead of waiting for the people to come. In the latter case, a constant outreach effort might be necessary. This includes both communicating the Living Lab purposes, but also adapting them and adjusting the frame. Overall,

constantly negotiating with participants and potential participants the objectives and the frame of the Living Labs can be particularly helpful in defining a shared vision, thereby increasing motivations and buy in of a broader audience. Organizers, in particular, need to estimate and take into account projects' indirect and cross-scale effects, also outside the boundary of analysis. To adequately cope with them and anticipate any negative impact, they also need to actively engage with stakeholders of the broader urban context that might be affected by the Living Lab or by an upscaled version of its results.

In the Brussels Living Lab, the citizens' place of residence was one of the most solid barriers to broad inclusion. In particular, the city is characterized by a great inflow of workers commuting in and out the city from the metropolitan area. These commuters are immediately impacted by air pollution in the city, and largely contribute to it. At the same time – with some exceptions – the Living Lab failed to include them in the activities because of lack of time and resources to identify suitable locations at the urban periphery, and because of their relatively lower concern for the issue at stake (i.e. widespread perception that suburban living is less impacted by air pollution).

Given its main focus (i.e. air pollution), the Brussels Living Lab was characterized by the overlapping presence of multiple scales. To minimize exclusion based on participants' place of residence, different arrangements were made. To begin with, the Living Lab ateliers were held in different locations, depending on the participants' place of residence and employment. In one case (group of parents of children at school age), the group was split in two, based on the location of the school, and the information between the groups was constantly being relayed by the Living Lab facilitators. These included places throughout the regional territory. In one case (EU officer citizen group), rather than building the group based on place of residence, it was built based on the shared place of work. To do so, meetings took place during office hour at the office location: this allowed for participation of people living in many different locations to interact around common questions. It also allowed to have a discussion on different scales: while it started from a concern about the air at place of work, it soon included the commute, and finally their place of residence.

Despite the outreaching efforts, the Living Lab was eventually not successful in including participants from all neighborhoods of the region, nor participants living outside of the regional borders. To complement for this shortcoming, constant efforts of networking and coordination with other organizations were made, to share good practices and lessons from the Living Lab: by experience sharing with organizations in nearby cities, the conditions were created for replication in other contexts.

In Maastricht, instead, although the station area was of main concern, the visioning assessment Living Lab experiment initially focused on the city of Maastricht as a whole. Later on, the scope of the visioning exercise was narrowed, and participants were specifically asked to consider implications for the station area. Also, the stakeholder analysis identified people from different areas (residents of city center, of outer districts, commuters) as relevant stakeholders for the vision of Maastricht, and these actively participated. This helped to include effects on other areas than the station area, hence anticipating this constraint.

8.4 Existing power structures are reproduced inside the Living Lab

One fundamental aim of LLs is to establish a democratic structure that guarantees that every voice is heard and taken into account. However, in practice, instead of achieving real participation, various circumstances can lead to mere reproductions of the power structures already existing in real life. This could be the result of deliberate management in the LL, if run as an alibi activity. Or, LL organizers might not be aware of the heterogeneity of stakeholders and precautions needed to provide any group with equal opportunities.

To avoid reproducing existing power structures, first these need to be assessed by carrying out a group dynamics analysis, aimed at understanding group structure and leadership relations among group members. Particularly, it is important to identify any dominant position among Living Lab participants, which could be due to already existing institutional roles, such as political responsibilities, lobbying or expertise. If people in such positions attend Living Lab activities, their ideas should be given no more attention than those of the other citizens without a leading societal role.The Living Lab organizers have then to design a communication and management strategy to address all identified target groups, applying tailor-made methods for each of them, and adopting proper facilitation methods, aimed at guaranteeing that any voice can be heard. To ensure fair and equal participation, flexibility in the use of methods is a key requirement (e.g. not only conversation or only ICT tools). Inviting people at various levels and occasions and building trust and social cohesion plays an important role for a long-term success of a Living Lab. Organizers should facilitate development of activities along different tracks and allow each group to adapt to their speed of progress: equal opportunities are often the result of different – not identical – processes. In general, group facilitation techniques help guarantee that everybody is engaged and contribute to a good learning and planning process.

Next to the methodology, also the locations should contribute to setting a plain ground. For example, if city representatives actively participate in Living Lab activities, meeting at the city hall might indirectly reinforce existing power structures, involuntary putting hosts in a dominant position. Meeting in places such as schools, or maybe changing locations over time, helps counter-balancing existing power structures.

For example, the City of Graz aimed to take action in a district with challenging circumstances: high proportion of migrants, various cultures and ethnics, education levels and incomes below average. Reaching out to marginalized groups such as migrants, elderly people and children turned out to be difficult. At events organized by the Living Lab the people who showed up represented an incomplete sample of the actual target group. Even more so, a couple of persons repeatedly “sabotaged” events by excessively raising their voices and acting as opinion leaders.

The Living Lab in Graz involved a lot of stakeholders including residents, shop owners, bus operators, city entities and politicians. All of them filled out certain roles that contained different levels of power. The Living Lab organizers aimed to blur the borders between them enabling each person to participate equally. This was achieved by offering different formats of Living Lab activities: online questionnaires, workshops, social safaris, mental maps, etc. By repeatedly offering possibilities for stakeholders to participate and actively approaching them over an extended period of time, also marginalized social groups (e.g. migrants) were included. Locations of events were carefully selected. In particular, a city district office was installed next to Griesplatz and was used as a neutral place for diverse activities throughout the whole project duration, complemented by outdoor activities in the district, literally bringing the Living Lab to the people. These measures created awareness for the Living Lab and social cohesion among the people involved.

In Maastricht, instead, the Living Lab was run by the local university, i.e. a relative outsider. They arranged the invitations and facilitation of the visioning workshops, whilst treating the municipality as just one of the six stakeholder groups (others were: entrepreneurs, mobility operators, and three types of residents/travelers). All groups made their own vision and these were presented and discussed as equivalent outputs. A facilitator was present at each of the six tables to manage the discussion among very different types of people and make sure everyone was included in the discussion. In the post-interviews all participants stressed they felt they could express themselves well. The municipality enjoyed their freer role as participant and not being the facilitator. No one mentioned (s)he felt overruled by another group.

8.5 The Living Lab's potential for learning is underexploited

Some stakeholders tend to reduce Living Labs to pilot project "to try out something new", without an agenda on what exactly they like to learn. Although the label of Living Lab is used and the importance of learning is acknowledged, local authorities taking part in such bottom-up experiences may not fully recognize opportunities offered by Living Labs, thus neglecting to systematically assess the process, to improve their future work. Performing structured evaluations and drawing lessons from Living Lab activities would instead allow them to get a broad understanding of specific innovation processes, including their implications and consequences, thus supporting diffusion of the innovation across spatial scales.

Often, local authorities lack the farsightedness and political will to perform explicit monitoring of the lessons learnt throughout the process since this would imply accepting the potential of shared (stakeholder) knowledge and could imply challenging the *status-quo* system.

When single Living Lab participants draw their assessments and conclusions, they often lack a comprehensive view of the process, and therefore no comprehensive knowledge is generated and the lessons learnt are partial or biased. If no single actor has an overview of all options, mechanisms and impacts emerged during Living Lab activities, limited transfer of learning is possible to future users, precluding upscaling.

Explicit comprehensive learning strategies are needed, including a learning agenda (i.e. a co-created set of learning goals), capable of capturing and monitoring knowledge creation and transferring it to the engaged actors, in order to empower them and supporting the transfer of lessons to other contexts. Living Lab managers should first formulate the learning goals, understand who has to be involved in learning, with respect to the final goal of upscaling Living Lab outcomes, and then make sure that the experiments are designed in such a way as to answer the learning goals. In other terms, this means developing a strategy to favour collective knowledge co-production.

To this purpose, first goals and ambitions of each actor need to be understood. Then, period reflection sessions can help to monitor the learning process. Especially people-to-people real-life interactions (i.e. physical meetings) make learning more rewarding and comprehensive to all and also ensure tacit knowledge to emerge.

For example, in Maastricht the Living Lab consisted of two physical meeting sessions with the stakeholders, with a combination of plenary meeting and sub-group meetings. The stakeholder knowledge was captured by asking them to make their vision for 2040 explicit in the first session. In the second session, they learned about each other's visions, they received reflections from practitioners about their vision (including implications on cost, environmental quality and accessibility) and they received visualizations of their vision. Possible adaptation of the visions they thus decided to introduce were monitored. The expression of the visions in the first round nicely mapped a diversity of stakeholder views on mobility in the future. However, in the second round most groups stuck to their vision of the first round. Only the urban planners (i.e. the municipality) adapted their vision, mostly based on feedback from practitioners. This lack of learning could be because:

- the groups were quite strongly convinced of their vision developed in the first round, with changes only likely on longer time frames (than four weeks);
- the format of feedback on their visions was not sufficiently "tailor-made" to be absorbed by the participants.

8.5.1 The constraint and the anticipation strategies in the *Bellidea* Living Lab

The *Bellidea* Living Lab was meant as a pilot project, run on a voluntary, politically non-binding base. On the one hand, this had favoured lab acceptance by the City managers, who were unfamiliar with participatory approaches, and in the past had even tended to oppose them. On the one hand, this favored acceptance of the Living Lab approach by the City, but on the other hand it made also responsibilities and commitment by the City to contribute to the participatory knowledge-sharing process less pressing. This made the process of capitalizing on the "lessons-learnt" from the Living Lab and integrating them into the City's policies more difficult, thus limiting possibilities for Upscaling 3.

To anticipate the risk of limited learning, a learning strategy was explicitly developed when designing the lab process itself, with the aim of monitoring knowledge co-creation within the *Bellidea* Living Lab. This implied analyzing the project's impacts according to a multi-criteria framework, assessing the level of engagement and satisfaction by Living Lab participants and reporting and communication of results, both internally to all actors involved, as well as externally, through local media.

Similar activities were also planned for the period following the launch of the *Bellidea* app to the whole population: regular statistics regarding app use and its effect on local mobility (who, when, how, how much, ecc.) were envisioned. Special attention was dedicated to avoiding "unbiased and neutral" assessment by external experts driving a one-way learning process, by defining "their problem", providing "their knowledge and technology", and preparing "their solutions". Therefore, such statistics would at first be summarized within traditional report documents, though they were planned to be publicly made available, within an online dashboard, showing anonymized key indicators, data and maps, and therefore also fostering a public debate on the future of local mobility and land development – with spillover effects also regarding Upscaling 2.

To further avoid a traditional "expert-driven" learning process, a user-centered approach to learning was adopted, and focus of the Living Lab was put on co-creation activities themselves, through the co-design of the persuasive app. In particular, during Living Lab meetings inclusive participatory techniques were adopted (division in small groups, round-robin interactions, voting, short discussions for different topics, ecc.), to better stimulate the participation and knowledge-sharing of all the different personalities present in a heterogeneous group of participants. Results of a final evaluation survey were planned to be openly shared with all Living Lab participants, in order to attract their further feedback and comments. Overall, such an approach was expected to help increasing intrinsic motivation, enduring participation and learning and knowledge-sharing between participants.

Further, according to their initial perception, the City of Bellinzona initially tended to address the Living Lab process as a sequence of closed and separate steps: first, the app has to be developed; (if and) when it will be available, a plan will be made to diffuse it to the whole population; finally, depending on the success and level of diffusion it will have, an assessment will be made whether additional citizens need to be engaged. And only at the very end of that process, decisions would have taken, if replicating a similar approach also in other decision-making processes. Namely, no specific upscaling strategy would have been devised by the City, in a pretty passive "wait-and-see" attitude. Particularly, app use to the population was initially expected to follow a rather traditional communication plan, involving a press conference and the distribution of information leaflets, and no specific efforts would have thereafter been planned to actively advertise the initiative and promote app use.

The very choice of engaging citizens in app co-design within the *Bellidea* Living Lab, however, triggered the citizens' own intrinsic motivation and commitment, thus innately generating communication and dissemination possibilities versus the outside. Therefore, the "multiplier effect" triggered during lab experience thanks to committed participants, who got actively engaged in promoting app use among their circle of family and friends, was explicitly exploited as a strategy to overcome the rather passive attitude by the City.

Also, specific functionalities were explicitly included in the *Bellidea* app-design ("collective challenges"), with the aim of periodically actively attracting new citizens to join app use: at least twice a year, it was planned that the City of Bellinzona launched collective challenges through the *Bellidea* app, inviting all citizens to join collaborative challenges asking to perform sustainable mobility choices for a limited period of time (e.g. "Next week-end let's all strive to use the car for less than 20% of our overall travelling time"). If such challenges are achieved, collective prizes are offered to the citizens. Also the product of the lab itself (the app), was therefore endowed with an inbuilt mechanism to favour its diffusion and counteract the dominant "wait-and-see" approach.

Finally, a specific plan for communication activities soon after the launch of the app to the whole population and also in the following months, was developed, to maintain app users' interest and increase their number over time.

8.6 The Living Lab is disconnected from broader societal debate

Urban Living Labs are forms of societal experiments that take place in real life conditions. While they can and should have an innovative flavor, they will successfully scale up only through existing windows of opportunity. If an experiment is designed as if it was to take place in a vacuum, disregarding the social, economic, cultural and political conjuncture, or if the external conditions change (the windows of opportunity close), the Living Lab is unlikely to scale up.

In such cases of "disconnected Living Labs", even though Living Lab outcomes are positively assessed by participants and aligned with original plans and expectations, the broader public is unlikely to share the Living Lab's objectives, understand and replicate its methods, and to find it relevant in addressing current priorities.

Under such shifts in policy windows, instead of proactively supporting upscaling of Living Lab outcomes, decision-makers might adopt a "wait-and-see" attitude, maybe not opposing the Lab launch and management, but intentionally avoiding to develop and implement any strategy specifically designed to favor the active diffusion of its results.

A Living Lab should be designed and implemented with great care for the local conjuncture. No immediate replication of Living Lab examples of best practices is likely to be successful if it is not adequately customized and adapted to changing conditions in the outside social and political agenda. This includes broader socio-economic, cultural and political considerations, but also ensuring links with the existing public debate, with what a community considers to be its priorities, and what is considered to be feasible by stakeholders.

Efforts to connect the Living Lab with the broader societal developments need to be done while designing the Living Lab, but also throughout its development. This requires a degree of flexibility and adaptability to changing external conditions, involving – when needed – adjustments and re-framing.

In particular, what can reasonably be scaled up should be identified since the very beginning of Living Lab activities and an upscaling strategy should be designed, together with the relevant communication and dissemination measures. Consistently, such a strategy should be kept flexible and open to the evolution of activities in the Living Lab as well as the external dynamics, and tailored to the specific context where Living Lab results are to be upscaled, by choosing the right channels, time and language.

In this context, an important precondition is to place citizens at the core of the process, as they are likely to have the most detailed understanding of the local context. In addition, it also requires to actively coordinate with other societal developments and initiatives related to the content of the Living Lab. This can be done at different levels ranging from simple information sharing, to building bridges and identify possibilities of cooperation. As a corollary, ensuring the Living Lab is well linked to the broader societal

debate, is also a way to ensure Living Lab participants feel recognized, thereby strengthening internal dynamics and empowering them. In turn, this further favors their active engagement in the diffusion of Living Lab outcomes and the implementation of the upscaling strategy.

For example, in Brussels, Living Lab activities have been coordinated from the onset with the broader citizen movement for a cleaner air in the city. To begin with, an initiative for “Smart Mobility” was immediately reframed by the local partners in order to put air quality and people health at the core. Adopting the right problematization approach favored raising commitment among those citizens who would not have voluntarily engaged in a mobility-related process, perceiving the topic as outside their own priorities. Instead, they genuinely and very proactively engaged in an air pollution-related process, since they cared very much for their health, and especially the one of their kids.

From very early on, in addition, the Living Lab initiators (the local university and a citizen movement) engaged in an open dialogue with all stakeholders active on the topic, contributing to establishing both a platform for discussion for all civic movements active for better air, and a network of researchers working on air quality and citizen science. Both efforts contributed to reaching out to a broad audience and ensure that the Living Lab was immediately part of a broader discussion.

Throughout the process, finally, the Living Lab was fully co-conducted by the project partners and by the various groups who decided to join. While the broad structure was proposed by the organizer (i.e. getting to know pollution, letting others know), different groups decided to fill it in in different ways, for example by raising different questions (e.g. the level of pollution in school, while commuting, or throughout the day) and identifying different communication forms (i.e. a citizens science paper, a public conference with experts, or creative ateliers).

In Maastricht, instead, Living Lab organizers decided to run a visioning assessment experiment to anticipate this constraint on upscaling smart-intermodality. Being well aware of the fact that the Municipality was one of the most relevant stakeholders in this process, Living Lab managers first waited about a year until the topic achieved visibility in the societal debate, thus leading the Municipality to accept participating in it and get interested in its results. Then, by organizing the Living Lab around visioning in the far future (2040) and inviting stakeholders relevant for urban mobility, Living Lab managers sought to make the lessons relevant for the coming years – not just the project plan for the station area that was due in July 2018. This way, they manage to nourish and enrich the ongoing debate on the creation of shared visions for the future.

Finally, in Graz the Living Lab was initiated by the city government which aimed to improve the quality of life in the traffic-dominated area of Griesplatz. The city’s Executive Directorate for Urban Planning was responsible for organizing a participatory process around a Living Lab. The concept was well prepared and applied by the Living Lab team. However, after one year, priorities in the city government changed towards other projects and the future of the Griesplatz was uncertain. The Living Lab continued but it was difficult to maintain a clear line in communication that would not promise too much but still encourage citizens to be active in the lab. Demonstrating flexibility, the city district office, where the lab was based, was turned into an exhibition room to show all collected results and ideas so far. As a direct reaction based on feedback from the exhibition, the lab organizers facilitated an additional social safari dedicated to the local economy in the district of Gries. In their overall communication strategy that comprised various media and channels they emphasized that “no idea is lost” and that everything would feed into the public architectural competition after the end of the Living Lab.

8.7 The Living Lab consensus is not reflected in policy and society

In some contexts or for some specific topics, outcomes of the Lab might not find consensus beyond Living Lab participants. Even when the need for intervention on a specific topic is well acknowledged by

the population and the interested parties, and addressed as a priority of the social and political agenda, persistence of conflicts might preclude reaching an agreement on a specific solution.

Conflicts might appear both within the Living Lab itself, thus leading to no shared outcomes, or outside, when trying to upscale the shared Living Lab outcomes across the city. In both cases, Living Lab outcomes would lack support or agreement by the population, as well as of the political majority needed to activate the envisioned upscaling measures.

Living Labs should open to participation as much and as early as possible, by activating participatory processes already from the development of visions, selection of methodologies and identification of the actions to be performed. Including natural beneficiaries of the Living Lab outcome (cities, regions) will favour later political agreement on the outcome. Also, a “participation policy” (e.g. guidelines for participation) at city level can support citizen involvement in the first place and give structure to ongoing processes.

Further, a stakeholder analysis should be performed at the start of Living Lab activities, and regularly updated whenever external conditions change, in order to avoid the exclusion of any stakeholder group. Participatory processes should then be designed as to favor emergence of any conflicting goals among Living Lab participants, first of all, and then among Living Lab participants and any external stakeholder groups not actively engaged in Living Lab activities.

Management of conflicting goals could then be performed by means of multi-criteria decision-making techniques, which support Living Lab participants and policy-makers towards a transparent and thoughtful choice among different goals. In doing so, community-level benefits should always be emphasized and already existing networks and coalitions between groups of stakeholders should be exploited. Relying on a multi-criteria approach might also favor the creation of new and unexpected alliances between groups of stakeholders.

Finally, also building relationships with successful initiatives already developed by other actors would be beneficial. In case these strategies fail in conflict resolution within the Living Lab, political authorities will be called to make decisions.

In Maastricht, Living Lab managers invited all those stakeholders that are relevant for urban mobility to attend the Living Lab and organized activities in a first session around visioning in the far future (2040). This was meant to help make the information emerging relevant for the coming decade– not just the project plan for the station area that was due in July 2018. This approach helped discussion not to get stuck on current conflicting issues, favouring instead a creative and less conflictual co-creation of visions for the future. In this context, by asking participants to draw their vision for 2040, Living Lab managers were also able to make the diversity of stakeholder perspectives explicit. In the second session, participating stakeholders learned about each other’s visions, they received an assessment from practitioners about their vision on multiple criteria: implications on cost, environmental quality and accessibility. Showing the pros and cons of each vision was helpful to prevent one stakeholder hijacking the debate, but it didn’t lead to overall consensus either. Although final convergence of visions was not achieved, involved stakeholders learned arguments to better understand each other’s point of view.

8.7.1 The constraint and the anticipation strategies in the *Bellidea* Living Lab

As emerged from the retrospective analysis presented in Chapter 5, in Bellinzona discussion on the future of mobility and land use planning in general is perceived as a very conflictual topic, with highly contrasting positions among stakeholders and an equally heated societal debate, as shown by the amount of municipal referendum processes activated in the last years against decisions made by local authorities.

In such a context, it is likely that local authorities would have not accepted to launch and support a Living Lab process shared with citizens and dealing with scenario-building for the future of mobility in Bellinzona. However, Living Labs can provide significant benefits exactly in such contexts, where achieving consensus is critical. Therefore, to start activating a Living Lab process, we opted for first focusing on a practical, technologically-oriented topic, such as the smartphone app development. Perceived as a low-conflict topic, it was easily supported. Scenario-building activities were instead introduced later on, capitalizing on the fact that a multi-stakeholder process had already been activated for the development and test of the app. At that stage, it was easier to ask Living Lab participants what they would have needed to make mobility more sustainable in Bellinzona, thus spontaneously upscaling discussion to future mobility scenarios and policy-making. This way, highly conflicting discussions were spontaneously introduced in the Living Lab.

8.8 Stakeholders and institutions are highly fragmented

Usually a series of different stakeholder networks and institutions are involved and need to interact with one another to pursue management and development of urban processes. Acknowledging this interdependency, however, coordination between these many actors is often difficult, fragmented, and may lack horizontal cooperation among the different sectors.

Fragmentation may be due to different reasons: a given legislative or hierarchical framework, lack of trust and/or communication, financial constraints, poor knowledge or strategic vision. Particularly, this phenomenon is detectable at the institutional level itself. It is not uncommon to experience vertical fragmentation in units and departments (“silo compartments”) within and between public administration institutions. Consequently, even when policy-makers embrace a Living Lab participatory approach, its outcomes might suffer from limited diffusion due to fragmented institutional arrangements, which hinder clear distribution of responsibilities and effective cooperation between involved city departments. This makes both horizontal and vertical dissemination of results rather difficult. As such, nurturing the interaction between different stakeholders and institutions is an important key to success for Living Lab processes.

Transparency and collaboration between administrative units and organizations should be actively fostered from the very beginning to create the atmosphere of ”a common endeavor”. To overcome problems of fragmentation, it is essential to acknowledge interdependency between different actors, institutions, units and departments and to strengthen and reinforce these networks and their specific roles. In addition, it might be necessary to build a comprehensive vision outside the administration, by putting the wished-for changes of citizens at the heart of the debate and then address specific issues to specific institutions

In Maastricht one constraint is high institutional fragmentation, in the sense that key stakeholders (residents, commuters, businesses) normally do not meet and discuss on these matters in an organized way, although probably having very different views on this. Typically, the municipality bilaterally speaks to business actors and citizens for policy input. The visioning assessment experiment was designed to help anticipating this constraint on upscaling smart inter-modality. In two sessions the stakeholders came together in both a plenary meeting and sub-group meetings, and the diverse visions were developed, presented, discussed, assessed, re-developed in an open and equivalent way.

In the post-interviews all participants stressed they felt they could express themselves well and freely. About half of the participants said they had heard some interesting points from other participants. At the same time, business actors found the residents “too ignorant for such a visioning exercise” and residents’ visions “just dreams”. This looks like a type of institutional fragmentation through a classic framing of “experts” and “non-experts”. A few participants remarked they liked the format of separate

stakeholder groups to first work with peers, before a larger discussion with a mix of stakeholders, because it helps to better structure arguments.

The Living Lab was successful to bring the different stakeholders in a dialogue amidst institutional fragmentation, by showing all participants the pros and cons of their vision. Although the experiment did not show convergence of visions, the municipality learned more arguments for a larger car-free area in the city center. Possibly, two sessions are not sufficient to enable convergence of visions, and a follow-up is needed.

8.8.1 The constraint and the anticipation strategies in the *Bellidea* Living Lab

In Bellinzona, administrative organization at the City level was seen as the main obstacle preventing diffusion of the Living Lab approach to other fields than mobility and institutionalization of new governance practices ("Upscaling 3").

The strategy to overcome the "silo compartments" constraint was to actively engage councillors and civil servants, instead of waiting for them to spontaneously express interest in process or results. Thus, it was planned to invite them to attend *Bellidea* lab meetings, in order to personally experience how they work and the effort needed, and guess their potential in addressing complex or conflictual topics. Also, a final meeting targeting councillors and civil servants of other departments than the *Bellidea* promoter, and the related political decision-makers, was planned at the very end of the process. It was aimed at presenting and discussing the approach and the results obtained, and particularly at focusing on its opportunities and limitations, as they emerged from the final evaluation of the whole *Bellidea* process (results of Phase 3 of the *Bellidea* Living Lab). Such a meeting, reinforced by expected positive results of Phase 3 evaluation, was supposed to reduce fears and prior oppositions by the city managers, and to favour their larger uptake of participatory approaches in future decision-making processes.

8.9 The urban assemblage is sticky and locked-in

Changes in urban contexts are sometimes tricky to achieve due to technical, infrastructural, legal or financial interlinkages. In fact, frequently obduracy to urban assemblages can occur, due to persisting infrastructure, long-term contracts or legal "lock-ins". Decisions need to be taken by multiple stakeholders or entities on a political level and cannot be attached to the outcome of a participatory process only. Depending on the specific situation in a city, several obstacles might exist at the same time which makes it difficult for Living Lab activities to take effect.

To find out about possible barriers for a Living Lab's objective, a dialogue with relevant actors has to be initiated and the connections between them have to be made visible. By developing future visions with stakeholders and crucial decision-makers, the potential of more structural changes can be highlighted. Also, local actors can be empowered by teaming up with supra-urban actors, such as municipalities with provinces or local NGOs with their national counterpart (scale jumping). They might also assume different roles, e.g. as decision-maker and personally concerned citizen at the same time.

If still circumstances do not allow big changes, a Living Lab should focus on what is actually possible. Also providing legal flexibility at least for a limited amount of time to experiment with temporary measures can be useful (e.g. permission for markets). Communication strategy and methodology have to be designed accordingly, in order to avoid wrong expectations among Living Lab participants. Finally, also collecting ideas and concepts to apply in future when circumstances will allow it, can be a strategy.

For example, the Living Lab in Graz aimed to improve the quality of life in the traffic-dominated area of Griesplatz through infrastructural changes. As a consequence of its purpose as traffic hub, not all infrastructural elements could be replaced according to citizens' desires. In addition, long-term contracts with bus operators forced the organizers to wait. Living Lab participants started to feel that elaborated

discussions ended up in little outcome. The organizers remained flexible and changed their strategy by focusing on short- and middle-term measures. In order to deliver visible outcomes of the participatory process, they provided small and quick improvements for the Griesplatz area such as a bike lane, a new lightening system in one street, enlargement of a public space and street furniture. Also temporary awareness-raising measures were taken, e.g. organizing a pop-up market. They released press articles ensuring that “no idea is lost”. That means that ideas created in the Living Lab will be remembered and put into place at a later stage in the course of a public architectural competition, once the bus contracts had expired.

In Maastricht one constraint on upscaling inter-modality is the “urban assemblage” around car use and parking in the inner-city, which is rather obdurate. This refers to the interlinking of traffic circulation plans that are adapted to the operation of the many underground parking garages; visitors expecting to be able to park in the center; shop owners who like cars passing by their stores; urban planners’ expertise around developing over- and underground parking; and operational contracts (mostly running until 2032) of the garages, also reflecting significant financial interests. This interlocking bundle of social and technical elements tends to resist change of the whole assemblage, only allowing “add-ons” that leave the rest in place.

The visioning assessment experiment was designed by considering a year in the further future, 2040, in order to move beyond the interests and structures of today, and to allow envisioning more structural change. The experiment found that there are broadly two different future visions:

- entrepreneurs and mobility operators envisioned incremental development toward more underground parking refining and strengthening the current urban assemblage;
- on the other hand, residents and commuters envisioned structural change towards an (almost) car-free city center. The group of urban planners had a compromise in the middle. The urban planners did learn that there is more support for a larger car-free zone than they thought, and in a second session they reduced urban parking. This was also based on the reflections that showed the ineffectiveness of park and ride (P+R) projects, without reducing urban parking.

All in all, the experiment (making integrated visions for mobility explicit, including the assessment and reflections provided on this), was somewhat successful to highlight to all stakeholders the pros and cons of basically two types of visions, but it didn’t bring the two types closer to each other. There was some evidence that the municipality has learned more arguments for a larger car-free area in the city center.

8.10 The Living Lab meets low institutional receptiveness

Sometimes barriers might be due to the lack of open-mindedness and receptiveness by institutions and policy-makers. Institutions may not show (or indeed not have) real commitment for a Living Lab approach. Sometimes barriers might be due to the lack of open-mindedness and receptiveness by institutions involved in Living Lab activities. Local governments, as well as other actors involved in the process, including NGOs, universities and companies, might in fact be unfamiliar with, or open to, co-creation approaches, believing that interaction with other stakeholders adds unneeded complexity to policy development.

Low receptive institutional contexts tend to favor expert-driven ways of thinking and agreement with powerful lobbies, in traditional Decide-Announce-Defend (DAD) approaches. In such contexts, even if Living Labs are activated and developed, they might lack full support of key institutions, who might support them as a façade tactic, indeed being unwilling to implement their outcomes.

To cope with such constraints, early inclusion of policy-makers should be sought for. Provided that activities in the Living Lab are adequately designed, namely that Living Lab organizers show genuine

commitment and give voice, role and responsibility to diverse groups of citizens, civil society organizations and experts, policy-makers and institutions might start appreciating the approach and its benefits. Then, it would be a matter of repetition. Once multiple successful pilot processes are carried out, institutions and policy-makers would embrace approaches and processes, supporting their outcome.

If instead policy-makers and institutions do not accept invitations to engage in Living Lab practices, one should try to bring Living Lab outcomes into traditional channels of democratic representation, fostering a public discussion with and within elected political representatives.

In Maastricht, although found cumbersome, there is already experience and (at least among part of the civil servants) appreciation for more Living Lab-type of approaches. The tool of visioning and participatory visioning is also applied in Maastricht, although not very often. One constraint for further use is that not the municipality, but stakeholders like the national railways and local businesses, prefer to exclude citizen groups.

A further constraint on upscaling of Living Lab approaches was anticipated by refining specific details in the experiment in Maastricht, most notably:

- separate stakeholder groups to first work with people with similar perspective, before a larger discussion with a mix of stakeholders, helping to better structure the arguments;
- build further on output of the first session in the second one, whilst receiving reflections;
- include the municipality as one of the participants since the very beginning.

These characteristics were indeed new and appreciated by civil servants, because they helped them to participate in an equal, more fruitful way. Normally, when the municipality facilitates participatory sessions, they either tend to be under pressure and criticism due to policies in the past (raising frustration at the side of citizens and others), or they risk (at least the impression of) “reproducing existing power structures”. Therefore, civil servants are now open for wider application in other policy fields.

During the first year of the Brussels Living Lab, different attempts were made by Cosmopolis and BRAL (respectively, the local university and a city movement) to engage with regional governmental institutions responsible for mobility, environment and smart city. These included various meetings with staff of the cabinet’s and of the administration, and official letters with different proposals for cooperation and joint activities within the Living Lab. The institutions did not answer to any of the proposals, for reasons that, at this point, we could only speculate on. On this basis, it was decided to approach institutions through a different channel: via the political production of the Brussels movement for cleaner air. Rather than approaching directly the regional institutions, BRAL and Cosmopolis contributed to facilitate a dialogue between citizen groups and political parties in the context of the local and regional elections, thereby scaling up the Living Lab via the consolidated practices of democratic representation. This was done, for instance, through, a process of citizen lobby in view of the regional election (series of facilitated dialogues between citizens groups and parties’ representatives), and of a large event on the topic of citizen, science, and air pollution.

8.10.1 The constraint and the anticipation strategies in the *Bellidea* Living Lab

The City of Bellinzona was formally owning the Living Lab process; however, due to the lack of familiarity with participatory approaches, they were not fully aware of the potential of participatory Living Lab projects in supporting policy development. Therefore, they lacked leadership and predominantly relied on advice and superintendence by SUPSI. Also, in line with their initial interest for exploring effectiveness of a persuasive mobile app, policy-makers tended to perceive the lab as a technology innovation testing ground: a single, small-scale, closed and controlled process, aimed at developing and

evaluating the app prior to its roll-out at city-level. In particular, they tended to cling to authoritative governance styles, rather than opening up to more consultative, cooperative or even facilitative approaches, mainly due to the fear of losing formal power and responsibility on the decision. Their main concern was to avoid possible financial and personal drawbacks and, inadvertently or not, the tendency was to keep the Living Lab in the policy periphery.

Such a situation is however not uncommon [Vreugdenhil et al., 2010]. In particular, leadership can only be learnt through experience, and providing first-hand opportunities of experiencing public participation processes is a first start. Therefore, within the *Bellidea* process we tried to promote a new political culture by ensuring the presence and active participation of representatives of the City of Bellinzona (both civil servants and political decision-makers) in lab meetings. This helped getting local authorities and decision-makers gradually acquainted with the concept that Living Labs and participatory processes in general may represent valuable learning-by-doing tools, and constructive and enriching means for reflection on practices or policy.

Another aspect strictly connected to the “Low institutional receptiveness” also refers to the general tendency by the city managers to oppose Living Labs and participatory processes in general. In the case of *Bellidea*, the city had accepted to run a Living Lab, as an attempt to address the key limitations that had emerged in previous research interventions with persuasive apps in the mobility field. At first, city decision-makers were not explicitly interested in enlarging the discussion to Phase 2 and mobility scenario building – though broadening the discussion and addressing mobility problems in a multi-level perspective has been acknowledged as the needed approach [Kemp et al., 2011; Geels, 2012] to face the mobility problems they were trying to address with the *Bellidea* app.

In this framework, the strategy we developed to try to anticipate resistance to activities aimed at discussing mobility scenarios (Phase 2) was to focus at first on an app development (Phase 1): practical and technologically oriented, this was perceived as a low-conflict topic and therefore easily supported. Later on, capitalizing on the actor- and context-dependent knowledge created while lab participants were testing the app and concretely experiencing new mobility behaviors, it was easier to upscale discussion in the lab to policy-related topics regarding future mobility scenarios (“What would we need to make mobility more sustainable in Bellinzona?”). This way, also potentially scaring, far-reaching and conflicting discussions were spontaneously introduced in the lab with the support of the institutions.

9 Conclusions and outlook

Public administrations worldwide are increasingly exploring effectiveness of Living Lab experiments, as new approaches to tackle urban challenges for sustainable development. Frequently, they are activated in parallel to smart city processes, as ways to support the innovation. However, experimenting in Living Lab processes does not always produce the intended effects, due to possible constraints arising throughout the project. Particularly, innovation that proves successful within the Living Lab may find obstacles precluding diffusion outside the Lab, and large-scale exploitation of the innovation might be precluded due to the lack of engagement of “non-smart” citizens. Being aware of such obstacles and constraints to scaling up would instead allow to design and manage Living Lab activities so as to anticipate and avoid them. To explore these challenges, in the SmarterLabs project we activated a partnership between cities, researchers, and NGOs and performed action research activities in already existing Living Lab processes run in four European cities (Bellinzona, Brussels, Maastricht and Graz). Though largely differing in the specific focus of the activities, action research in the Living Labs allowed to identify a number of constraints on upscaling inclusive Living that typically takes place, and at practically testing possible anticipating strategies in the Living Lab themselves. Outcomes of such experimentations, and especially cross-comparison between them, allowed to identify successful strategies to favour upscaling of inclusive Living Lab experiments. Experimentation in real-life Living Labs was valuable also when the implemented strategies failed to provide large-scale upscaling or social inclusion: failures activated a learning process, which led to the identification of more successful strategies to anticipate constraints.

The final result of the project consisted in the identification of a set of ten constraints that typically affect social inclusion and upscaling of Living Lab outcomes, accompanied by a number of suggestions on how to successfully anticipate each of them. Putting such strategies into practice would thus allow Living Lab processes to turn into “smarter” Living Labs. The constraints and anticipating strategies were summarized into guidelines targeting policy-makers and Living Lab initiators and managers. To favour dissemination of the project outcomes, a set of different materials was developed, including a video aimed at increasing awareness on the reason why “smarter” Living Labs are needed, and a practitioner’s brief aimed at providing practical suggestions on both the constraints affecting Living Labs and effective anticipation strategies (stories from the cities).

Throughout such a process, academic partners were highly involved in sharing their learnings and insights from the processes they were respectively leading. An intense collaboration also occurred between the academic partners and the partner cities and NGOs, both within each country, as well as across the countries. In particular, cities involved in the SmarterLabs project directly benefitted by the development of “smarter” Living Lab processes, which in fact produced benefits regarding both the specific topics dealt with in each Living Lab, as well as, more generally, the possibility to learn by practically experimenting new governance practices and approaches. Also, the exchange with other cities, as well as the close interaction with NGOs both within the local Living Lab process and within the project meeting and the related dissemination workshops, provided occasions for cities to learn from each other, which will provide benefits long after the conclusion of the project.

Regarding specific activities developed by the Swiss partners within the *Bellidea* Living Lab, here we briefly summarize its main results and identify open challenges for the future. Activities in the *Bellidea* Living Lab were explicitly designed to overcome the traditional scepticism of local policymakers towards involvement of stakeholders in decision-making processes, which is partially due to a lack of familiarity with participatory and co-creative approaches. This typical attitude was anticipated by opting for first activating a thematically focused and low-conflict activity such as designing the *Bellidea* app, and addressing strategic, key urban policy-making and planning topics only on a later stage. Discussion on “hot” policy topics, such as future mobility and land planning scenarios, was in fact envisioned to occur

only after an open and bi-directional interaction process between the City and its citizens had been activated. This allowed to explore new governance and policy-making practices at the city level and was expected to have a tangible impact on city governance processes.

However, the emergence of an unexpected technological obstacle (related to a critical dependency on the external *Moves* mobility tracking app) that could not be avoided or disentangled by means of process design and management, impaired the usability of the *Bellidea* app exactly at a time when the *Bellidea* Living Lab process was starting to bear fruits. This led to temporarily freeze the *Bellidea* app, partially restricting the political window of opportunities that it was meant to create. The wished for outcome of initiating the three upscaling processes to pave the way towards streamlining future citizen participation in public policy decision-making at City level has not yet been reached. At the same time, the inertia which has characterized the political agenda of Bellinzona in the past years and the generally low institutional receptiveness towards public participation emerged in the retrospective analysis risk to re-emerge. Thus, in order to avoid that the whole *Bellidea* process remains in its seedbed, the whole *Bellidea* team is actively looking for alternatives to the *Moves* app, with the aim of soon restoring the *Bellidea* app and hopefully restarting the related upscaling process from where it has temporarily stopped. Among the key lessons learnt from this process, we highlight the importance of maintaining full control over the technological tool the process depends on: the envisioned upscaling benefits would have been better and earlier achieved, if the *Bellidea* app had not depended on external technology.

In the meanwhile, we however acknowledge that the *Bellidea* process has already produced positive outcomes, both in terms of gaining specific insights about persuasive apps and the potential of combining behavioural change tools and approaches with mobility policy-making, and, more generally, in terms of urban governance practices. Until the external decision to close *Moves*, the envisioned upscaling processes were sailing before the wind. In fact, the co-design and launch of the *Bellidea* app to the population was successfully completed, soon achieving a good number of users, including a significant share of “mainstream car drivers”. City managers (civil servants and politicians) recognized the full potential underlying the use of smartphone applications in crowdsourcing data for improved policy-making and have embraced open data approaches, also with the aim of publicly discussing future policy scenarios. Moreover, *Bellidea* provided them with a first-hand experience in public participation processes, illustrating alternative means of approaching daily challenges and planting seeds of “innovative governance” for the management of Bellinzona. Citizens who joined the *Bellidea* Living Lab highly appreciated the initiative, and voluntary made their free time, knowledge and enthusiasm available to the City, getting engaged in a collective learning process. Civil servants have hands-on learnt about possible benefits of participatory processes, and started to change their practical approach to addressing their daily duties. We therefore trust that future attempts to keep exploring such innovative governance approaches will be welcomed by the population and will find good supporters at least among the civil servants who, through engagement in the *Bellidea* process, personally experienced the opportunities which can arise from tapping directly into the knowledge and creativity of their citizens to better address real needs of their community.

9.1 Next steps after end of project

The whole SmarterLabs consortium is currently engaged in the dissemination of the SmarterLabs guidelines, by promoting the video, the fan and the exhaustive version of the guidelines to the target audience of policy-makers and practitioners. To this purpose, specific conferences such as Open Living Lab Days are targeted. From a more academic perspective, the outcomes of the project (the ten constraints precluding upscaling inclusive Living Lab experiment and the related ways to anticipate them) are at the centre of a scientific paper currently being developed by the academic project partners.

In Bellinzona, the activities generated by the SmarterLabs project will definitely evolve and remain alive over time. On the one hand, in fact, the whole team of the SmarterLabs Swiss partners is actively working to replace Moves and re-launch the *Bellidea* app. Once a new *Bellidea* app will be available, a new marketing and promotional campaign will be activated, which we expect will raise again the interest in a large number of citizens. Once *Bellidea* will re-start at operating speed (“Upscaling 1”), activities aimed at favouring “Upscaling 2” will be re-activated as well. The City of Bellinzona could in fact make the mobility data collected by the *Bellidea* app fully available to any interested citizen, through an open access web-portal, and public availability of such data could allow re-launching the discussion on the future of mobility in the Bellinzonese region. Finally, the conclusion of the SmarterLabs project and the restart of the *Bellidea* activities will also create the framework conditions for the City to activate an internal discussion on new governance approaches, and open-up possible new opportunities for further experimenting in urban living-lab processes (“Upscaling 3”). Therefore, even though the SmarterLabs project has come to an end, the *Bellidea* Living Lab and the process it has enabled in Bellinzona still have a long road ahead.

10 Publications

The following list shows the publications developed within the SmarterLabs project by the Swiss project partners. Two more publications are currently being developed, to be submitted to scientific journals: one focusing on action research in the *Bellidea* process and one regarding the overall SmarterLabs lessons on anticipating constraints on upscaling inclusive Living Lab experiments (in collaboration with the other research teams involved in the SmarterLabs project).

Cellina, F., *Bellidea - A Living Lab to co-design a smartphone app promoting sustainable individual mobility patterns*. Oral presentation at: MobLab 17 - International conference on sustainable mobility, industry and innovation, 15.11.2017, Bellinzona, Switzerland.

Cellina, F., Rudel, R., Kovacs, N., Castri, R., Granato, P. *Bellidea - A Living Lab to co-design a smartphone app promoting sustainable individual mobility patterns.* Poster presented at the SCCER Mobility Annual Conference 2017, 15.09.2017, ETH Zurich, Switzerland, 2017.

Cellina. F., Simão, J., Mangili, F., Vermes, N., Granato, P. *Outcomes of a smart city Living Lab prompting low-carbon mobility patterns by a mobile app*. In: Proceedings of the 18th Swiss Transport Research Conference STRC 2018, Ascona, May 16-18, 2018.

Cellina. F., Castri, R., Veiga Simão, J., *Lessons from a mobility smart city Living Lab triggering new governance practices at the urban level*. In Proceedings of “Breaking the Rules! Energy Transitions as Social Innovations International Conference”, Berlin, June 2018.

Cellina, F., Castri, R., Diethart, M., Höflehner, T., Da Schio, N., Dijk, M., *Constraints on upscaling and social inclusion in smart city Living Lab experiments and ways to anticipate them: lessons from four “smarter” labs.* In Open Living Lab Days 2018 Research and Innovation Conference Proceedings 2018, European Network of Living Labs, ISBN (e-book): 9789082102789, DOI: 10.5281/zenodo.1434741.

Cellina. F., Veiga Simão, J., Granato, P., *Co-designing a persuasive app promoting a less car-dependant community: introducing the Bellidea Living Lab*. In Book of abstracts Behave 2018 - The 5th European Conference on Behaviour and Energy Efficiency, Zurich, September 2018.

Cellina, F., Veiga Simão, J., Mangili, F., Vermes, N., Granato, P. *Outcomes of a smart city Living Lab prompting low-carbon mobility patterns by a mobile app*. Poster presented at the SCCER Mobility 2018 conference, Zurich, Switzerland, September, 11 2018.

Vermes, N., Mangili, F., Cellina, F., Veiga Simão, J. *Accurate transport mode detection in Smartphone-based mobility tracking for sustainable mobility*, In Proceedings of the FTAL 2018 Conference on Industrial Applied Data Science, Lugano, Switzerland, 18-19 October 2018.

Cellina, F., Castri, R., Veiga Simão, J. (2019) *Co-designing a persuasive app promoting a less car-dependant community - Introducing the Bellidea Living Lab*. Oral presentation at the Swiss Political Science Association (SPSA) Annual Conference 2019 & Dreilaendertagung, February, 14-16 2019, Zurich, Switzerland.

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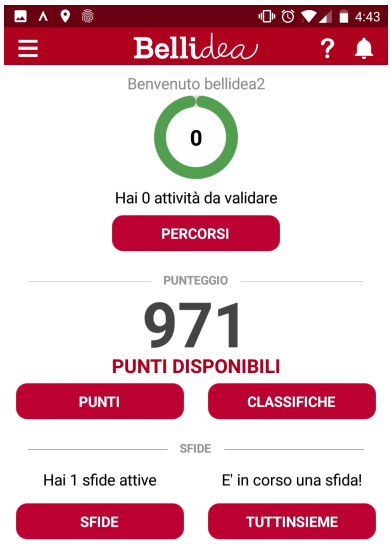
12 Appendix

12.1 Appendix 1 - Outcomes of a smart city Living Lab prompting low-carbon mobility patterns by a mobile app (manuscript presented at the Swiss Transport Research Conference STRC 2018)



Outcomes of a smart city living lab prompting low-carbon mobility patterns by a mobile app

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Abstract

Cities seek to improve alternatives to car to counteract problems associated with traffic and carbon-intensive lifestyles. Novel tools that exploit ICTs to persuade mobility behaviour change are emerging as effective supports for existing structural and regulatory tools. For instance, in Bellinzona a living lab was created to co-design with citizens a persuasive smartphone app promoting individual mobility behaviour change by means of gamification and tangible prizes. In this paper we present the co-designed smartphone app, named *Bellidea*. Based on the commercial *Moves* tracking app and algorithms developed on purpose, *Bellidea* automatically tracks routes travelled and modes of transport used, thus allowing citizens to get aware of travelling time, distances and the related energy and climate impacts. *Bellidea* also invites its users to enrol in individual and collective challenges. Travelling time performed by sustainable modes and completed challenges are rewarded with points, which can be redeemed with tangible prizes. Besides expected tangible effects on local traffic reduction, use of the Bellidea app by a large number of citizens will provide city managers with low-cost, high-quality and high-granularity real life data on their citizens' mobility patterns, to directly inform future policy-making.

Keywords

mobility tracking, behaviour change, smartphone, living lab

1 Introduction

People living in Switzerland have grown surrounded by an extensive transport network that allowed the redistribution of production assets and of people's knowledge and experience, being a key enabling factor for the prosperity this country has reached. This does not imply that average mobility patterns by Swiss citizens are sustainable. Actually, private motorized transport by car still accounts for 66% of the total distance an average Swiss citizen travels on land, and for 74% if we consider an average Canton Ticino citizen (FSO, ARE, 2015). Also, in 2015 the transport sector was responsible for 36% of the final energy consumption and 39% of the total CO_2 emissions, with private cars producing around two thirds of such emissions (FSO, 2017). Furthermore, the Swiss government has calculated that traffic congestion annually costs the country CHF 1.6 billions in lost time, wasted fuel, environmental damage and accidents. The cost of time lost in traffic accounts for around 70% of such a cost and rose from 1.1 billions CHF in 2010 to 1.25 billions CHF in 2014, with a tendency to keep rising (ARE, ASTRA, 2016).

Cities have been trying to counteract problems associated with such an intensive use of private cars, by improving infrastructures and implementing regulatory tools. For instance, since 2016 the Municipality of Bellinzona (the capital city of Canton Ticino) has created seven low speed zones, introduced traffic calming measures along two roads and built cycle-pedestrian lanes in two districts, investing a total of 2.1 million CHF (Municipio Città di Bellinzona, 2016, 2017).

However, frequently structural and regulatory tools alone are not sufficient to break car-dependant habits and produce tangible reductions in car use at the community level. Nowadays improving a city system does not solely mean building new infrastructures or repairing aging ones: transportation does not only rely on concrete and steel, increasingly also depending on information and communications technologies (ICT) (Ezell, 2010). In fact, with the digitization of data related to transport, in a bunch of years our society observed the introduction of electronic ticketing systems, the bloom of intelligent transportation system (ITS) and the appearance of automatic vehicles, somewhat turning transport into another software industry.

In this context, soft policy measures can strengthen traditional urban mobility management and favour adoption of more sustainable mobility patterns (Bamberg *et al.,* 2011). In particular, novel possibilities are offered by the growing diffusion of smart city programmes and ICT tools (Gössling, 2018), which facilitate adoption and effectiveness of cognitive-motivational tools promoting more sustainable mobility patterns (Steg and Tertoolen, 1999), in the framework of behaviour change support system (BCSS) approaches (Oinas-Kukkonen, 2013).

Acknowledging that digitization, and in special BCSS, can have a huge potential to transform the current situation, the City of Bellinzona decided to develop an ICT tool capable of actively promoting a change in citizen's mobility behaviour. In order to have a tangible impact in the Bellinzona region, such a tool had to be available to a large group of citizens. It also had to be portable and with a minimal impact in the life style of its users. Considering that Switzerland has a penetration share of smartphones of 71.7% (Newzoo, 2017) and that smartphones are already deeply integrated into people daily lives, the decision was to create a persuasive mobile app, directly exploiting the phone's inbuilt sensors that enable mobility behaviour tracking (GPS, accelerometer and gyroscope).

This paper briefly introduces the main characteristics of already existing persuasive apps in the mobility domain (Section 2), highlighting main open challenges and showing how we addressed them in the app for Bellinzona, which was developed by means of a co-design process involving interested citizens (Section 3 to Section 5). We conclude by discussing remaining challenges for future research activities in this field (Section 6 and Section 7).

2 Persuasive apps in the field of mobility

Many persuasive smartphone applications (BCSS) have recently been popping-up throughout the world, as summarized in Table 1. Some of such apps are based on manual trip detection, requiring a strong interaction with the user. For example, the CicloGreen app requires users to manually enable tracking before starting a trip, indicate the mode of transport they are going to use and manually stop tracking, once the trip has ended.

However, the large majority of apps are currently trying to move towards automatic mobility tracking frameworks, in order to minimize the need for explicit user input (Bothos *et al.,* 2014). Thanks to fast progress in the quality of mobility tracking processes, in fact, several persuasive apps are already able to automatically detect trips and transport modes. These apps run in the background and automatically detect start and end of the trip, being also able to recognize the mode used. Jonietz and Bucher (2018) however note that at some degree all current apps would still benefit from a manual checking of the transport mode by the user, provided that a good level of accuracy is sought. A recent trial run in Toronto to assess effectiveness of state-of-the-art mobile tracking apps also confirmed that automatic detection capability is still limited (Harding *et al.,* 2017). Therefore, apps frequently adopt a mixed approach, combining automatic detection with manual validation by the users. An example is the GoEco! app, that we have recently developed and tested in Canton Ticino and in the Zurich area (Bucher *et al.,* 2016): for every

recorded route, GoEco! predicts a mode of transport, but it always asks user to manually validate it, thus ensuring high accuracy in the identification of individual mobility patterns.

Table 1: Persuasive apps aimed at reducing individual car use.

App	**Country**	**Mode of transport detection**	**Points**	**Reference**
SMART, 2017	Netherlands	Automatic, manual validation is possible	Proportional to kilometers travelled by soft modes	www.smartintwente.nl
Bellamossa, 2017	Italy	Manual: user has to start/finish an activity and select the mode	Proportional to kilometers travelled by soft modes	www.bellamossa.it
Ciclogreen, 2017	Spain	Manual: user has to start/finish an activity and select the mode	Proportional to kilometers travelled by soft modes	www.ciclogreen.com
GoEco!, 2016	Swtizerland	Automatic, with manual validation	No points system; goal setting	Bucher *et al.* (2016)
QT, 2015	USA	Automatic, with manual validation	No points system	Jariyasunant *et al.* (2015)
BetterPoints, 2015	UK	Manual: user has to start/finish an activity and select the mode	Proportional to kilometers travelled by soft modes, including running	www.betterpoints.uk
Peacox, 2014	Ireland	Automatic	Based on challenges	Bothos *et al.* (2014)
Matkahupi, 2013	Finland	Automatic (though stability issues were encountered)	No points system	Jylhä *et al.* (2013)
Tripzoom, 2012	Netherlands	Automatic, with manual validation	Based on challenges	Bie *et al.* (2012)
UbiGreen, 2009	USA	Automatic, with manual validation	No points system; visualizazion of progress	Froehlich *et al.* (2009)

One of the most frequently adopted approaches to persuade behaviour change in such apps is *gamification*, which is usually defined as the use of game elements in non-gaming contexts (Deterding *et al.,* 2011). Particularly, many apps rely on a points system, by automatically attributing points if the mobility data tracked by the app show users perform sustainable mobility

choices, coherently with a set of given rules. Depending on the app, points can then be redeemed for real-life goods and services or remain just virtual achievements inside the app. As shown by Table 1, apps usually acknowledge points based on the kilometers travelled with a given set of modes of transport, frequently soft modes such as walking and cycling. To simplify user interaction and avoid computational burdens related to user profiling and consequent app-customisation, the same rules are usually applied to all users, without taking into account their initial mobility patterns or the mobility options actually available to them, with respect to their daily needs.

Acknowledging that adopting such "one-size-fits-all" rules could be detrimental to their motivational effectiveness (Huber and Hilty, 2015), some apps opted for adding a few customisation options, by relating points to achievment of individual, voluntary challenges, or even for directly avoiding them, exploiting instead other motivational elements, such as individual goal setting (Cellina *et al.,* 2016) or intuitive visualization of progress towards change (Froehlich *et al.,* 2009). Such approaches also allow not to lose sight of the "big picture" of one's own mobility patterns, by focusing on overall mobility choices, instead of single trips. In fact, attributing points proportionally to the kilometers travelled with a given mode of transport, such as the bicycle for example, might lead to paradoxical situations: users who add bicycle rides during their leisure time, instead of replacing car use when commuting to work, would be rewarded with points, even though they are not contributing to addressing current mobility problems. As remarked by Froehlich (2015), such points systems might encourage people to take more trips simply to earn more points, leading to increase consumption, emissions and the related environmental impact. Namely, exactly the opposite of what persuasive apps are designed for.

3 Co-creation in the *Bellidea* living lab

With the aim of developing a persuasive mobile app, the City of Bellinzona built on the above knowledge and particularly on the experience gained in the app-based, persuasive GoEco! intervention, which was run in the same area. GoEco! had shown two main limitations:

- *preaching to the converted*: the app had mainly attracted citizens with high environmental awareness, which had already lead them to significantly change their behaviour, thus not being representative of mainstream "car-dependent" citizens;
- *high drop-out rates and early abandon*: level of engagement of smartphone app users decreased over time: frequently users quitted app use before they had modified their mobility patterns.

To overcome such limitations and favour enduring and large scale diffusion of the new app to the whole population, the City opted for:

- encouraging social inclusion and sustaining app use with a set of tangible prizes (extrinsic motivational factors), directly targeting mainstream citizens who otherwise would not show any interest in the app;
- favouring empowerment, retention of interest and enduring engagement by opening-up the design of the app main contents and functionalities to the citizens themselves.

The hypothesis was that, if citizens owned the tool, they would have been stimulated to use it for a longer period of time and to promote its diffusion among their circle of family and friends.

Therefore, in line with recent understandings of the smart city concept as "smart technology, smart people, smart collaboration" (Nam and Pardo, 2011), the City of Bellinzona decided to activate a *living lab* process, named *Bellidea*. Living lab processes, defined as "user-centred, open innovation ecosystems based on a systematic user co-creation approach, integrating research and innovation processes in real life communities and settings" (Pallot, 2009), were in fact assessed as particularly suitable to address the needs of the City. More specifically, the *Bellidea* living lab aimed at engaging citizens in co-designing and testing the *Bellidea* mobile app, namely a persuasive app rewarding sustainable mobility choices, thus supporting the whole community in the transition from car-dependency to car-alternatives.

In early 2017 the City of Bellinzona launched a public campaign inviting citizens to join the *Bellidea* living lab. Such a campaign was targeting both car-drivers and public transport users, in order to guarantee sufficient diversity and enhance creative discussion. It also explicitly targeted students, elderly people and citizens from foreign communities, with the aim of preventing risks of exclusion of such social categories from effective use of the *Bellidea* app. On average twenty citizens attended the monthly lab meetings, held from April 2017 to February 2018, with a break during Summer. First meetings were mainly shaped as participatory workshops, dedicated to the exploration of already existing apps, the identification of the key functionalities to include in *Bellidea*, and the discussion on the gamified rewarding mechanics to be activated. Later meetings were instead organized as test-beds for the prototype versions of the app, which were step-by-step released. A website and online forum further supported discussion and reporting errors (http://www.bellidea.ch). The outcome of co-creation in the lab was the *Bellidea* app, developed for iOS and Android operating systems, which respectly have 55,5% and 43,4% of the Swiss market share (StatCounter, 2016). *Bellidea* was available to the general public since the end of April 2018, when a press conference and related communication and advertising activities launched it to the whole population living and working in the area of Bellinzona.

4 The *Bellidea* mobile app

As indicated above, activities in the *Bellidea* living lab were first aimed at understanding functionalities and limitations of previously developed apps and, later on, at identifying effective persuasive elements to stimulate app users to behaviour change. To this purpose, we referred to the effective persuasive techniques to stimulate pro-environmental behaviour identified by Froehlich (2015) and Anagnostopoulou *et al.* (2016), which can be summarized as follows:

- *Provide information:* when providing information to a user, it is most valuable if it is related to the user's behavior and is given as timely as possible (close to the triggering element, in both space and time). This makes it easier to understand and remember. In our case, possible information could be on available transport alternatives tailored to the individual's needs, interests or living context;
- *Provide occasions for social comparison:* offer individuals the opportunity to compare their choices and performances with the ones of other people or groups, which users perceive as comparable to themselves (e.g., members of the same community). This generates both peer pressure and a desire for imitation;
- *Provide goal setting opportunities:* if target values are really challenging for the individual, self-setting goals can have powerful effects, since they create a self-competitive setting in which the individual strives for personal progress and mastery (intrinsic motivation for change);
- *Provide feedback:* since individuals require a baseline to assess their performances, giving feedback is complementary to and essential for goal setting activities;
- *Provide rewards (incentives) or punishment (disincentives):* these can be either tangible or intangible, expressed in monetary terms or in physical unitsProvided as an outcome of the individual's performances, they can either reinforce individual motivation to adopt a certain behavior (reward of good performances) or stimulate a user to increaseher efforts, in case of poor performances. The use of punishment, however, is controversial (Foster *et al.,* 2011), since it might quickly lead to the unwanted effect of demotivating users.

The result of co-creation in the *Bellidea* lab is an app that performs automatic mobility tracking, provides users with (eco-)feedback on their individual mobility patterns, stimulates them with mobility-related challenges and invites them to collect points, which are proportional to the weekly percentage of travelling time by public transport, bicycle or walking. Points can be redeemed for prizes, such as discounts on energy bills and vouchers for local stores and public transport tickets. A summary of the key motivational elements introduced in *Bellidea* to persuade behaviour change is offered in Figure 1.

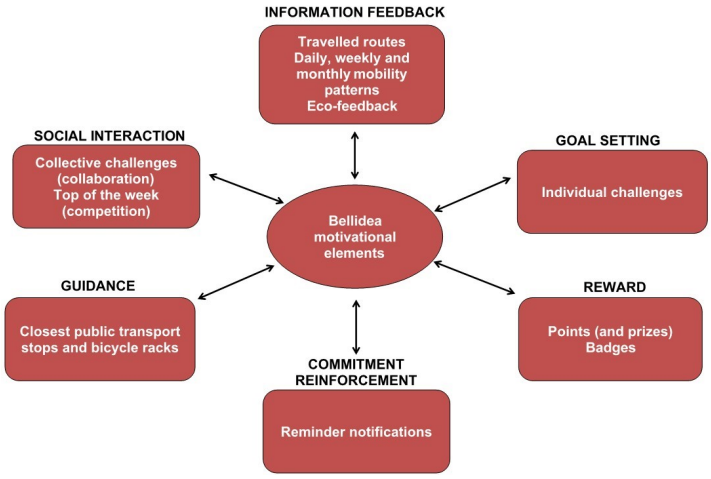

Figure 1: Components of the *Bellidea* motivational mechanics.

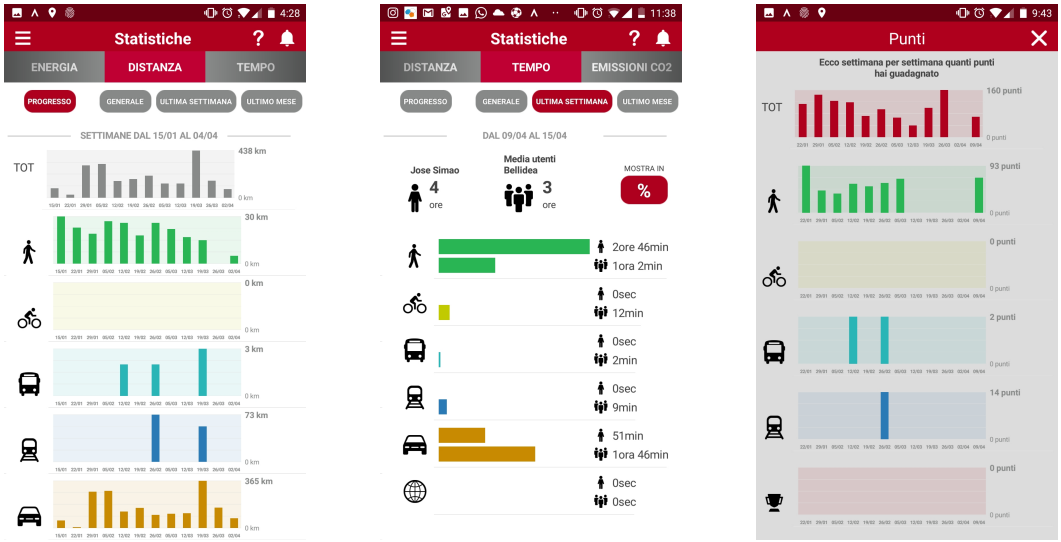

Figure 2: Example of feedback charts offered by the *Bellidea* app (only available in Italian). From left to right: weekly evolution of kilometers travelled; weekly share of transport modes and comparison with average *Bellidea* users; weekly evolution of points.

The feedback on individual mobility patterns is performed by means of a series of charts (Figure 2), which summarize the share of use of the modes of transport on a daily, weekly and monthly basis, both in terms of kilometers travelled and travelling time, as well as energy consumption and CO_2 emissions (eco-feedback). Some charts also show how the user performs with respect to the average *Bellidea* users, with the goal of enhancing occasions for social comparison.

Since the aim of *Bellidea* is to persuade a change at all levels in mobility choices, as indicated points are attributed on a weekly basis, by taking into account all the routes travelled over seven days, from Monday to Sunday. In more details, points are attributed according to the percentage of the weekly travelling time with sustainable means of transport. At the end of every week, provided that the user has travelled at least four routes, the total travelling time is computed:

if it is entirely travelled with a mix of sustainable means of transport, user is attributed 100 points. Otherwise, she is attributed a smaller amount of points, in a linear proportion to such a percentage. This means that points are attributed by taking into account mobility choices of a user as a whole, including both systematic and non-systematic routes, travelled for any purposes. The contribution of such routes is in fact getting increasingly significant, both in term of kilometers travelled and travelling time: according to the last Swiss Census on Mobility and Transport, on average 45.2% of the daily travelling time and 44.3% of the daily travelled kilometers are due to leisure reasons (FSO, ARE, 2015).

Occasions for goal setting are offered by individual challenges, that stimulate users to commit themselves to adopt certain mobility patterns, such as *This week I will not use the car during peak hour*, or *This week I will opt for public transport, when I go out in the evening*, or *This week I will opt for soft mobility for all my shorter than three kilometers routes*. Such challenges are always available in the app and users can freely decide if and when engaging in them. Since *Bellidea* monitors all the routes performed by a user, it is also capable of automatically checking completion of a challenge, by comparing the user's mobility data with respect to a set of rules, which are also made explicit to the users themselves, in the description of the challenge. If the rules are respected, the challenge is achieved and the user is directly rewarded with points. She is also intangibly rewarded by receiving a virtual trophy, visible in the app, and checking her progress in the weekly statistics charts. Challenges are structured in levels: at the entry level, the challenge lasts for one week; if they achieve it, they are invited to progress to the next level, which lasts two weeks and so on. Four levels of difficulty are envisaged, with the fourth level lasting for four weeks. Once the user completes all the four levels, she can still keep engaging in the same challenge, remaining at the highest level of difficulty.

Users are also rewarded with surprise badges, which are attributed when specific sustainable mobility choices are detected by the system, such as *using the bicycle every day for at least five consecutive days* or *travelling long than 100 kilometer trips by train*. Differently from challenges, in which users are voluntary and consciously engaged, badges are unexpectedly delivered by the app. This aims at making users aware of positive actions they perform and stimulates them to repetition in the future. Moreover, badges reinforce commitment and rekindle user interest.

Participants to the *Bellidea* living lab opted for further relying on challenges, exploiting the power of social interactions: to this purpose, *Bellidea* also offers community-level challenges, that can periodically be launched throughout the year, such as *This month, let's use the bicycle for at least 20% of our overall travelling time* (Figure 3). If app users collaborate in achieving such a challenge, they do not earn points; instead, the community as a whole gets a prize, such as

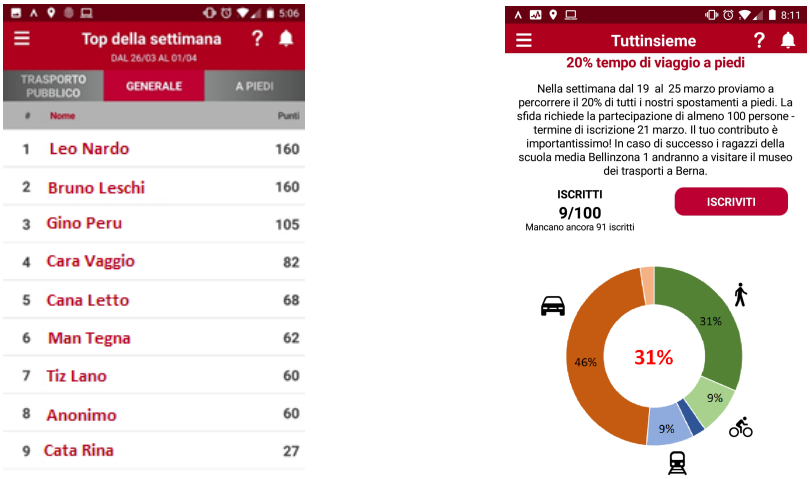

Figure 3: The functionalities of *Bellidea* exploiting social interaction elements (only available in Italian). On the left, the weekly leaderboard; on the right, a collective challenge.

for example discounts on public transport season tickets, public transport excursions for school classes or cargo-bike transport services for elderly people. Such a mechanics is expected to further motivate people to keep level of activity high, since it builds on their feeling of belonging to the local community, besides on their desire for attractive prizes. Collective challenges will only be activated in specific periods of the year, accompanied by dedicated communication campaigns aimed at engaging new citizens in app use.

Besides exploiting collaborative group mechanics, *Bellidea* also builds on competitive feelings among its users, and provides them with weekly leaderboards, based on the number of points they earn during the week: users can compare themselves with the other members of the community based on the overall amount of points gathered and also on the subset of points they earned by walking, cycling or using public transport (Figure 3). Since the leaderboard is always updated by just considering the points collected during the previous week, potentially every week any user has the chance to be in the top positions - and, if not in the general leaderboard, maybe at least in one of partial leaderboards related to single modes of transport. This guarantees that the leaderboard keeps its motivational impact over time. Since however not all individuals might appreciate being included in public comparisons, an opt-out rule is followed: in principle, all users are shown in the leaderboard, but they can ask to leave it at any time - in which case, their user name is replaced with an anonymous one, in order to keep a stimulating comparison for the other app users.

To support users in opting for public transport and soft mobility choices, *Bellidea* also offers practical information on the position of closeby public transport stops, bicycle racks and cycling lanes. This functionality is expected to guide and reassure inexperted users in their attempts to reduce car use, thus leaving less room for commonplace statements such as *I keep using the car*

because I am unfamiliar with the other mobility options and would not even know where to take the bus from or where to park the bicycle.

Finally, a notification system is always active, in order to recall users about ongoing activities in the app: *Bellidea* provides its users with one daily notification about the tracked routes (and the possible related need for validation), one weekly notification when statistics are updated and points are attributed and one notification when a challenge the users is engaged into is close to conclusion. The type and frequency of notifications is designed with the aim of reducing intrusiveness, while keeping users' interest in the app and reducing app churn. In the future, possibilities to customize the number and type of notifications will be offered.

5 Automatic mobility monitoring

Effectiveness of the above persuasive elements critically depends on the capability of the app to correctly and automatically detect mobility data, particularly in terms of routes travelled and modes of transport used. For this reason, here we focus on the main challenges that were discussed and addressed in the *Bellidea* lab regarding how to monitor individual mobility data.

5.1 Data acquisition

Due to time and budget limitations, developing a tracking app from scratch was not possible within the *Bellidea* living lab. Therefore, to track raw mobility data we had to rely on existing commercial tools. We opted for using another app, instead of other tools such as GPS devices or bracelets, since requiring to buy external devices would have been too high a barrier preventing app diffusion among the citizens. Following the findings of Bucher *et al.* (2016), we opted for using the activity tracker Moves app (https://moves-app.com/), originally developed for fitness purposes. Main advantages offered by Moves can be summarized as follows:

- it runs in background and is capable of automatically identifying transport activities, without any user interaction, provided that GPS location services are enabled;
- it records GPS points with a reasonable accuracy,allowing to reconstruct actually travelled routes to a good approximation, though at the same time guaranteeing low battery consumption and usual phone usage during the day without extra recharging;
- it has inbuilt pre-processing algorithms able to organize GPS data into routes and activities as well, in case different means of transport are used in the same route;

- it already effectively detects some modes of transport (the fitness-related ones, namely walking, running and cycling); all the other transport activities are identified and segmented in routes/activities, though in such cases the mode of transport is generally classified as "transport";
- it provides an application programming interface (API) that enables other apps to automatically access these data and process them for further elaborations;
- it is freely available, both for iOS and Android operating systems.

Nevertheless, the use of Moves as a tracking provider presents a few downsides:

- there is no direct control on the data collected, nor on the models and procedures used to get them: Moves produces data under a black-box approach;
- data are also stored in third-party servers abroad, which might comply with less restrictive data protection laws and requirements with respect to the Swiss ones;
- the service might be disrupted at any time, which implies high dependency on the willingness of its developers to keep it available;
- it is an external app, which cannot be integrated in *Bellidea*, therefore compelling users to install two apps instead of one.

Notwithstanding such limitations, due to the lack of other equally good performing alternative options, we opted for using Moves.

The mobility tracking data collected by Moves and imported in the *Bellidea* database are organized in routes and activities, which are segments of routes travelled with the same transport mode. For each activity, Moves provides the following characteristics: distance, duration, start and arrival time, GPS coordinates of a few tracking points (their number depending on the specific route and activity), and estimated transport mode (walking, running, cycling, or "transport").

5.2 Data processing

If being unable to tell the difference between a car, a motorbike, a bus or a train is not a problem for a fitness tracker app, such as Moves, it becomes critical in a mobility tracking app aimed at reducing car use, such as *Bellidea*. In particular, since in *Bellidea* the feedback on individual mobility patterns is one of the key persuasive elements towards behaviour change, and, depending on such mobility patterns, real prizes are offered, detection of the mode of transport is crucial in *Bellidea*.

To address automatic mode detection, in our GoEco! earlier project in which we had exploited Moves as well, we had developed algorithms performing a further classification of Moves estimates of the transport mode, achieving an overall average accuracy of 82,9% (Bucher *et al.,* 2016) in automatic mode detection. In GoEco!, however, we had always asked users for a manual validation of the mode of transport we had identified: namely, for every recorded activity, the app asked users to either confirm the detected mode or indicate the correct one. Such a request for validations turned out to be critical for app users, up to the point that in final project survey and individual interviews they indicated it as a major reason for app churn, that is users' early abandon of regular app use (Rizzoli *et al.,* 2014*,* Cellina *et al.,* 2016). Moreover, as already noted, requesting users for a manual validation of the mode of transport leaves room for cheating the system, which would not be accceptable in *Bellidea*, where real-life prizes are at stake.

Having learnt such lessons, in *Bellidea* we aimed at avoiding as much as possible to ask users to confirm or correct the mode of transport automatically detected by the app. However, we were aware that we could not totally remove validations: in fact, as remarked in the above literature review, current smartphone-based automatic detection capability is limited (Harding *et al.,* 2017) and therefore, even adopting different algorithmic approaches, errors in the identification of the mode of transport would still have been common. If we removed validations, users would at first appreciate not having the burden to regularly validate their routes, but in the end would in any case be led to quit using the app, due to dissatisfaction with detection accuracy. Therefore, in agreement with the citizens involved in the *Bellidea* living lab activities and with policy-makers in Bellinzona, we opted for an hybrid configuration, underlying a relationship of trust between the app and its users. We decided in fact to improve the classifying algorithms we had developed for GoEco!, with the aim of limiting both users' validation effort and mode detection errors, while not totally eliminating either the former or the latter.

The hybrid configuration works as follows: at app download, all users first enter a short training period, during which they are required to validate all the activities they travel and do not get any points. This period, which on average lasts for a couple of weeks, allows to calibrate and train our algorithms, in order to improve their performances. Then, validation of an activity is only asked when the estimated probability of a mode of transport identified by our algorithm falls below a given threshold.

Figure 4 schematizes the *Bellidea* app data acquisition and processing activities. Once a day the mobility data of the day before, collected by Moves API, are pushed into the Bellidea datastore, which sends them to the *Bellidea Classifier*. The Classifier is based on a random decision forest algorithm (Breiman*,* 2001). Basically, it takes as input the points of an activity (i.e. the geographical coordinates, but also the corresponding timestamps), from whom it computes a

number of features charaterising the activity itself. The full set of estimated features for each activity is the following one:

- transport mode indicated by Moves (bike, walk or motorized transport);
- user identifier;
- average speed;
- total traveled distance;
- maximum distance between two (consecutive) track-points;
- average change of direction between track-points;
- start hour of the activity (0-23);
- start day of the week (1-7);
- distance between first track-point and closest bus stop and distance between last track-point and closest bus stop (a direct connection between the two stops must exist);
- delta between actual travel time and bus travel time between the two stops;
- distance between first track-point and closest train stop and distance between last track-point and closest train stop (a direct connection between the two stops must exist);
- difference between actual travel time and train travel time between the two stops;
- first track-point latitude and longitude;
- last track-point latitude and longitude.

The Classifier processes such data and returns the probability distribution over the following transport modes: walk, cycling, train, bus, car, other. Namely, it returns the probability that each activity has been travelled with each mode of transport. Then, the two modes of transport with the two highest probability values are considered. If the difference between such probability values if higher than a given threshold value, then the mode of transport with the highest probability is considered correct and is sent to the *Bellidea* datastore, to be shown in the app as the detected mode of transport, with no possibility for the user to modify it. Otherwise (the difference between the two highest probabilities is below a given threshold value), it means the *Bellidea* Classifier is not capable of reliably detecting the mode of transport to a good approximation. Therefore, a validation is requested to the user. In such a case, the *Bellidea* datastore receives the indication of the mode of transport with the highest identified probability, but the app asks the user for a validation, namely to confirm or modify it. After validation, the mode of transport validated by the user is sent to the Bellidea datastore as well.

Figure 4: Architecture of the *Bellidea* system for detection of the mode of transport.

The above process refers to the classification phase, but there is also the training phase. A preliminary training was initially performed on the data collected by the GoEco! app during the related research project (62'956 activities collected by 220 users between March, 14 2016 and

April, 30 2017); after, training was periodically launched, also including new activities validated by participants to the *Bellidea* living lab, when they were testing prototype releases of the app. Every time a new training is performed, accuracy in the detection of the transport mode is further improved. If in the classification phase the algorithm considers one activity at a time, in order to detect its mode of transport, in the training phase the Classifier is fed by the whole set of activities for whom the transport mode is already known (i.e. the set of activities already validated by the users). Doing so, the Classifier can be trained, and also updated if a substantial amount of new data is available, and overall detection accuracy increases. While the classification phase must be run online (the user has to immediately receive the indication of the mode of transport), but it is very fast, the training phase can take a non neglectable amount of time (depending on the amount of training data), but it can be done offline, for instance during night time, once per week.

It is important to say there is only one instance of the Classifier, common to all users: the approach of developing a set of classifiers, one per every user, has also been explored, but discarded. In fact, despite adopting multiple classifiers would allow to better detect the features of every user, it would also have two important drawbacks. The first one is that the amount of data needed for every user would be much larger if compared to the single Classifier solution; the second, and more important, is that having single classifiers for every user would be more sensitive to cheating. In fact, if during the first validation period a user untruthfully indicates a transport mode which provides more points (e.g., bicycle) for all activities, then the individual classifier would attribute that same transport mode to all her future activities; unlike, the single common classifier, which does not differentiates between users, would only slightly be biased. However, analyses we performed on the performances of the single Classifier showed that totally ignoring the differences between users providing validations reduces the overall performances of the Classifier. Therefore, the implemented Classifier also considers the identity of the user as an input parameter, thus allowing for a certain degree of customization of the classifier to suit each particular individual. As a consequence, the customized single classifier is more sensitive to cheating than the common one, yet, it is more robust than a set of user-specific classifiers.

5.3 Assessment of performances

Performances of the whole *Bellidea* Classifier and hybrid system for the detection of the mode of transport were assessed by means of the data collected by the citizens involved in the *Bellidea* living lab. In fact, after being involved in co-creating the app functionalities, participants to the *Bellidea* living lab supported us in testing the *Bellidea* app prototype, as long as its functionalities were released over time. In particular, they were invited to validate the mode of transport for all

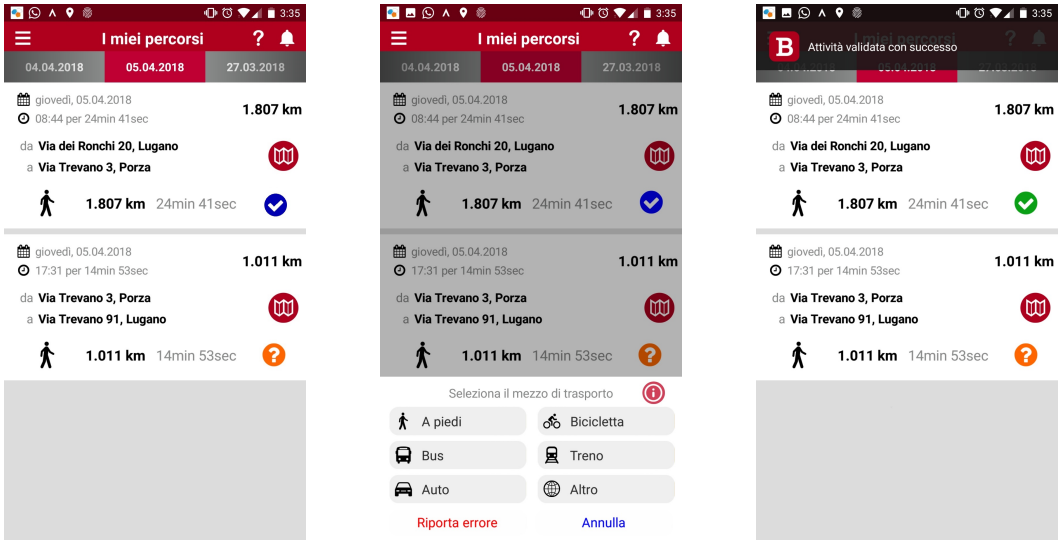

Figure 5: User interface for the validation of the transport mode during the test with living lab participants. Blue icons were shown if the *Bellidea* Classifier considered the transport mode as correct, while Orange icons indicated *Bellidea* Classifier requested for a manual validation. In both cases, manual validation was required. Once it was performed, both icons became green. Note that in the final version of the *Bellidea* app, blue icons were replaced by already green icons and their validation was blocked.

their activities, both those for whom the Classifier considered the mode of transport as correct and those for whom the Classifier requested for a manual validation. To visually differentiate these two situations in the app, the user interface showed the former type of activites with a blue icon, while the latter with an orange icon. After validation, in both cases the icon turned to green (Figure 5). This procedure allowed us to assess the following indicators:

- the frequency of the requests for validation (namely, the number of "orange icons" per day per user);
- and the accuracy in automatic detection of the means of transport (namely, the percentage of the "blue icons" for whom the transport mode validated by the user corresponded to the one considered correct by the *Bellidea* Classifier).

The test took place from January, 15 to March, 11 2018, involving 28 living lab participants. A total number of 8'687 activities were collected, of whom 85.8% were regarded as correct by *Bellidea* ("blue" icons) and 14.2% were instead required a manual validation ("orange" icons). On average, such "orange" icons correspondend to 0.78 activities per day per user. Overall, 69.6% of such activities (6'047 activities) were manually validated. Such validations showed that the *Bellidea* Classifier was able to correctly detect the mode of transport for 89.6% of the "blue" icon activities.

Starting from these indicators, a sensitivity analysis was performed in order to assess perfor-

Table 2: Results of a sensitivity analysis on the value of the threshold to be used to identify activities that need to be manually validated.

		Threshold [%]						
		0	5	10	15	20	25	30
Manual validation [%]		0	4	7	11	14	18	21
Recall [%]	bicycle	67	69	69	70	71	72	72
	bus	17	13	13	13	13	14	12
	car	90	92	92	93	94	94	95
	train	68	68	71	73	75	78	81
	walk	93	93	94	95	95	96	96
Precision [%]	bicycle	76	78	80	81	82	85	85
	bus	78	67	68	68	67	73	67
	car	77	79	81	82	84	85	85
	train	90	90	91	92	91	92	95
	walk	93	94	95	95	95	96	96
Accuracy [%]		85	86	88	89	90	90	91

mances of the *Bellidea* Classifier, on varying the threshold used to differentiate "blue" from "orange" icons - namely the value against whom the difference between the two highest probabilities of a transport mode is compared. The goal was in fact to determine a threshold value with a good tradeoff between Classifier performances and amount of activities to be confirmed by the users. To assess performances of the Classifier, three indicators were considered:

- the *recall*, which indicates how many of the activities validated as a particular mode were classified as such;
- the *precision*, which indicates how many of the activities classified as a particular mode were actually validated as that mode;
- the overall *accuracy*, which is the number of modes correctly identified divided by the total number of classified activities.

Table 2 shows how the percentages of manual validations, accuracy, recall and precision vary with the value of the threshold. Based on such analysis, we decided to use a 20% threshold, which is expected to produce an overall 90% accuracy of the Classifier, without stressing the number of manual validation requested to the users: on average, users would in fact be called to validate 14% of their activities. This was assessed as not critical with respect to cheating, since it would only allow users to modify 14% of the recorded activities, if they wanted to gain

more points. Also, it was regarded as not critical in terms of validation effort: according to the average data collected by participants to the *Bellidea* lab, for whom on average 38.8 activities were registered every week, every user would only be requested to validate 5.5 activities per week, which is less than one per day. Finally, a 10% error in the detection of the transport mode was assessed as still acceptable, with respect to the risk that users abandon, due to a lack of satisfaction in the quality of automatic mobility monitoring.

6 Discussion

In this section we comment on the implications of a few design characteristics of the *Bellidea* app and indicate how we addressed them. Practical implementation of the motivational elements introduced in Section 4, coupled with the mobility tracking system we implemented, in fact led us to address a few challenges. The main aspects we dealt with can be summarized under the following dilemmas:

- dynamism versus rigidity;
- trust versus control;
- global versus local.

6.1 Dynamism versus rigidity

The first challenge refers to the opportunity to develop a dynamic system, as much as possible capable of operating in real-time. This is in fact what citizens expect: if their phone is tracking their mobility data, they expect they can immediately see their routes and activities on their phone, and possibly also see the immediate increase in the amount of points available to them. Indeed, Moves provides routes and activities in (nearly) real-time, as soon as they have ended. *Bellidea*, instead, imports them in a bulk, once per day: tipically, every day at 3 p.m. it imports all the activities travelled on the day before (from midnight to midnight) and then at 6.30 p.m. sends a daily notification informing about possible activities to be validated. This rigidity was decided in order to guarantee data imported from Moves are complete and stable, since they refer to activities that have definitely concluded. In our previous experience with GoEco!, instead, we had opted for maintaining activty import as dynamic as possible, though this frequently resulted in importing partial data and incomplete activities, about whom users frequently complained. In fact, Moves updates an activity while the user is still moving, and already makes it available among its APIs, ready for export. However, Moves might keep updating it, depending on the

specific route the user is travelling. Importing an activity as soon as it gets available in the APIs might therefore imply the risk of importing an incomplete activity (wrong destination points, lack of tracking points characterizing the path, more likely errors in the detection of the mode of transport). Since the specific procedures and rules followed by Moves in data processing were not known to us, we decided to favour data quality, to the expense of frequency of update: *Bellidea* might look a bit static, though activity data are correct.

Another aspect impacting dynamism is related to the rules to attribute points. Since we explicitly aimed at attributing points based on the users' mobility patterns as a whole, instead of the single trips they travel, for point attribution the real-time framework had to be necessarily abandoned. Instead, we set a time-step during which mobility patterns are assessed, with points being attributed at the end of such time-step. We opted for a weekly time-step, believing the week allows to take into account the variety of mobility needs users usually have, including both work/study-related and leisure-related ones, and therefore is particularly adequate to perform an overall assessment of how sustainable mode transport choices are. A shorter period (e.g. one day) would result in too much variability: one day might result more sustainable than the other not because of active decisions by the users, but simply because of different external factors influencing one's mobility needs. A longer period (e.g. one month), instead, would be as interesting to summarize mobility patterns, though it would imply way too little dynamism: feedback offered by the app would be too rare to have an impact and users would easily lose interest in the app.

For these reasons, points are updated on a weekly basis and refer to the mobility data collected from Monday to Sunday. They cannot be updated on Sunday evening, however, since the validation issue comes into play. The need for a validation, which is only introduced for a limited amount of activities, implies users are left some time to check their activities and validate the mode of transport, before points are attributed. We decided to keep the same rule for all the users, setting the update to Tuesday mornings at 10 a.m. Every Monday evening at 6.30 p.m. the daily notification also recalls to validate any "orange icon" activities regarding the previous week (from Monday to Sunday) and indicates validations will only be possible until Tuesday at 10 a.m. If on Tuesday at 10 a.m. any "orange icon" activity is still present in the app, meaning that not all requested validations have been performed, no points are attributed for that week. Moreover, validation of such "orange icon" activities will no longer be possibile, since activities of the past week will be turned to gray and no interaction possibilities will remain available. Again, the system is quite rigid and precludes possibilities for users to validate old activities and correspondingly get the points updated. This choice was mainly due to avoid retroactive management of the point system, which was considered too complex with respect to the time and budget available. However, it was not only compelled by technical limitations. In fact, we

preferred to force users to at least one weekly interaction with the app, in order to guarantee that they still remember about the routes they travelled throughout the previous week, therefore being able to correctly validate the transport mode. Moreover, the need for at least one weekly interaction contributes to rekindle interest by the users and is expected to reduce app churn, thus at least partially counteracting possible app churn due to lack of real-time dynamism.

6.2 Trust versus control

The second challenge we addressed refers to the dilemma of trust versus control. As already discussed in the previous sections, the general approach followed in the *Bellidea* app reflects a "controller" attitude: fearing that allowing too much validations can lead users to cheat the system, due to availability of tangible prizes, automatic detection of the mode of transport is favoured, to the extent possible. Participants to the *Bellidea* lab in fact preferred to accept a 10% risk of not attributing points to users who deserve them (the percentage of errors in mode detection for the "green icon" activities) instead of leaving users free to validate any activity.

In oder to manage and monitor such errors, we introduced the possibility for users to automatically notify them. Four categories of errors have been envisioned: not performed activity, wrong duration, wrong address(es), and wrong mode of transport. For the time being, the system automatically deletes activities of the firts type. It is not unfrequent, in fact, that GPS devices track short activities that actually have not been performed, for instance around a place where user is standing still for a few hours. The other types of errors, instead, are not followed by any practical action, apart for being monitored. Any automatic cancellation of activities might in fact pave the way to cheating - a bit more difficult for users than by validation, but, in any case, possible. Therefore, such error reporting is manually analyzed: if specific users are seen to frequently report errors, they are directly contacted to investigate their problem.

Accepting that around 14% of activities need in any case to be validated by the user (the "orange icon" activities), the control attitude at least partially opens up to a trust attitude. Indeed, the most effective way to cheat the system would be very easy: users might simply disable Moves or leave the smartphone at home whenever they are going to travel by car. Every week, they would just need to register four routes by foot, bicycle or public transport, to be rewarded with 100 points (four being the minimum number of weekly routes needed to get points). This recalls us that at the heart of the *Bellidea* concept is an attitude of trust between the City of Bellinzona and its citizens.

6.3 Global versus local

The third challenge deals with considering the whole mobility of a user, no matter where it takes place, or only considering the part of mobility that involves the Bellinzona region. Again, this issue was debated since tangible prizes are at stake, and such prizes are offered by the City of Bellinzona, by relying on the municipal budget. In principle, everybody in the lab was convinced of the need to stimulate global improvements in one's mobility patterns, be them in Bellinzona, Lugano, London or wherever else in the world. However, they also acknowledged that current administrative organization had to somehow be taken into account: if the City of Bellinzona is paying for prizes, it should be in exchange for tangible improvement of individual mobility patterns over its territory. If improved mobility patterns are also registered outside the City, it is definitely valuable, but the City cannot be called to be directly responsible to reward them. Acknowledging this implied introducing boundaries: *Bellidea* in fact only considers routes with either a starting or an arrival point in the area of Bellinzona (for the sake of simplicity, schematized in a rectangular box). Any route travelled completely outside such a box is not imported in *Bellidea*, even though it is regularly tracked in Moves.

Note that this choice could lead to paradoxical situations, such as citizens being rewarded with points (and prizes) for always using the bicycle in Bellinzona, even though every day they travel by car to their workplace in Lugano - which is pretty common - and alway stop at the service station outside Bellinzona for a coffee. Being entirely out of the "Bellinzoa box", the route from the service station to Lugano (and vice-versa), which is about 25 kilometers, would be totally ignored by *Bellidea*, leading to wrong assessment of the mobility patterns of the user. The only option to avoid such boundary effects would be to enlarge the boundaries of the area taken into account, for example by securing collaboration between cities or with the Canton, thus enlarging the box as to account for the areas which are most likely to be covered by daily mobility needs of average citizens.

7 Conclusions

With the *Bellidea* app we tried an innovative approach to prompt people living or working in Bellinzona to more sustainable mobility patterns. The app was co-designed with interested citizens within a smart-city living lab process, which spanned over one year. Being developed by computer software professionals, it was launched to the whole population at the end of April 2018, at the very time we are writing. Therefore, for the time being we cannot yet assess its effectiveness in tangibly impacting individual mobility patterns in the area of Bellinzona.

However, we can remark the steps forward we performed, with respect to previous persuasive apps, and indicate the main open challenges to be addressed in future applied research.

The first innovation lies in the *process* of development itself: since the *Bellidea* app was developed with the active contribution of its future users, in the living lab framework, it is expected to get a wider diffusion, thus producing a wider impact. The second innovation refers to the *hybrid system to detect the mode of transport* we implemented: the compromise solution of combining largely automated detection with limited manual validation by the users was not found in any other currently available app. This mechanism takes over the tedious task of manual checking all travelled trips, while limiting detection errors and avoiding potential cheating effects. The third innovation lies in the choice of rewarding app users by *considering their mobility patterns as a whole*, instead of rewarding them for single trips they travel - which might paradoxically lead to adding more trips instead of replacing those travelled with less sustainable means of transport.

In developing the *Bellidea* app, however many compromises were made, in order to manage proposals by the living lab participants with current technological limitations and budget constraints. The main challenge we wish to address in the near future is to remove the *Bellidea* dependency on the Moves app, which is out of our direct control both in terms of quality and frequency of data collection. Also, we would like to further develop the "guidance" functionalities offered by *Bellidea*, which currently are very limited. Citizens involved in the lab have in fact explicitly asked for the integration of multi-modal navigating systems, capable of providing them with practical and real-time suggestions about the most convenient available alternatives to car. Finally, we would like to work on customization, by providing app users with personalized suggestions for change, as long as we acquire data allowing us to learn their mobility patterns and available alternatives to them.

To conclude, we are well aware that the solutions implemented in *Bellidea* are not the panacea to solve all the problems related to personal mobility. However, they are an attempt to integrate and support already existing policies and regulations in the mobility sector, worth of being monitored and continually improved, as well as replicated in other cities or regions. Also, we believe that positive impacts will go further than persuading some citizens' mobility behaviour. In fact, the *Bellidea* app will provide the City of Bellinzona with low-cost, high-quality and high-granularity real life data on the citizens' mobility patterns, that could be used to directly inform future policy-making activities.

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12.2 Appendix 2 - The Charter of Principles for Sustainable Mobility elaborated during the Living Lab meeting of February 19, 2018 (in Italian)

Bellidea

Sintesi dei punti di forza, delle debolezze, delle opportunità e delle minacce per la mobilità sostenibile a Bellinzona (matrice SWOT)

PUNTI DI FORZA	PUNTI DI DEBOLEZZA
La morfologia del territorio, in parte importante pianeggiante, offre la possibilità di percorsi sicuri per la mobilità lenta	La morfologia del territorio, non del tutto pianeggiante, rende difficile raggiungere in bicicletta alcune zone della città (ad esempio, la zona dell'ospedale)
	Spaccatura della città in due aree distinte e separate fisicamente da una direttrice molto frequentata (parte storica e parte con importanti centri di studio/lavoro/ricerca/fruizione del tempo libero)
Buon livello di servizio offerto dal trasporto pubblico	Trasporto pubblico non ottimale: frequenza insufficiente delle corse, coincidenze non-ottimizzate (specialmente durante il fine settimana)
	Autisti del trasporto pubblico non sempre pazienti: spesso sono nervosi, vanno troppo veloci e non rispettano i limiti di velocità
Tradizione ciclistica nella popolazione	Numero di piste e corsie ciclabili non sufficiente
	Sicurezza delle piste e delle corsie ciclabili non sempre garantita (es. ridotta sicurezza per i ciclisti dovuta a corsie ciclabili posizionate su strade troppo strette o corsie interrotte)
	Manutenzione carente delle corsie e delle piste ciclabili, con pericolo per i ciclisti (verniciature e pavimentazioni in cattivo stato ed eseguite con poca cura, radici degli alberi a lato strada, forti ritardi nella spalatura della neve)
	Mancanza di indicazioni cartografiche relative ai percorsi ciclabili/pedonali (che magari riportino anche i tempi di percorrenza stimati)
	Mancanza di un servizio bike-sharing
---	Dipendenza dell'automobile ("pigrizia")
	Marcato traffico sulle arterie principali, specialmente negli orari di punta
	Automobilisti indisciplinati
	Traffico parassitario su strade residenziali/ di quartiere (ad esempio tra Giubiasco e Bellinzona, tra Camorino e Giubiasco)
	Presenza di traffico che si potrebbe evitare: trasporto dei figli a scuola in auto
OPPORTUNITÀ	**MINACCE**
Disponibilità dell'attuale politica a realizzare importanti passi verso una mobilità sostenibile	**---**
Effetto positivo dell'aggregazione: facilità nel coordinare gli sforzi realizzativi sul territorio	---
A partire dal 2016, le norme sulla circolazione stradale consentono di creare percorsi in contromano per le biciclette, nelle arterie stradali a senso unico (Ordinanza sulla segnaletica stradale OSStr, Art. 18, comma 5)	---
Iniziative di carpooling già attivate sul territorio cantonale, che si basano sull'interazione tra cittadini (rete di collaborazione): promozione di tragitti condivisi sui percorsi casa-lavoro/scuola/tempo libero, quali ad esempio carpooling o pedibus	---
Allacciamento ferroviario con Lugano più rapido a partire dal 2019/20	Aumento del traffico pendolare per l'ultimo chilometro, legato all'allacciamento ferroviario più rapido con Lugano a partire dal 2019/2020

PRINCIPIO DI FONDO

Rendere la mobilità più sostenibile significa fare in modo che, ogni volta che devono spostarsi, i cittadini scelgano il proprio mezzo di trasporto secondo il seguente ordine di priorità:
- a piedi
- in bicicletta
- con il trasporto pubblico (treno, autobus)
- in automobile

A questo scopo, occorre:
- prima di tutto migliorare le possibilità di uso in sicurezza di mezzi di trasporto alternativi all'automobile;
- quindi, favorirne l'adozione mediante misure di sensibilizzazione.

In linea di principio, conviene evitare di introdurre divieti rigidi.

Nel quadro sopra indicato (matrice SWOT), per concretizzare questi principi, si propongono le misure seguenti.

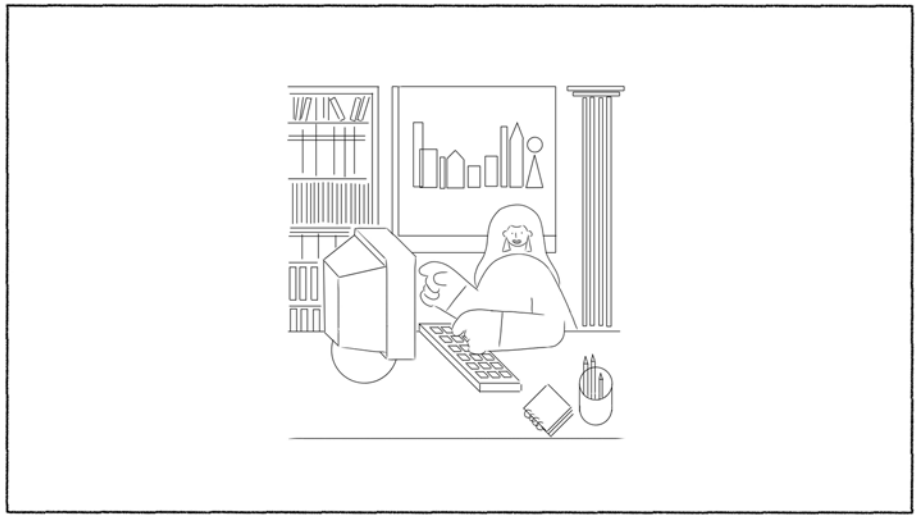
Bellidea

Sintesi delle misure da introdurre per favorire la mobilità sostenibile a Bellinzona

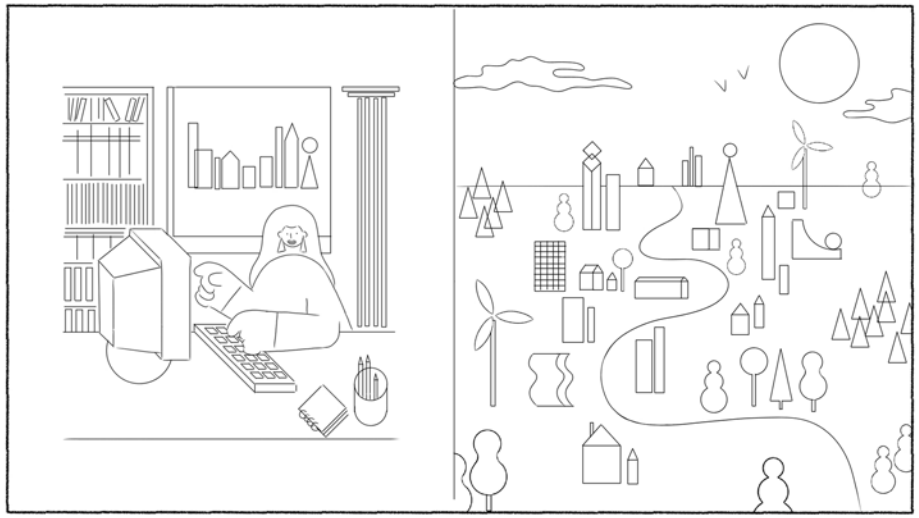
	MISURE	Suggerimenti puntuali per misure - ove possibile, localizzate su mappa
Misure a favore della mobilità lenta 	Ampliare zone pedonali (o ad accesso limitato per i residenti)	Ad esempio, via Orico, via Dogana e piazza Governo (dove la presenza dei posteggi attira auto e crea pericolo per i pedoni)
	Introdurre divieto di transito negli orari di punta su certi assi stradali, installando dissuasori del traffico mobili/semoventi, che si alzano e abbassano in base all'orario (=> riduzione del traffico parassitario)	Strade locali tra Giubiasco e Bellinzona
	Estendere le "zone 30"	L'intera Bellinzona potrebbe diventare una zona 30, con qualche eccezione per il traffico di attraversamento
	Migliorare la sicurezza dei ciclisti e dei pedoni attraverso il miglioramento dell'infrastruttura, semafori e segnaletica	Ad esempio, migliorare l'illuminazione lungo la Golena [segnalazione sulla mappa, no. 1]
	Sfruttare l'autonomia dei comuni per realizzare un arredo urbano che amplifichi cromaticamente i limiti/le restrizioni	
	Migliorare la sicurezza di ciclisti e pedoni promuovendo la formazione degli automobilisti (obbligo di dare la precedenza ai ciclisti nelle "zone 20" e "zone 30")	
	Estendere la rete delle piste ciclabili	Ad esempio, costruire un percorso ciclabile lungo la stazione S. Paolo [segnalato sulla mappa, no. 2]
	Aumentare il numero di stalli e posteggi per le biciclette	
	Creare una rete di punti di ricarica per le biciclette elettriche, nei pressi degli stalli di parcheggio	
	Introdurre il servizio bike-sharing, localizzando le postazioni anche in corrispondenza dei parcheggi d'interscambio "Park&Rail"	
	Favorire ovunque possibile l'autorizzazione all'accesso in contromano nei sensi unici per le biciclette	Ad esempio, costruire una pista contromano in Via Pellandini [segnalato sulla mappa, no. 3]
	Creare strade unicamente per ciclisti ("bike-street", "superstrade" solo per bici)	
	Promuovere l'uso della bicicletta nelle scuole, ad esempio mediante linee di "bici-bus" (simili alle linee "pedibus") per i percorsi casa-scuola (con accompagnatori adulti)	
Misure a favore del trasporto pubblico 	Armonizzare al meglio le coincidenze e gli orari dei vari mezzi di trasporto in modo da offrire agli automobilisti una vera opportunità di utilizzo di mezzi di trasporto alternativi all'auto	
	Promuovere un maggiore coinvolgimento dei cittadini nella pianificazione di linee, percorsi, orari, punti di interscambio e coincidenze del trasporto pubblico, in modo da far emergere tratte/orari non coperti	
	Ampliare i parcheggi di interscambio "Park&Rail"	
	Favorire il trasporto pubblico di bambini, con corse speciali e incentivi per le famiglie	

12.3 Appendix 3 - The video storyboard: why are “smarter” Living Labs needed?

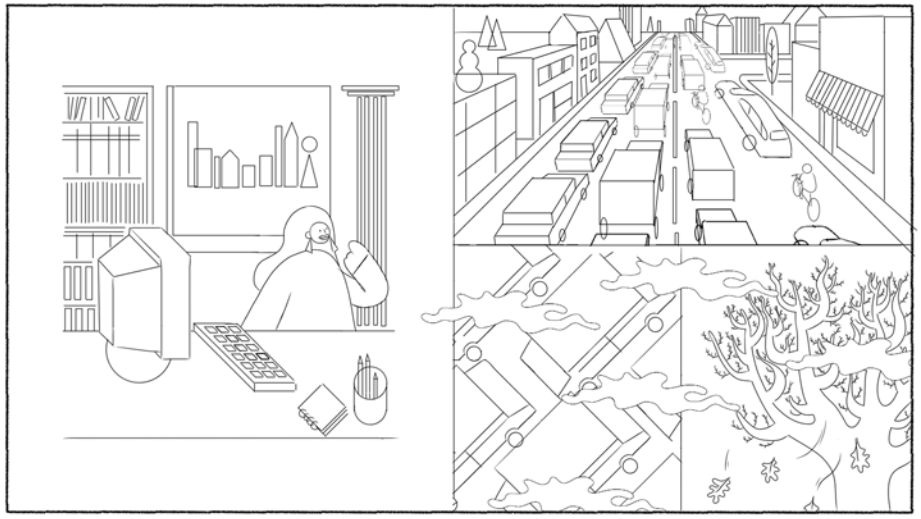
SMARTERLABS : STORYBOARD



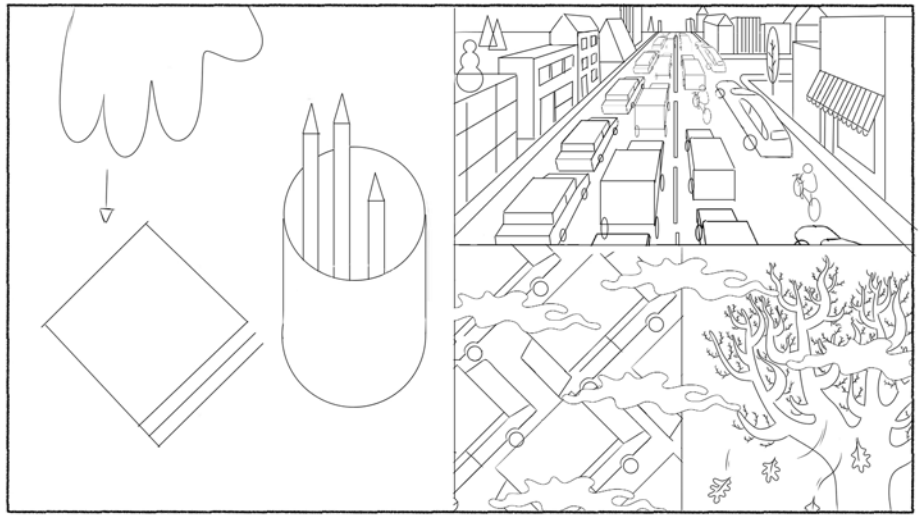
V.O : Lisa is a civil servant

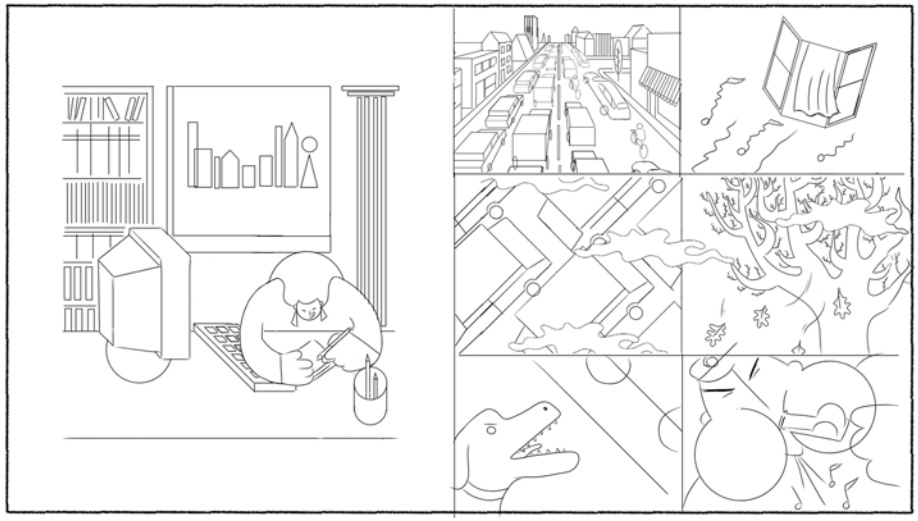


V.O : in a medium-sized city dealing with urban development.

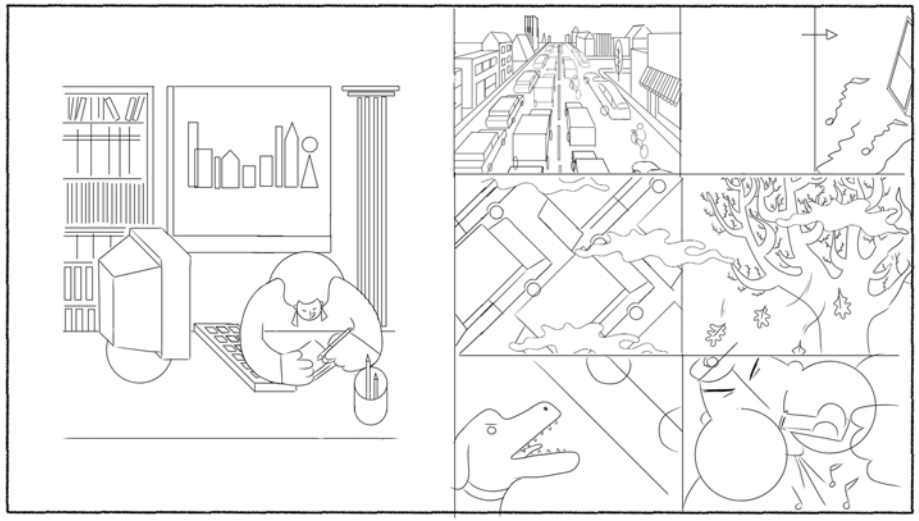


V.O : She has to re-design a congested avenue to improve the quality of life in the neighbourhood.

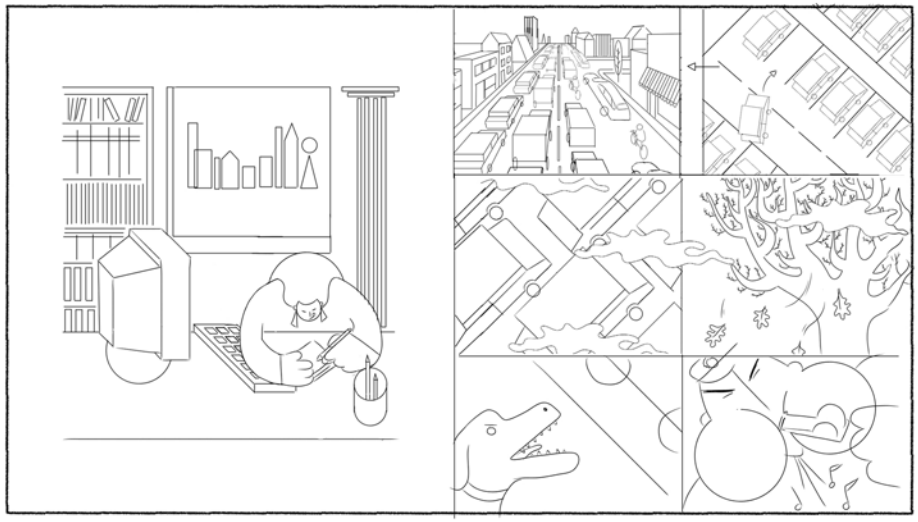




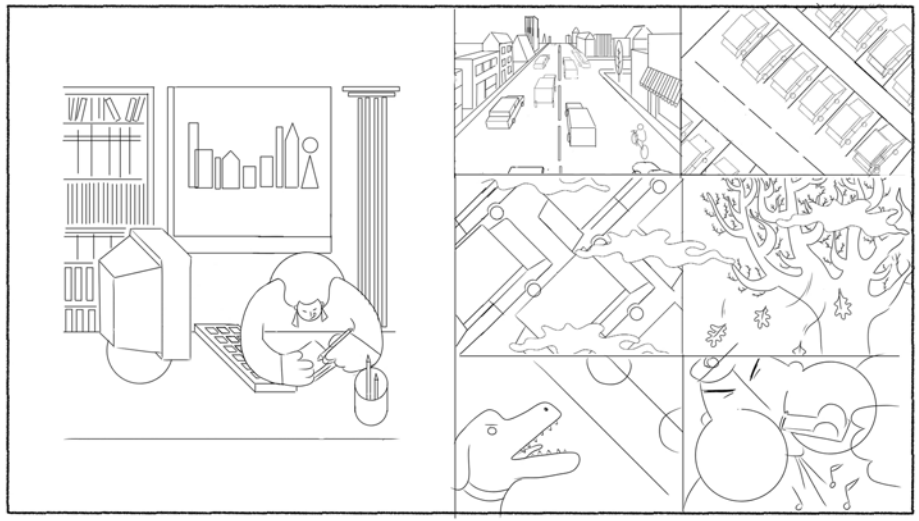
V.O : It is a hot topic, with no straightforward solution

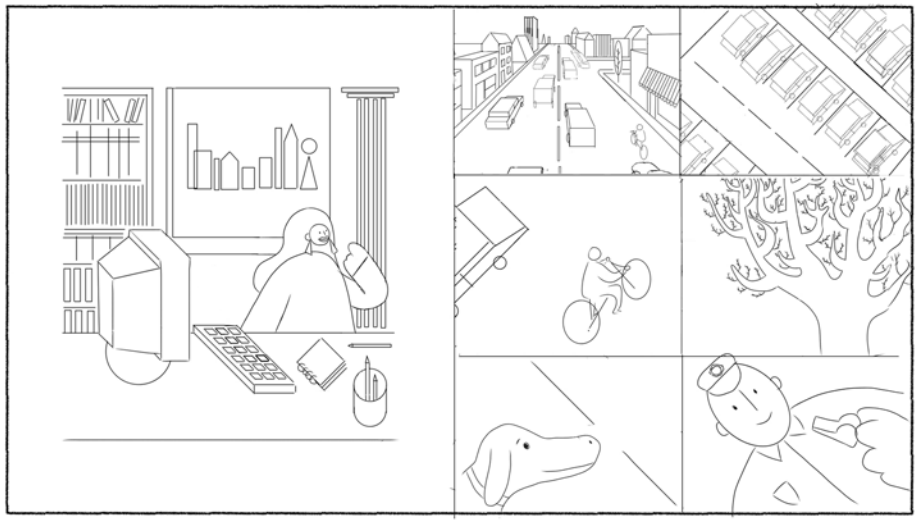


V.O : and highly conflictual visions!

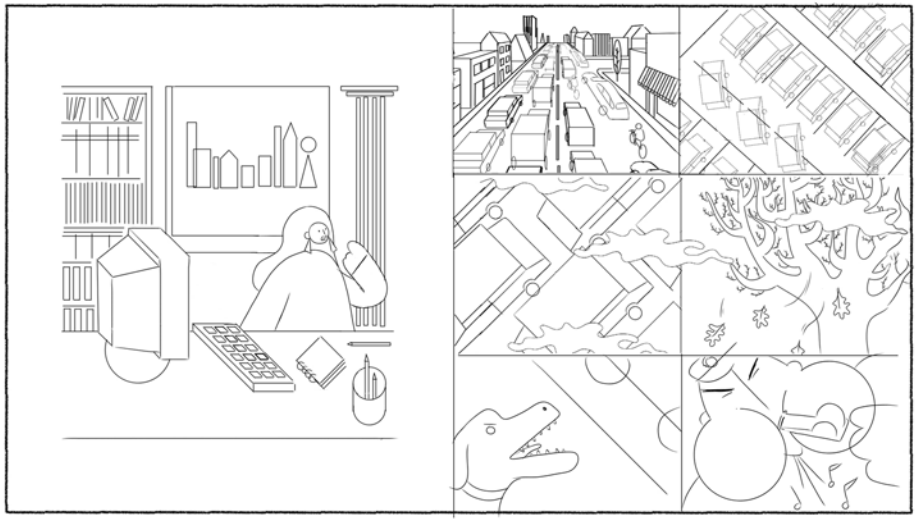


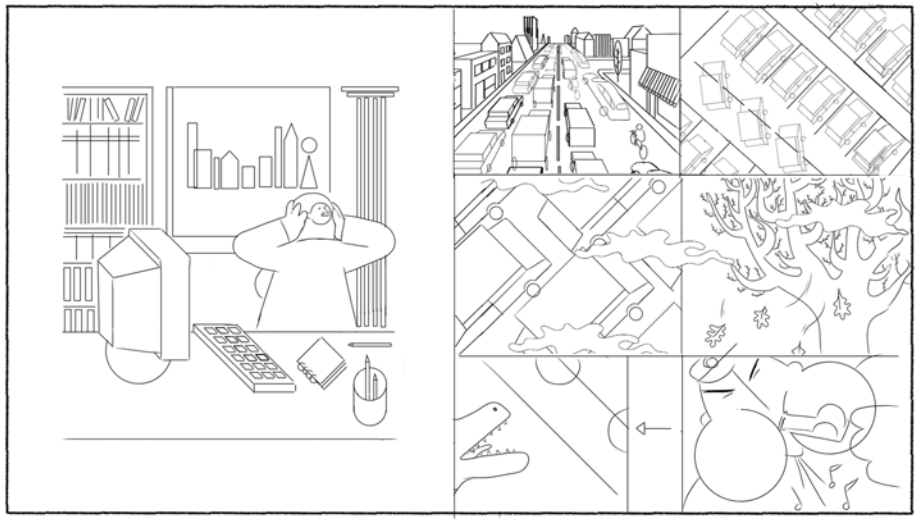
V.O : She knows that nowadays a top-down decision risks to be unpopular

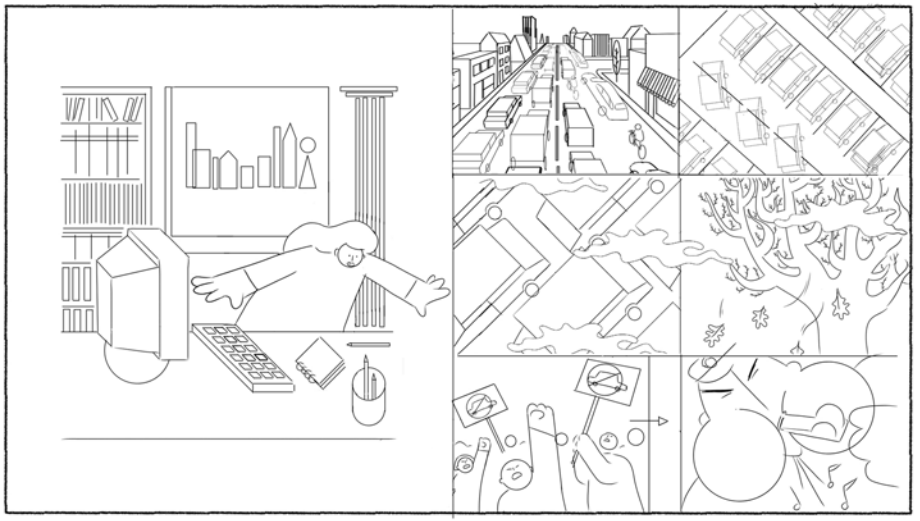


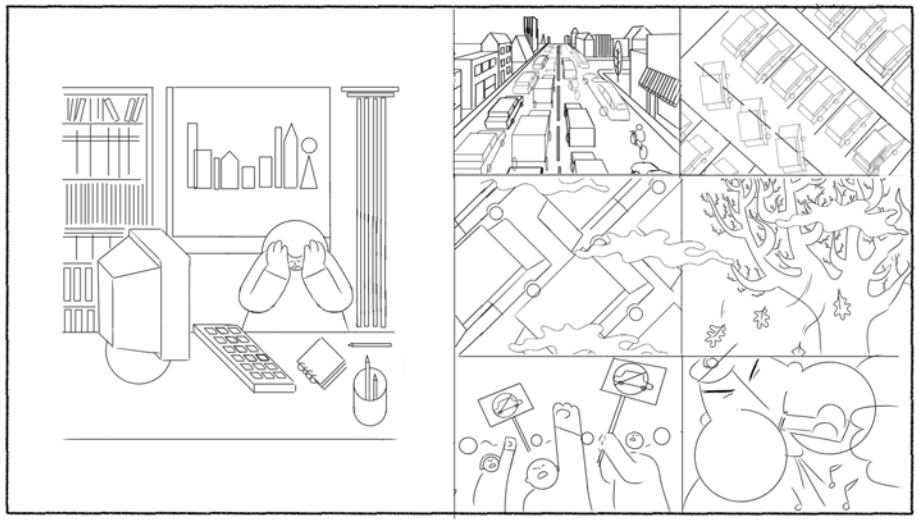


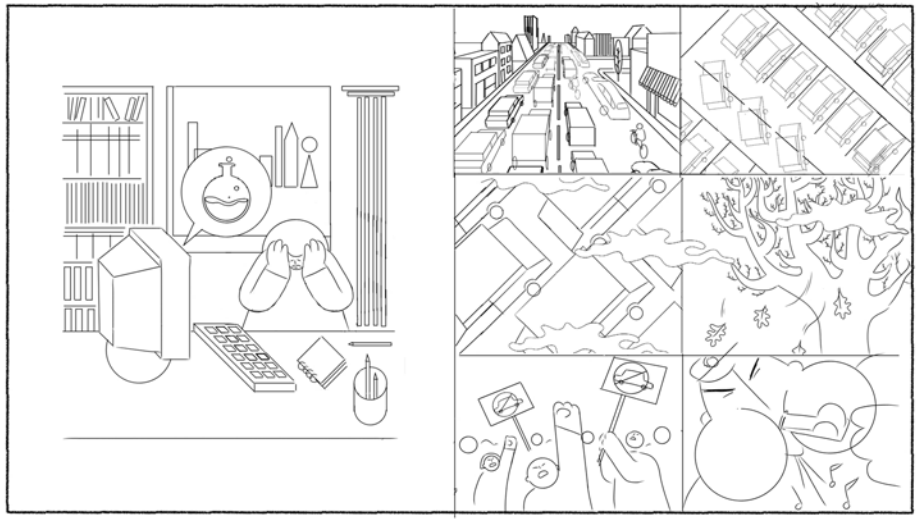
V.O : however an agreement that makes everybody happy will be difficult to achieve.



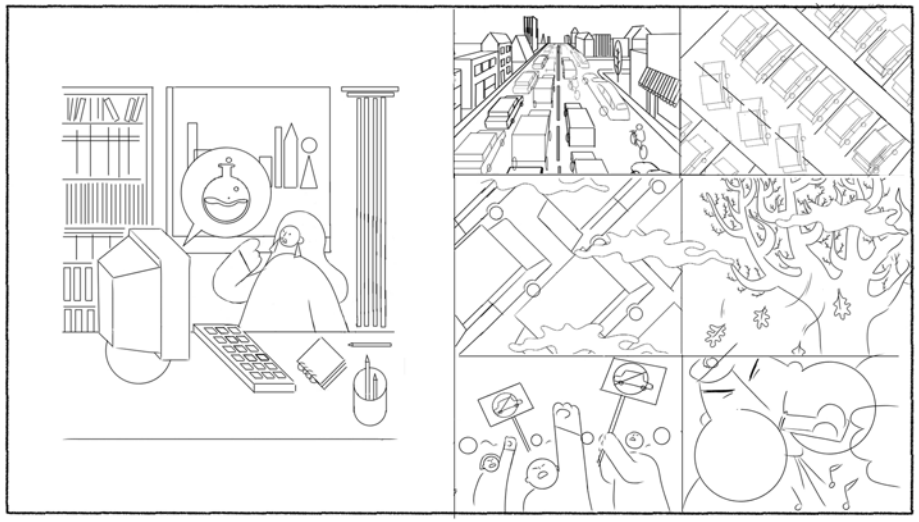




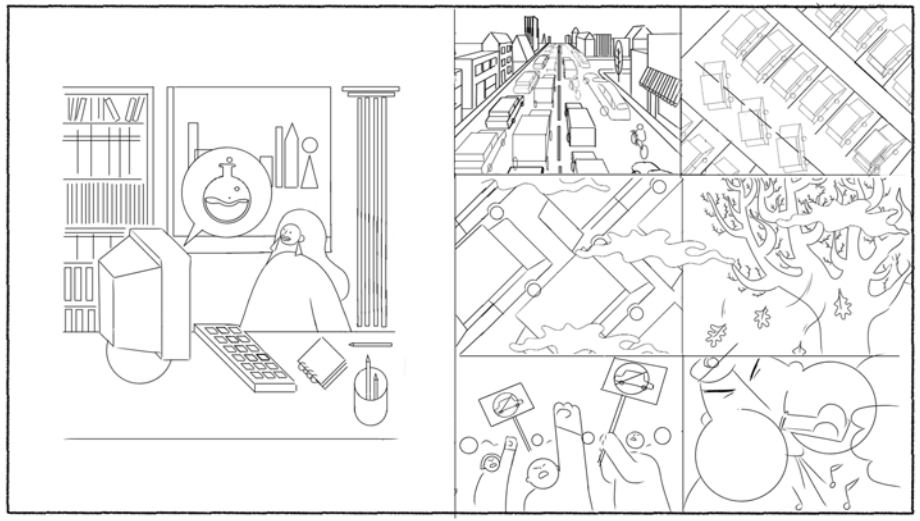


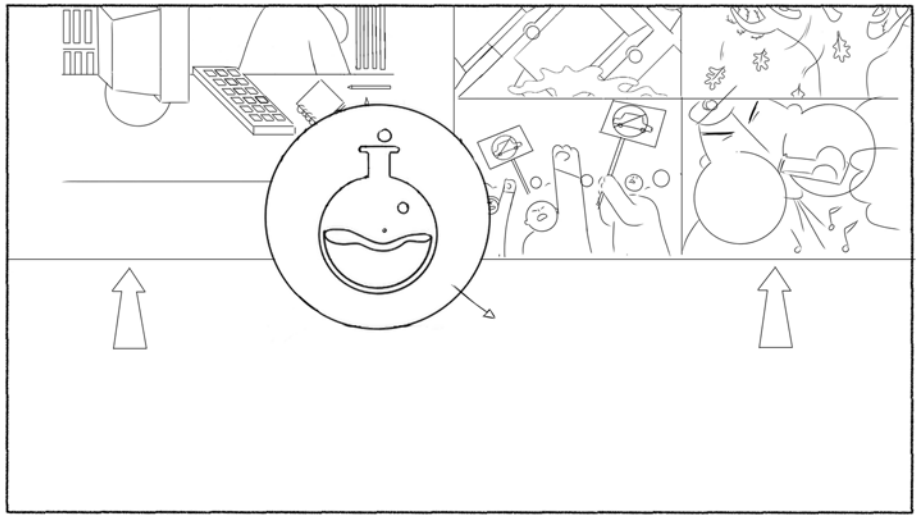


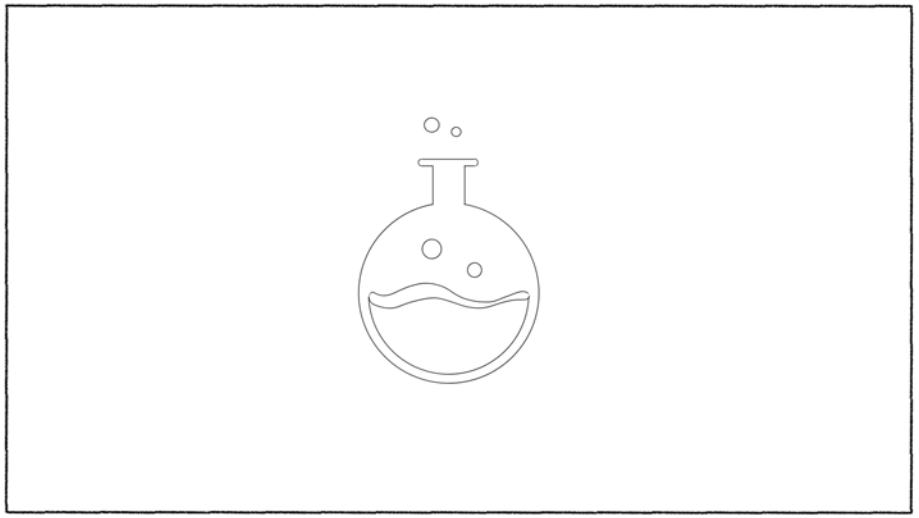
V.O : She then hears about the Living Lab approach,

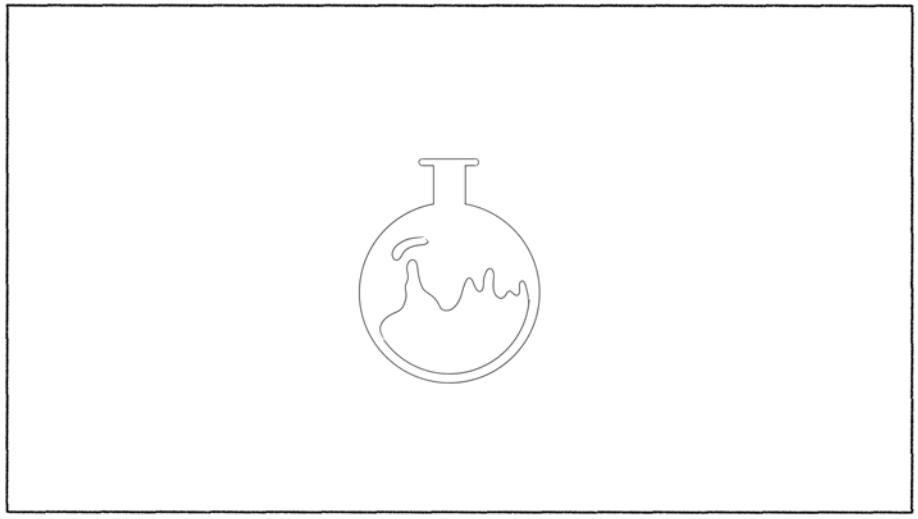


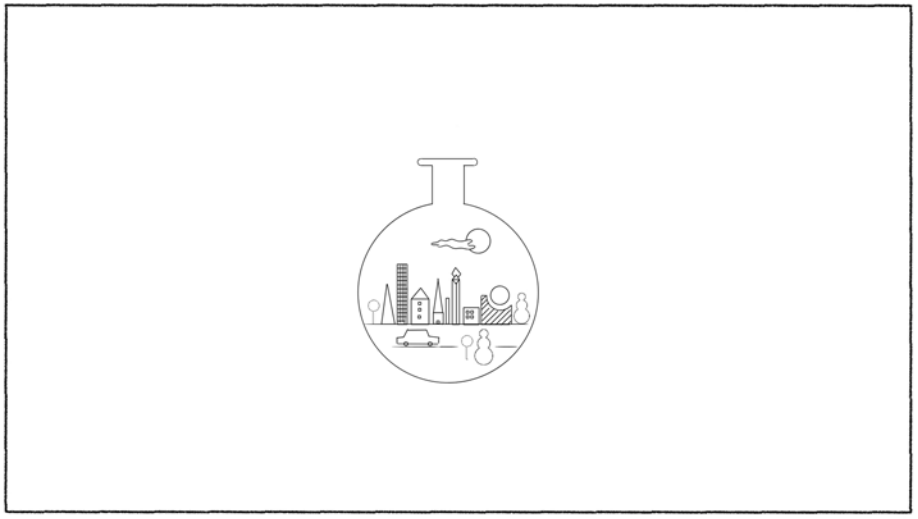
V.O : a new way to address urban problems.

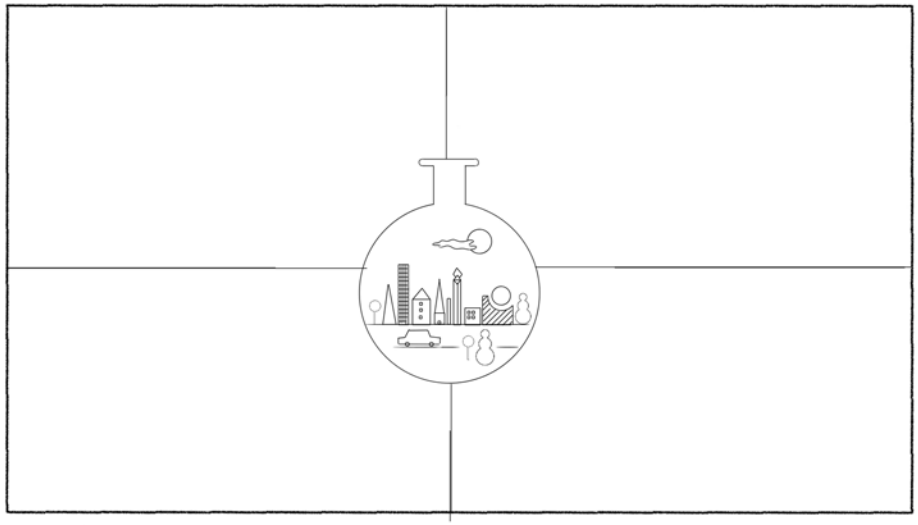




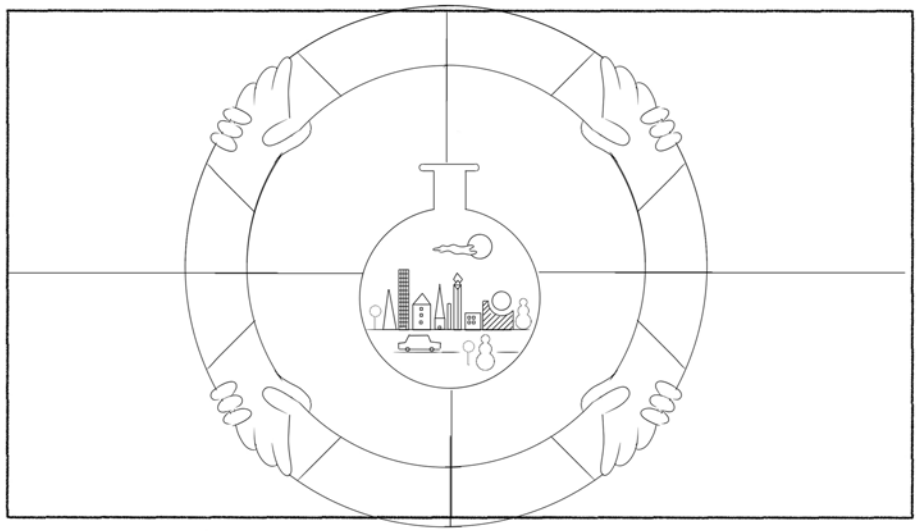




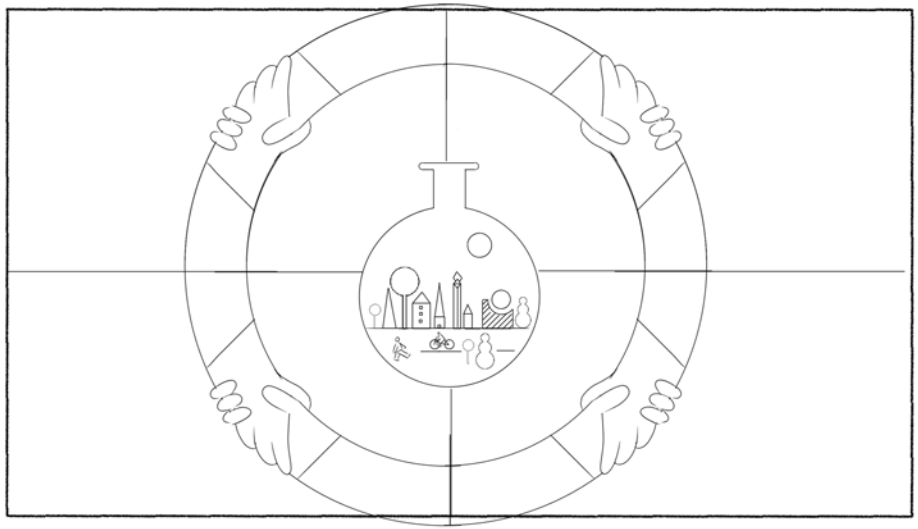




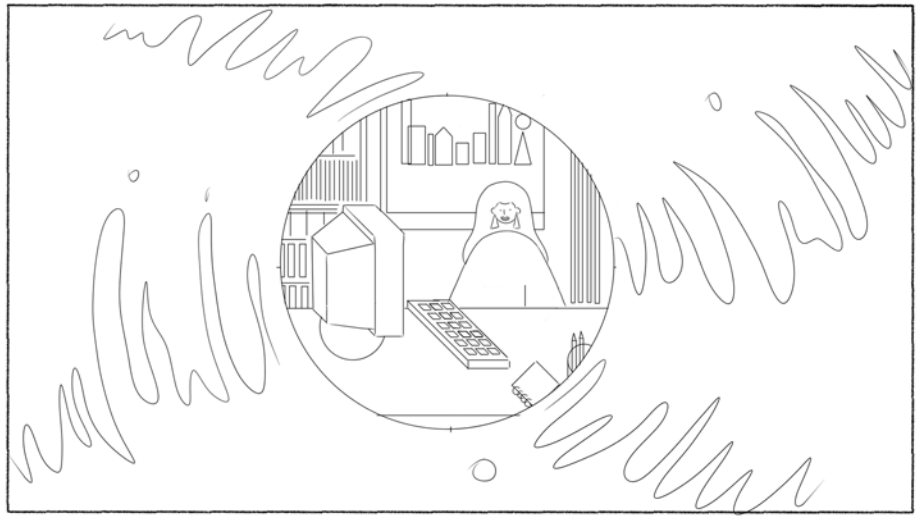
V.O : Living Labs are spaces



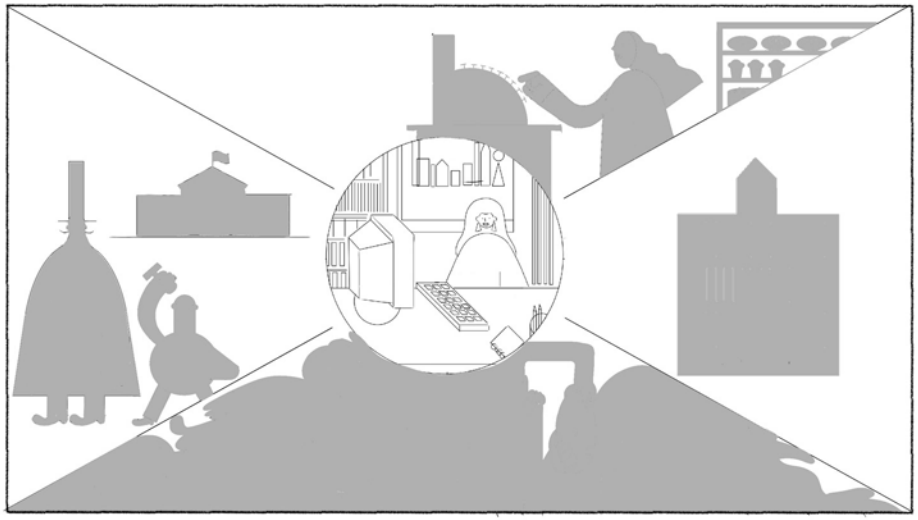
V.O : where multiple actors work towards a shared understanding of a problem



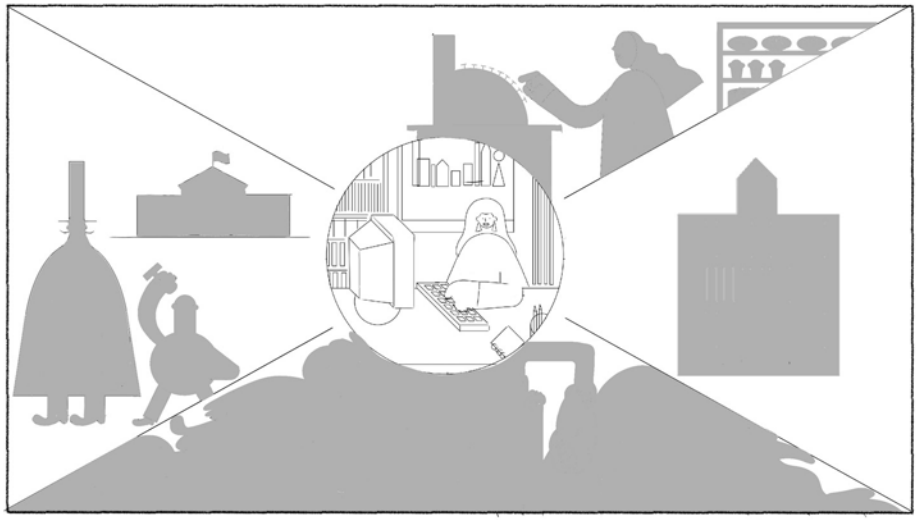
V.O : and experiment solutions in a real-life context.



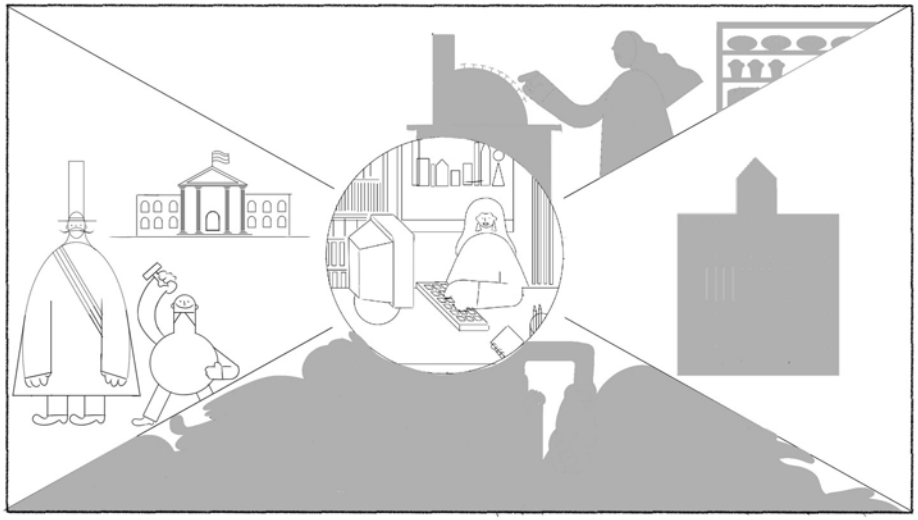
V.O : This approach seems particularly relevant for her case:



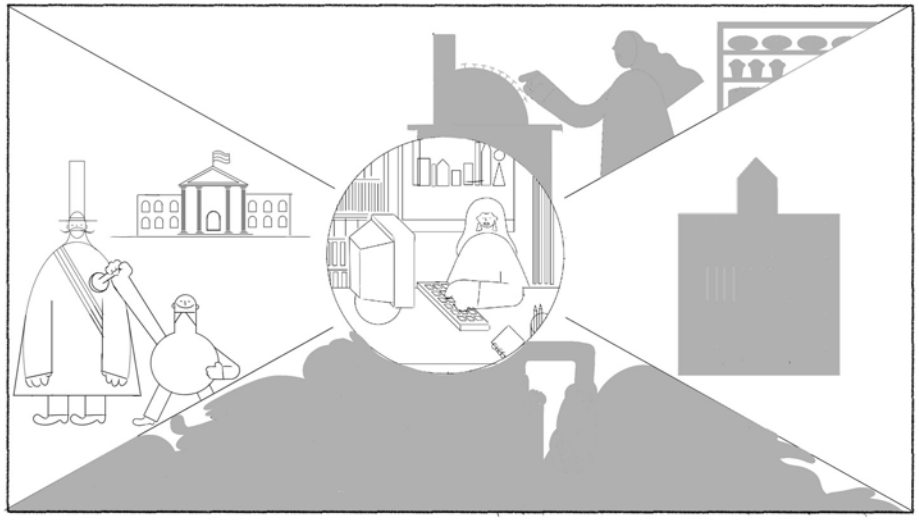
V.O : in a Living Lab she could engage



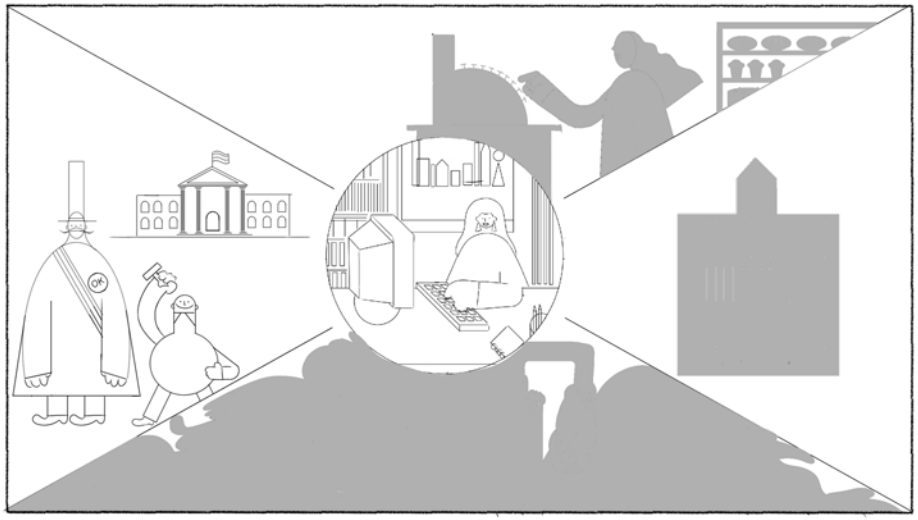
V.O : all relevant stakeholders,

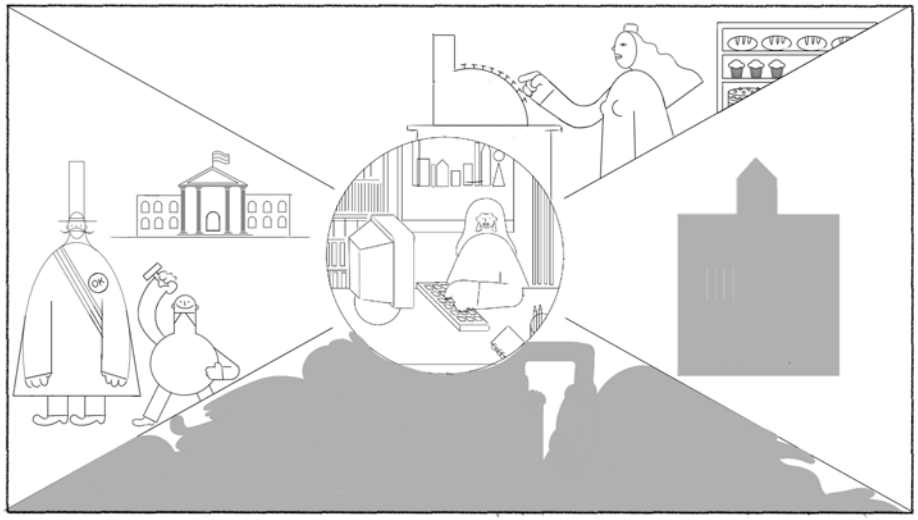


V.O : from public administration

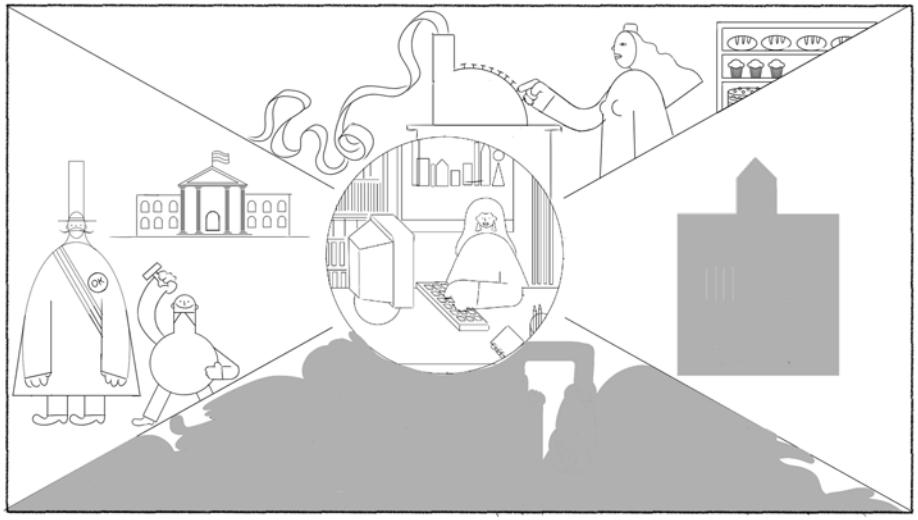


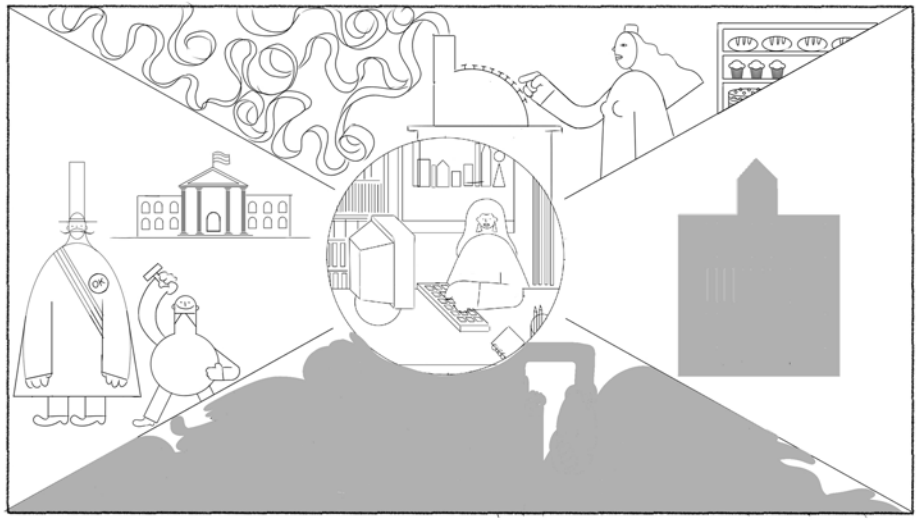
V.O : and politicians

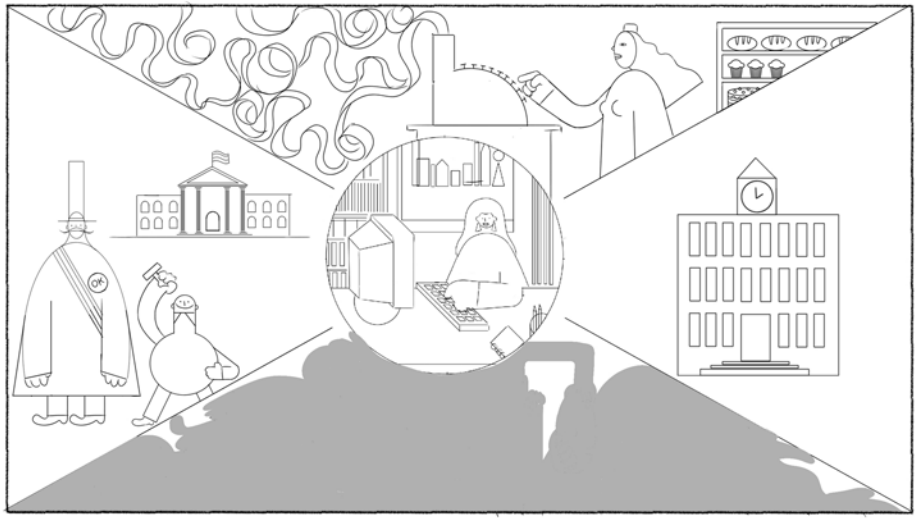




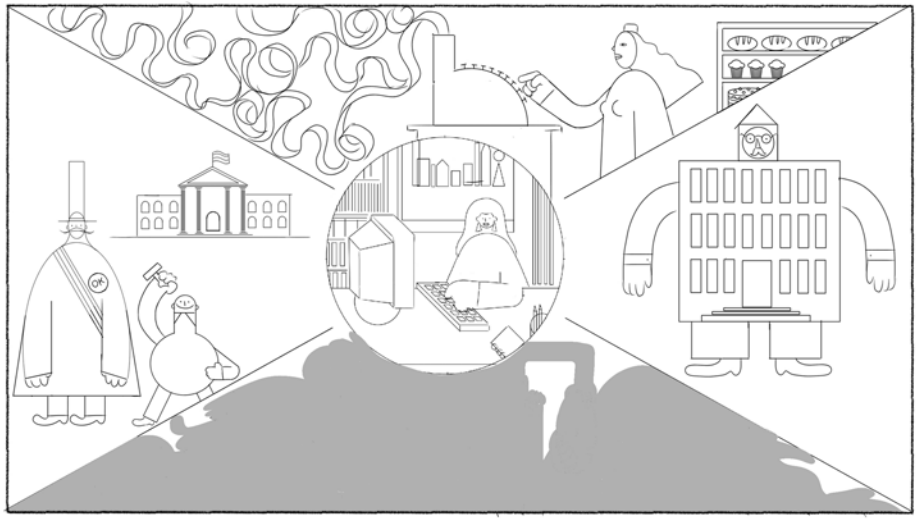
V.O : to business,

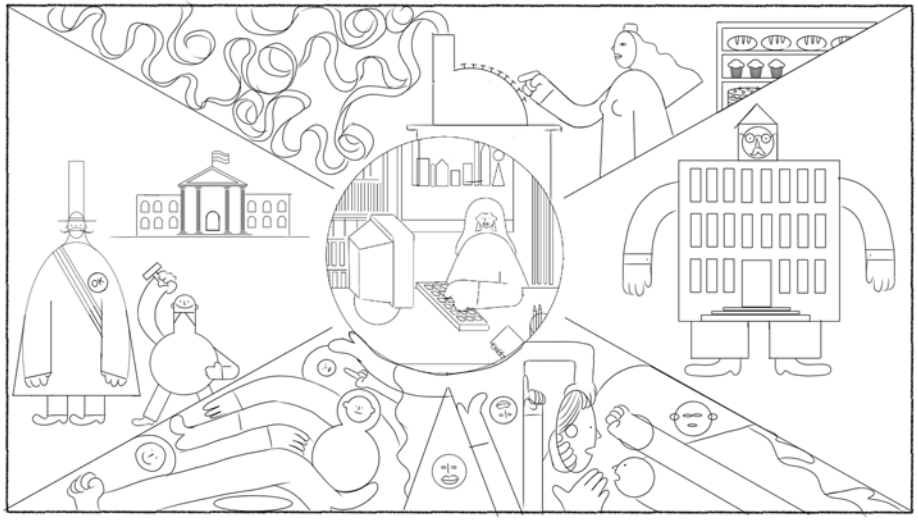




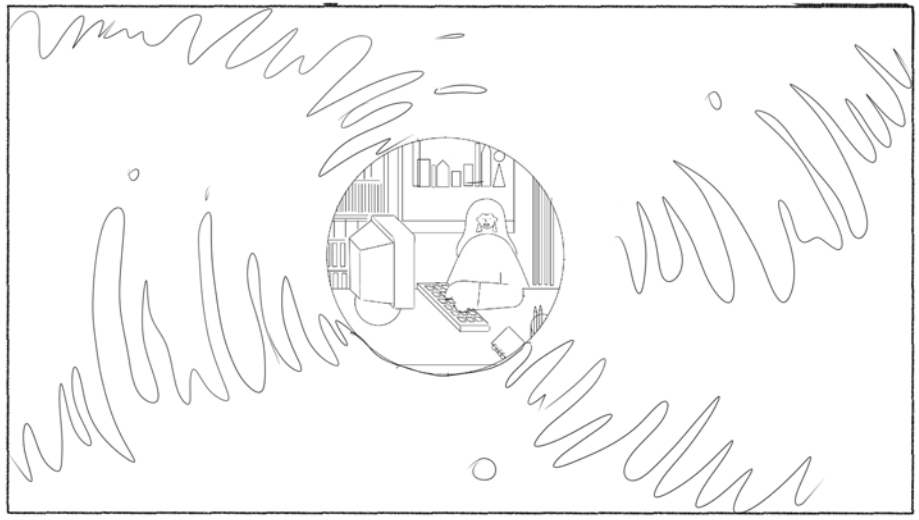


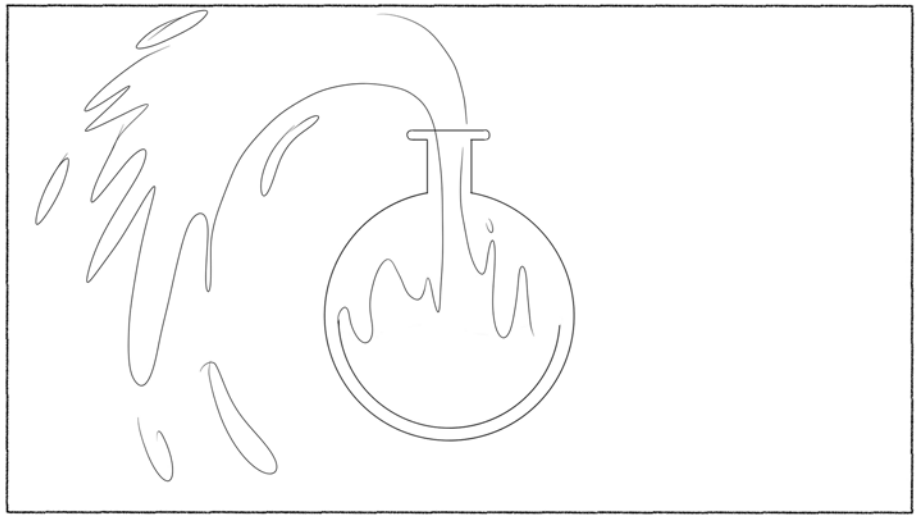
V.O : academia,



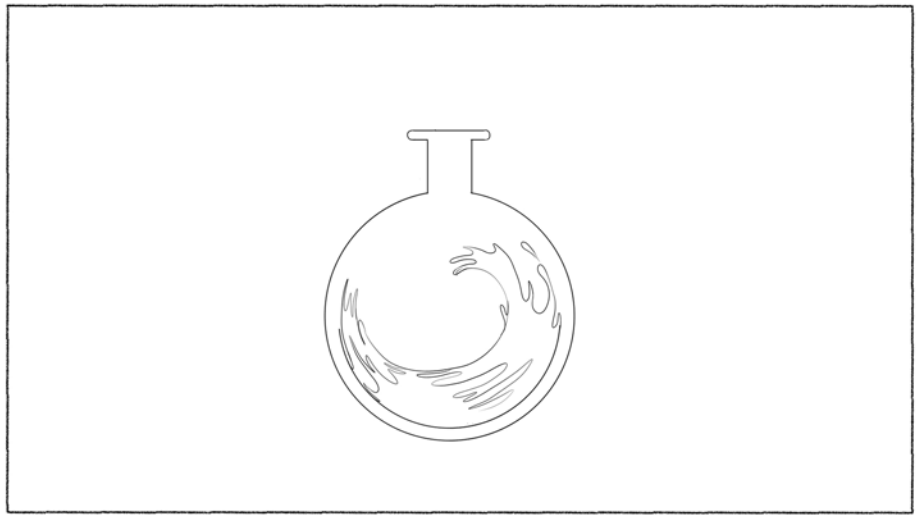


V.O : and citizens.

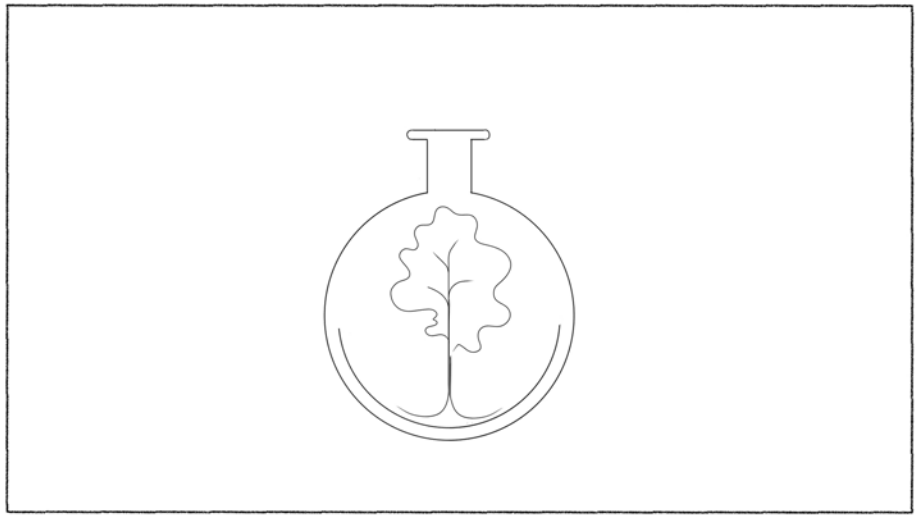




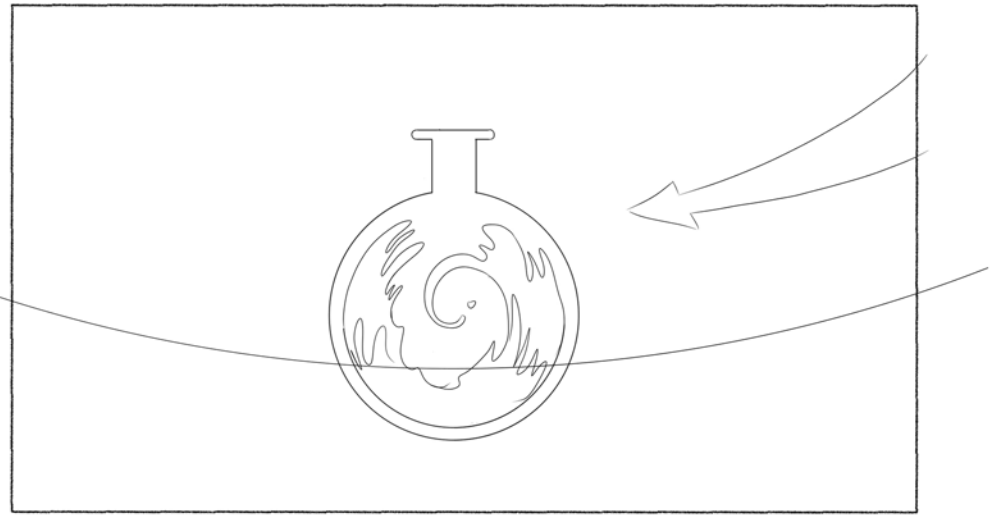
V.O : Together, they could address

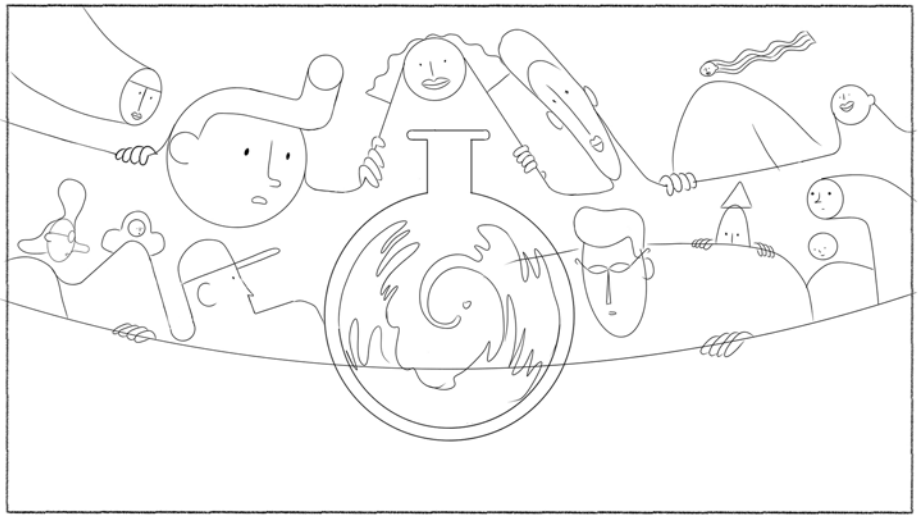


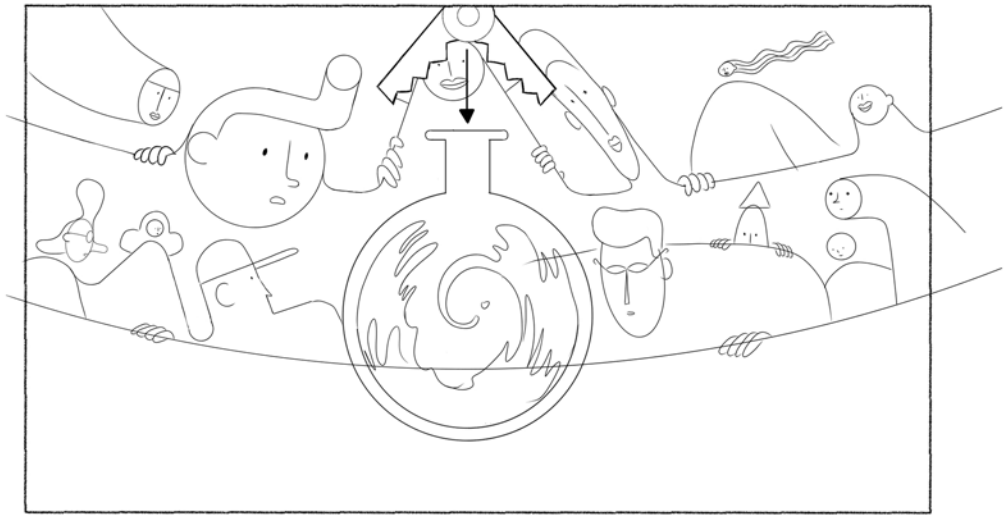
V.O : the many relations between



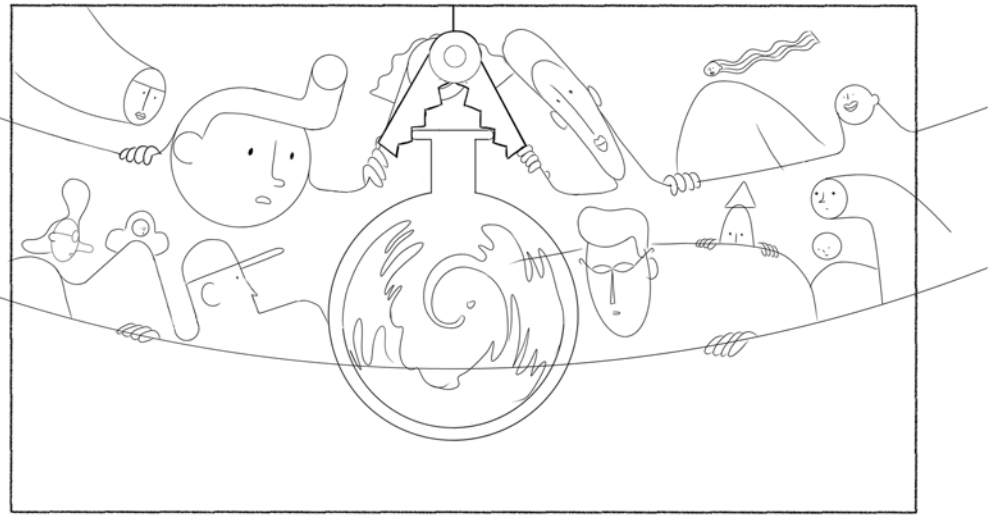
V.O : environmental,

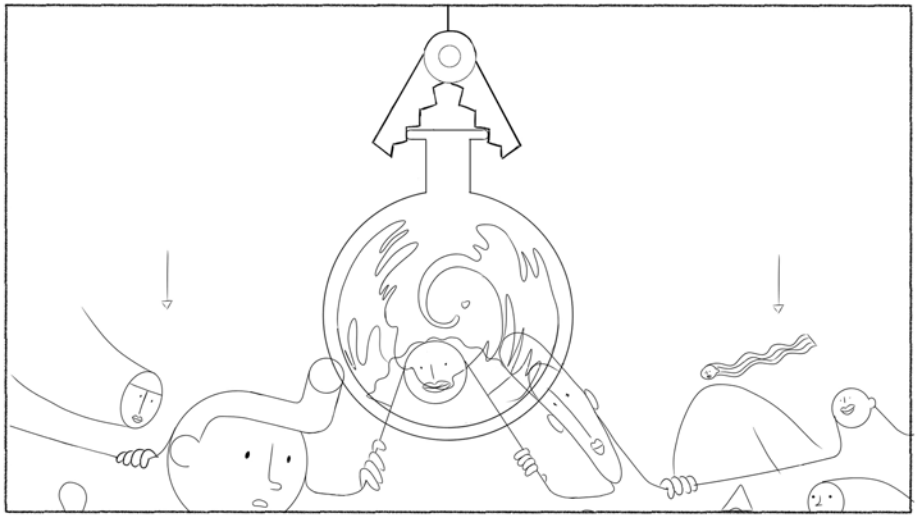


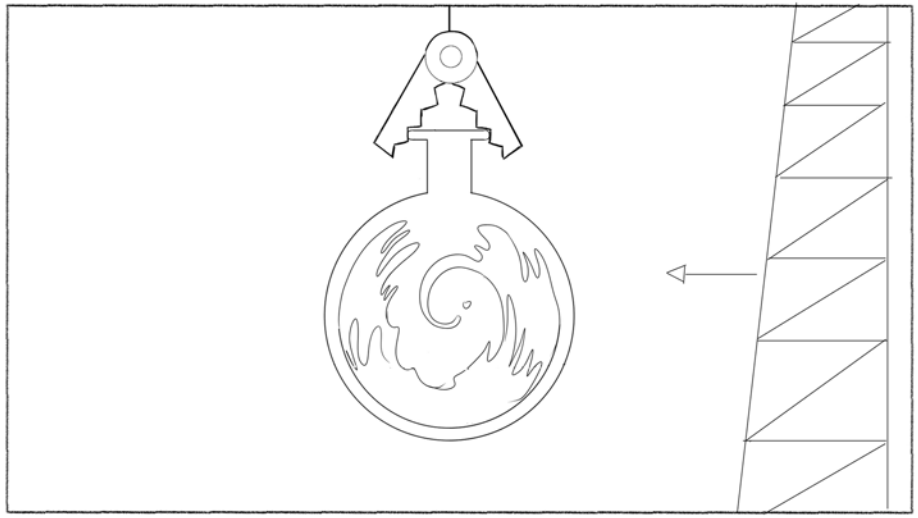




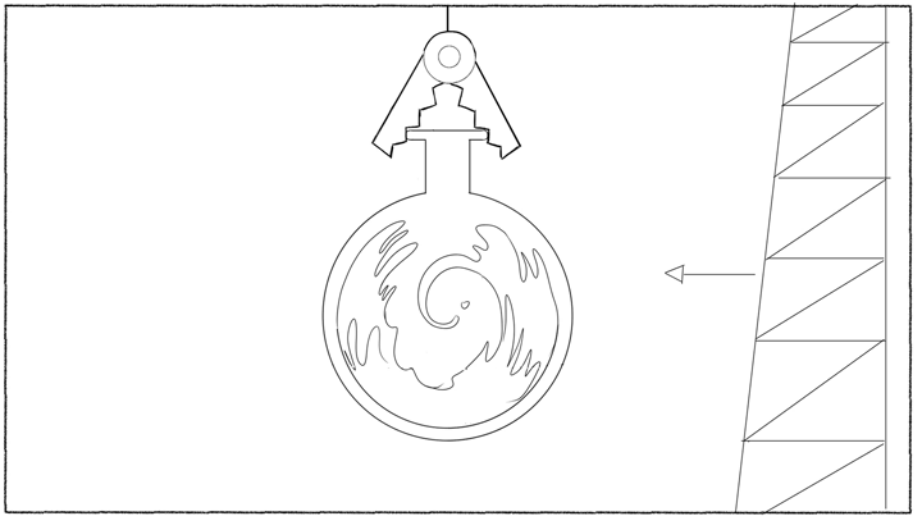
V.O : social,

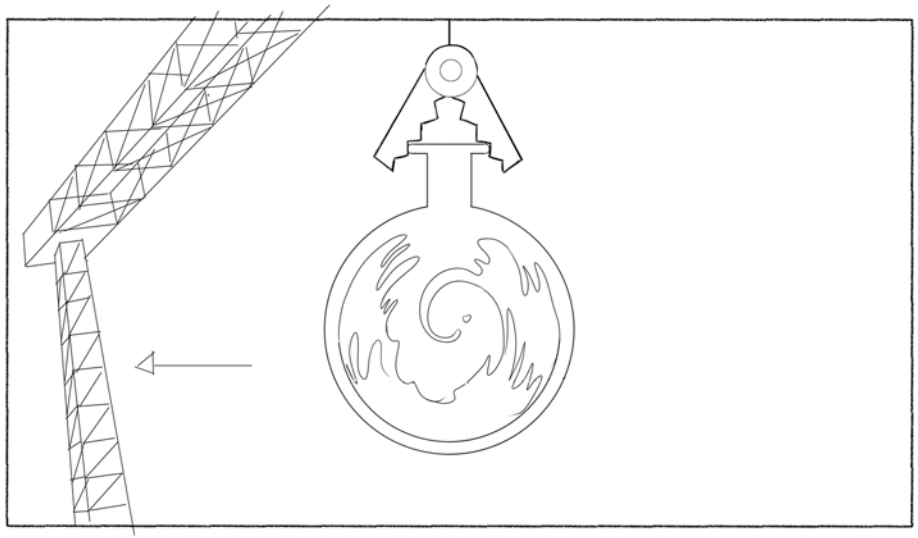


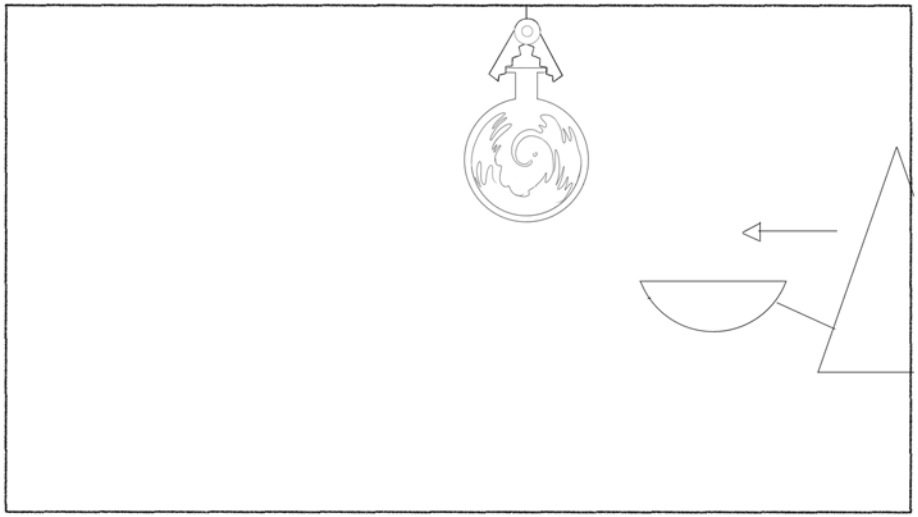


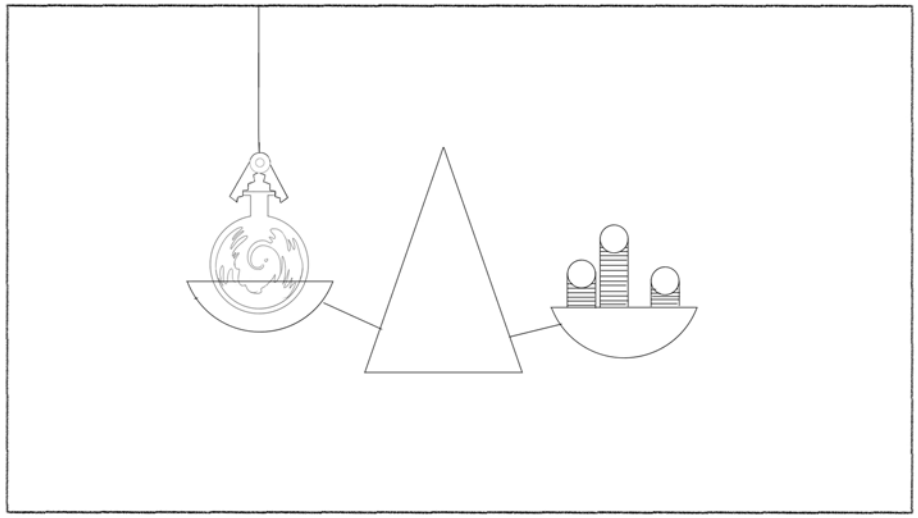


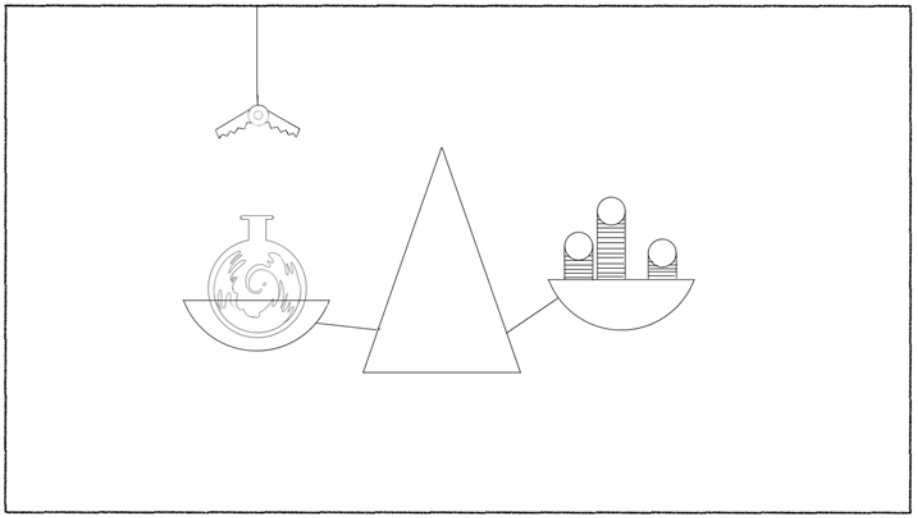
V.O : technical,



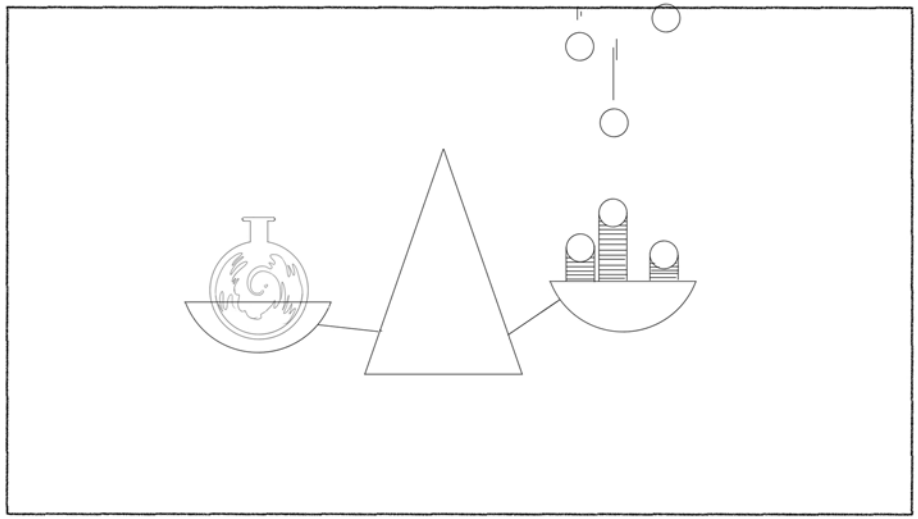


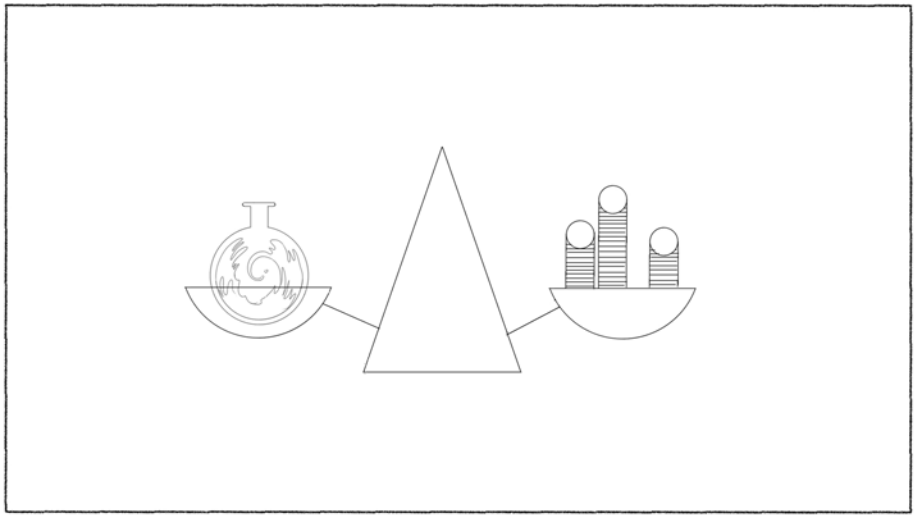


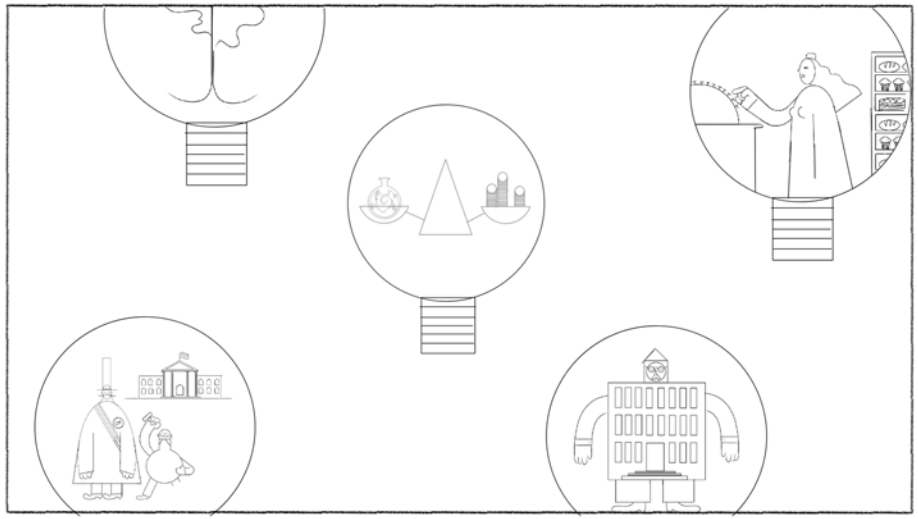




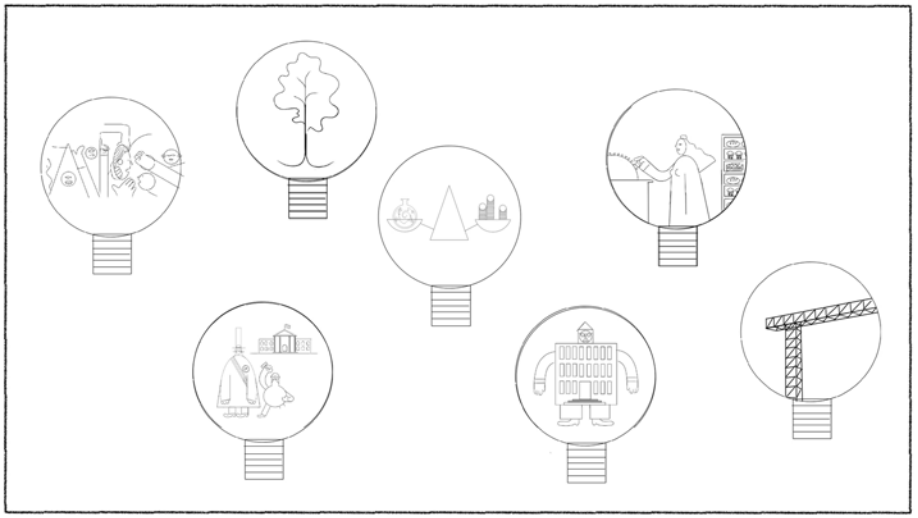
V.O : and economic impacts of the project,

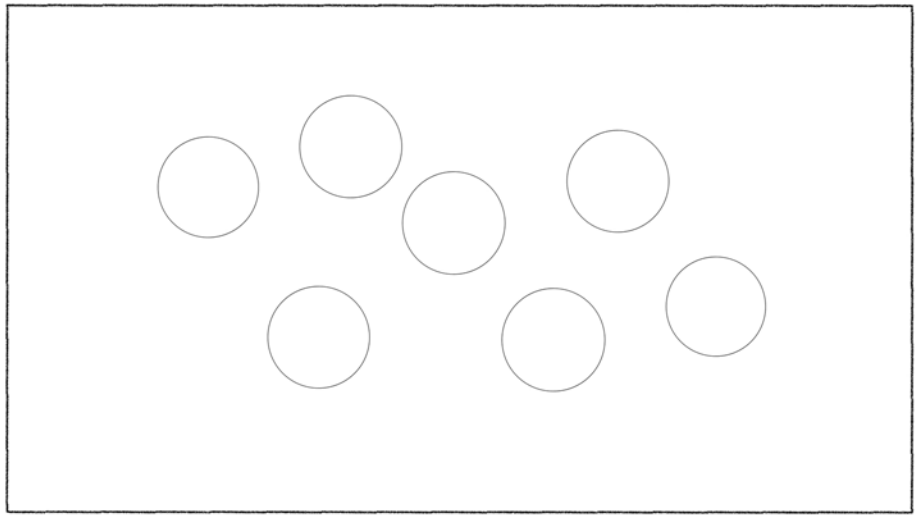


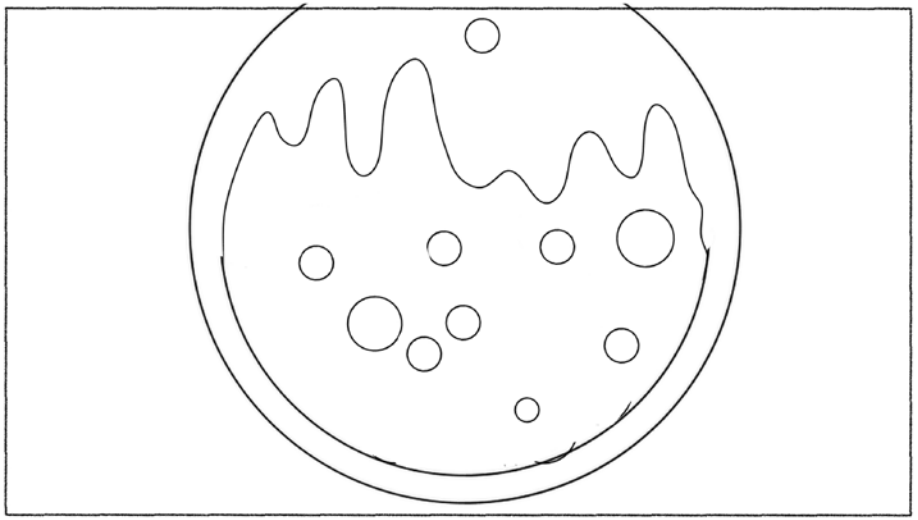




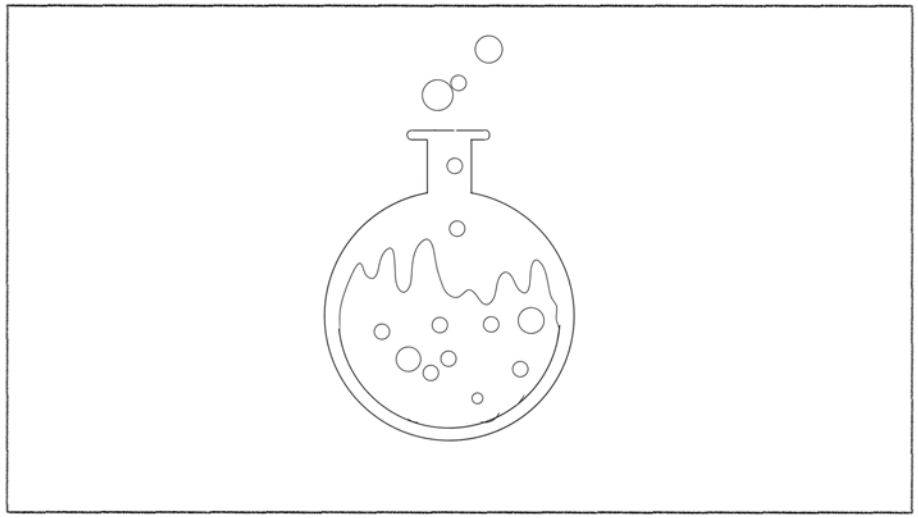
V.O : and find innovative solutions.

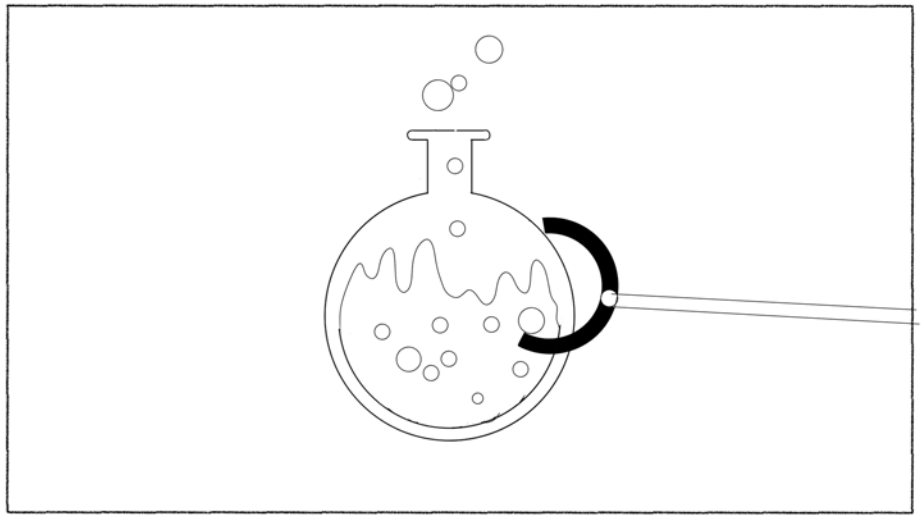




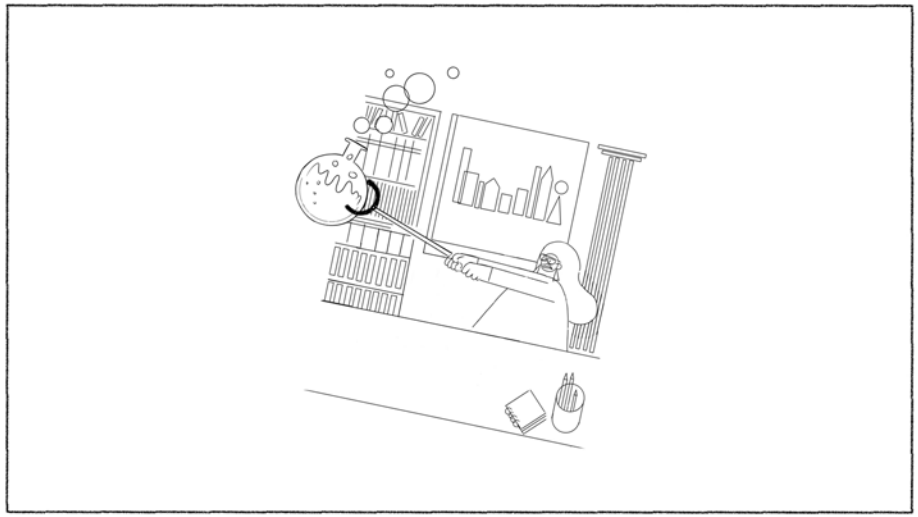


V.O : She wants to try out this new approach.

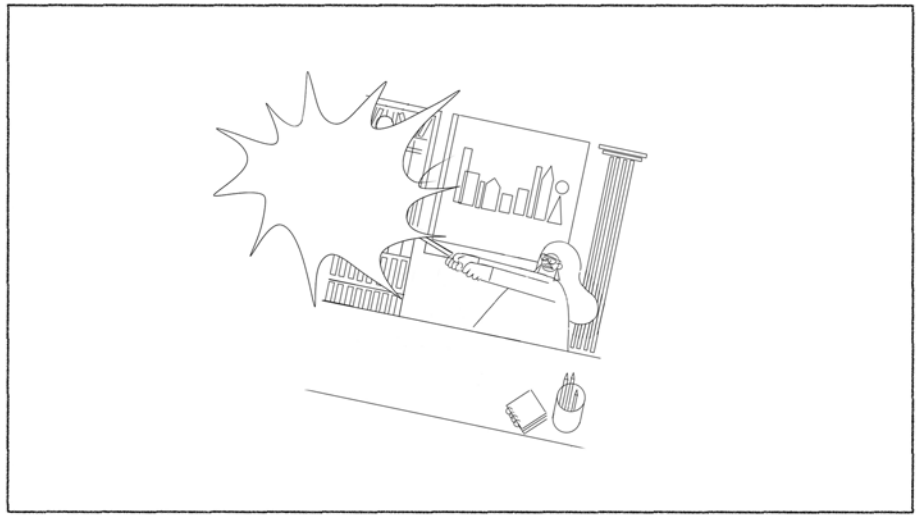


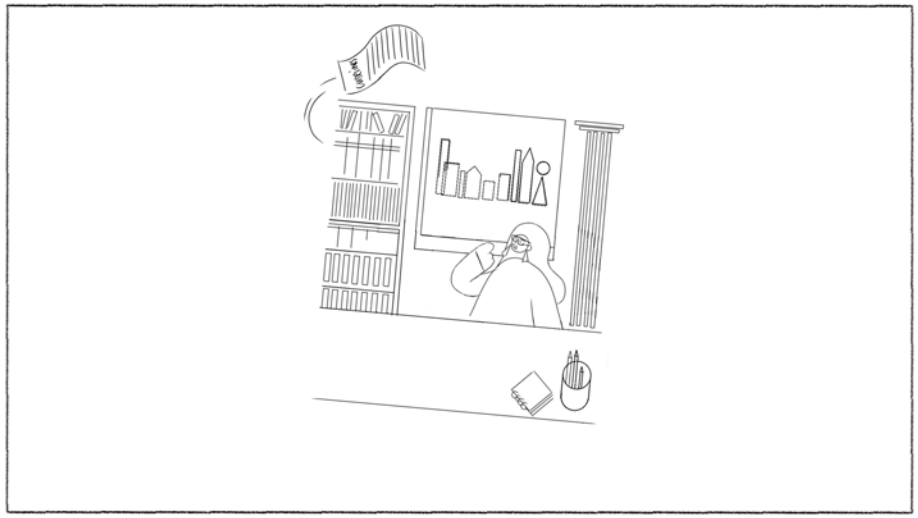


V.O : However, experimenting is risky

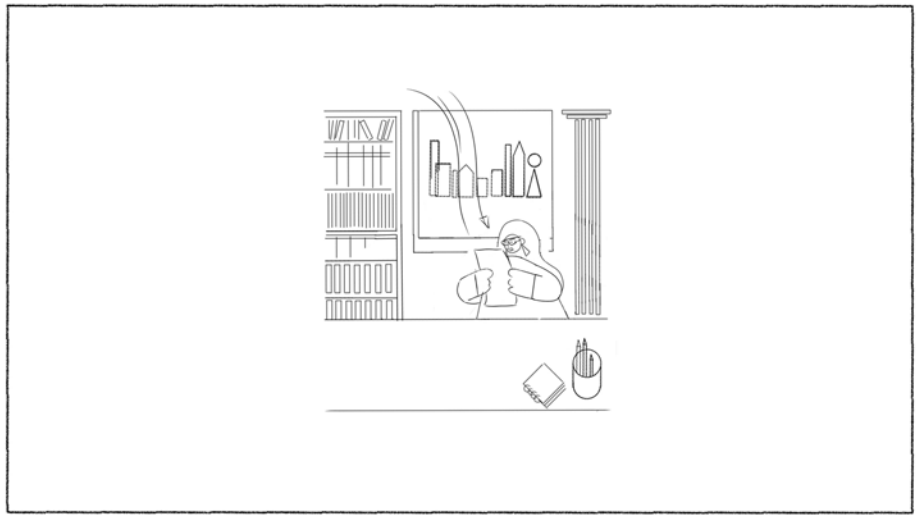


V.O : and Living Labs do not always work out as intended.

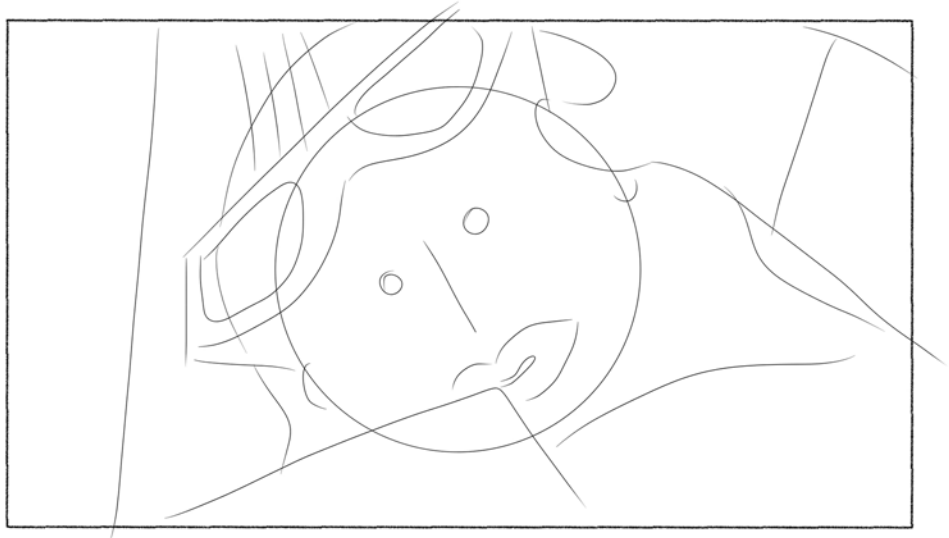




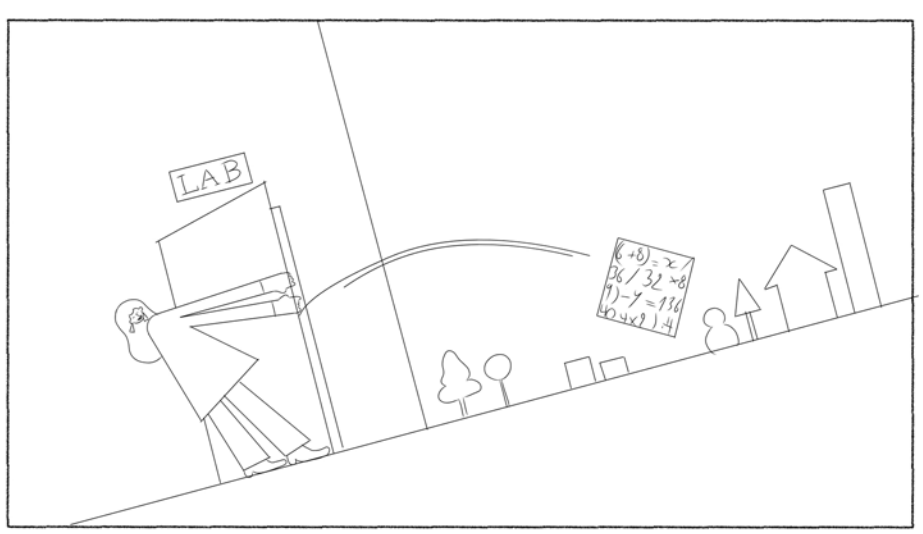
V.O : Fortunately, she learns about the SmarterLabs guidelines



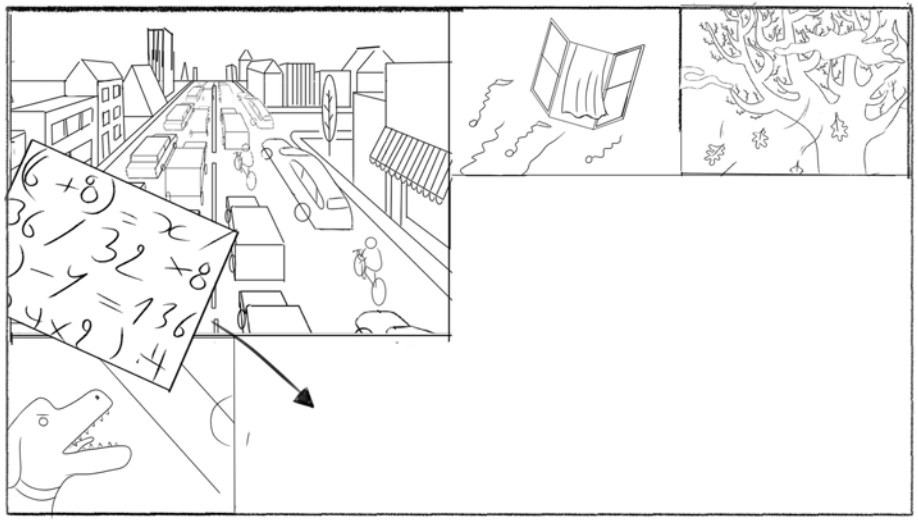
V.O : which help her to avoid common pitfalls,

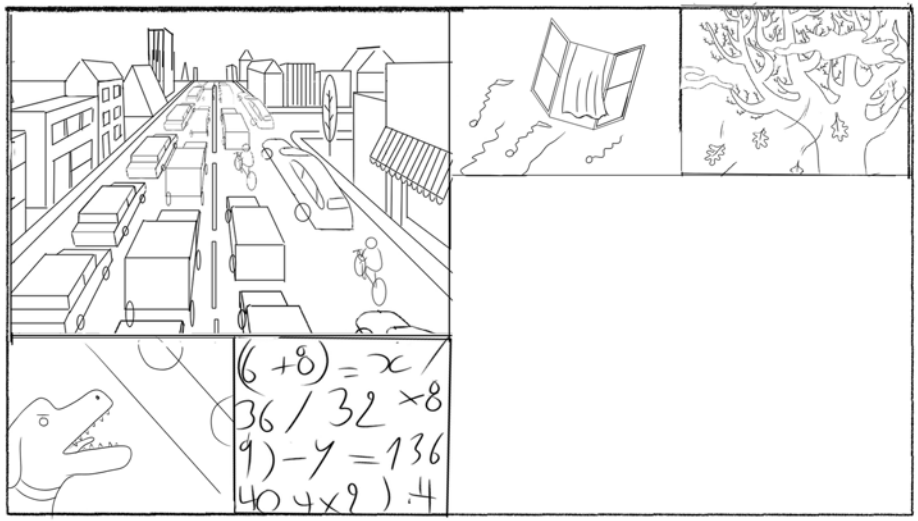


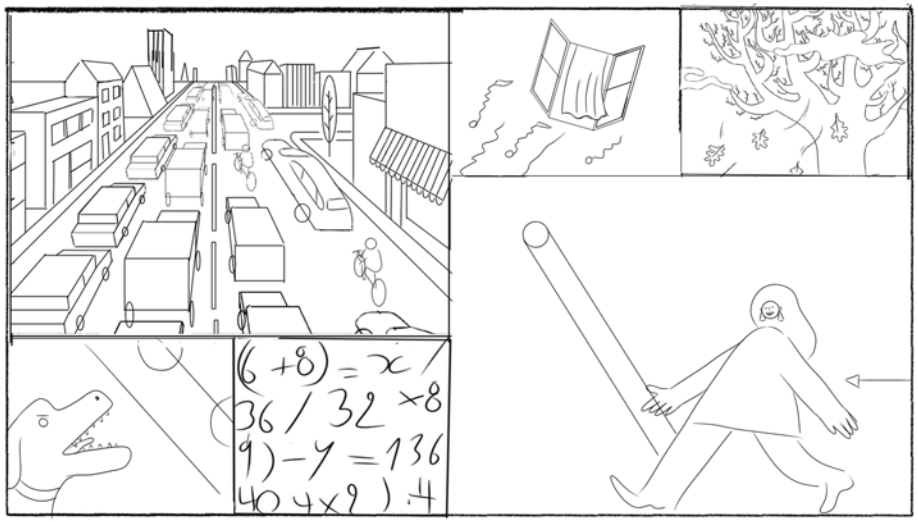
V.O : such as

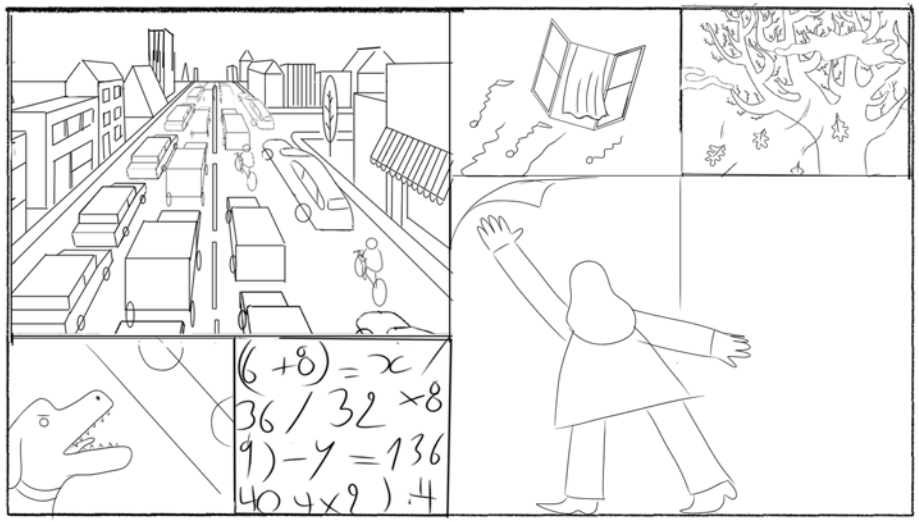


V.O : results not being used outside the Lab

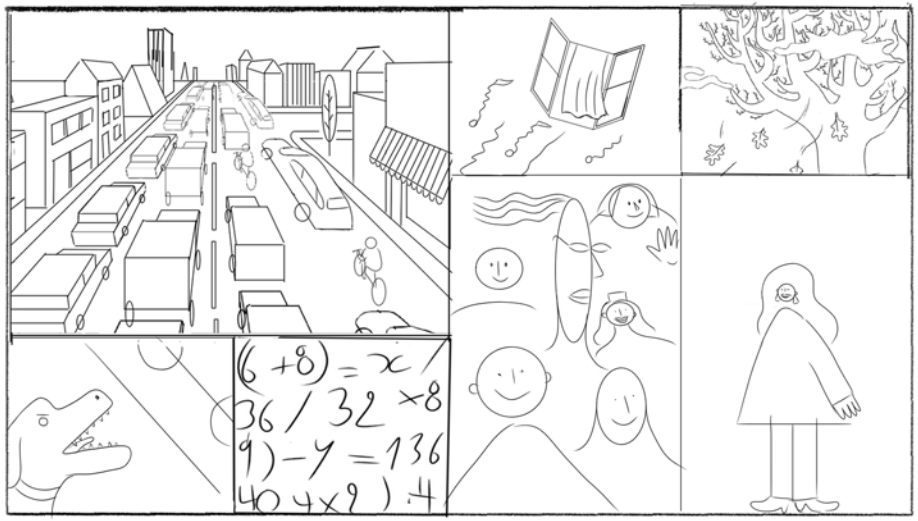


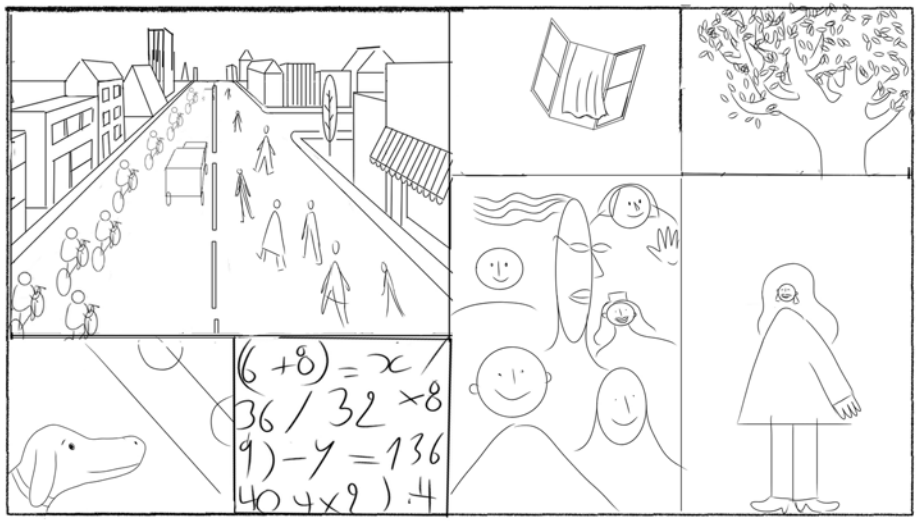


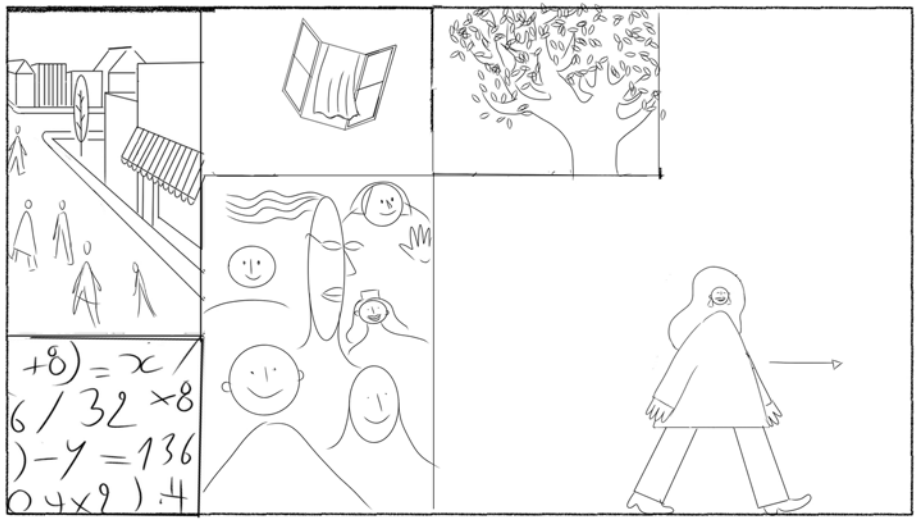


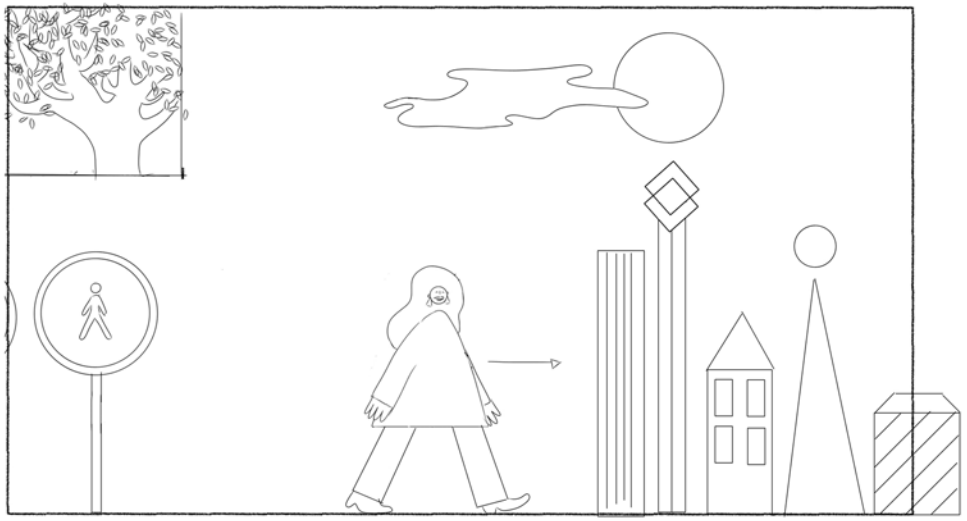


V.O : or relevant stakeholders being excluded.

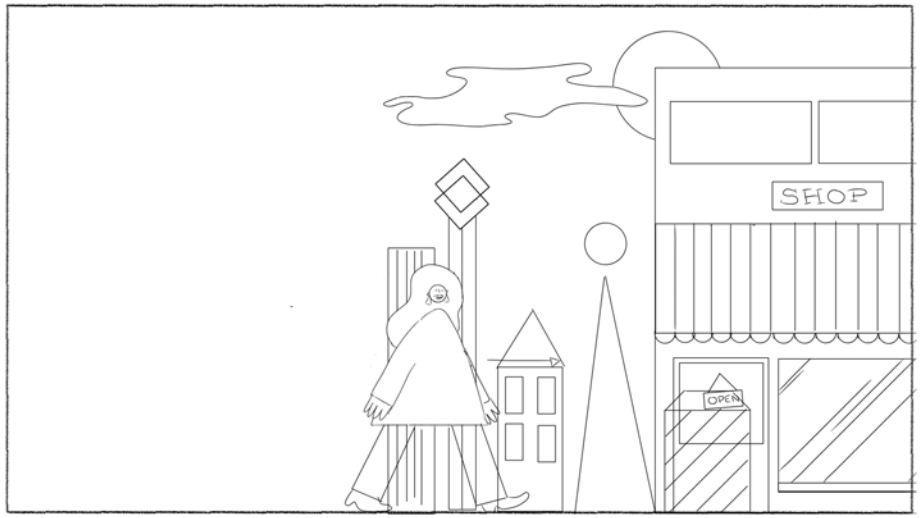




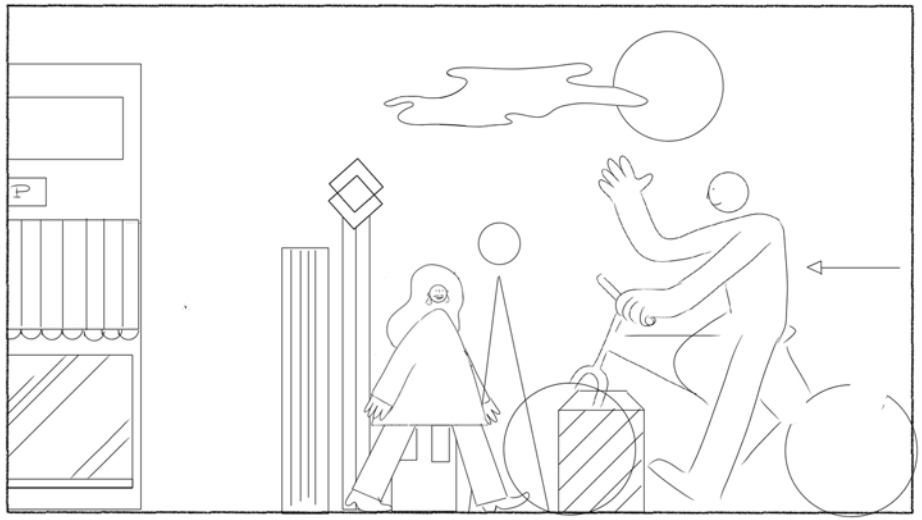


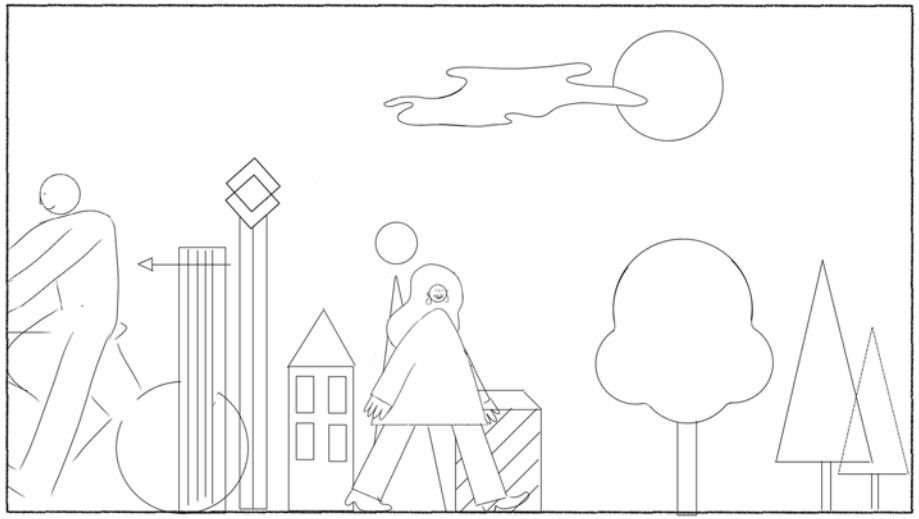


V.O : If, just like Lisa, you are interested in creating a Living Lab,

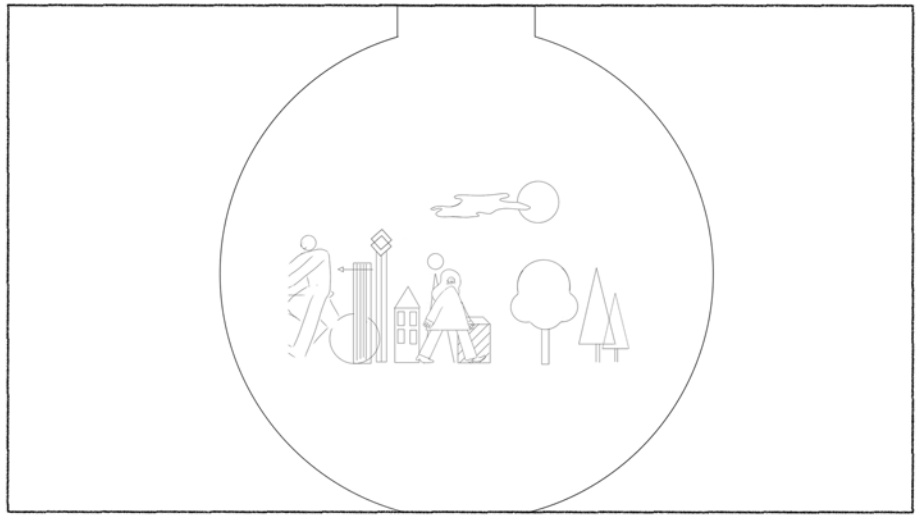


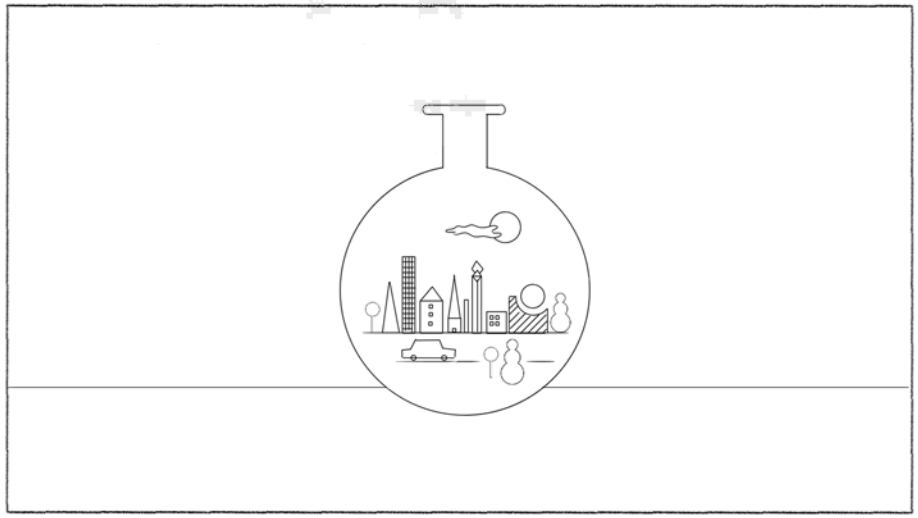
V.O : take a look at the SmarterLabs guidelines.

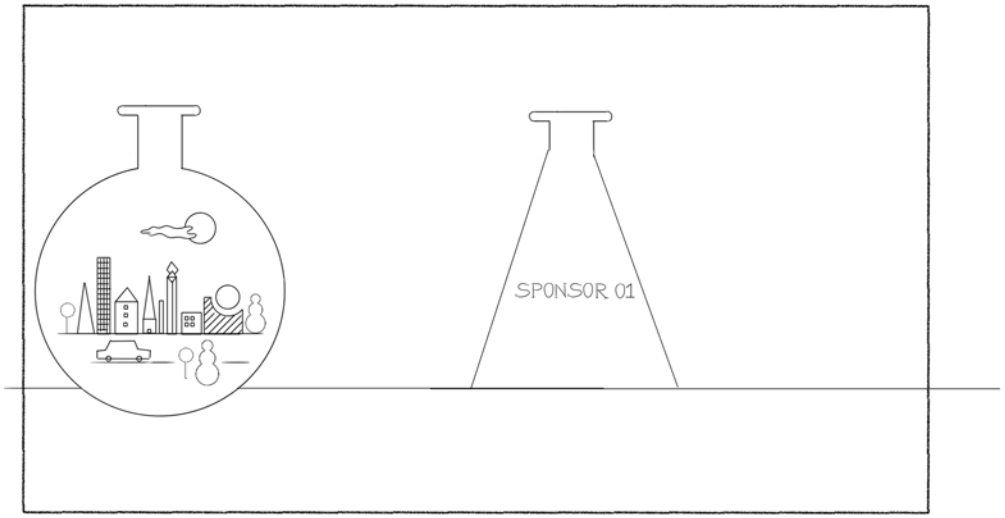




V.O : They will help to set up a successful Living Lab.



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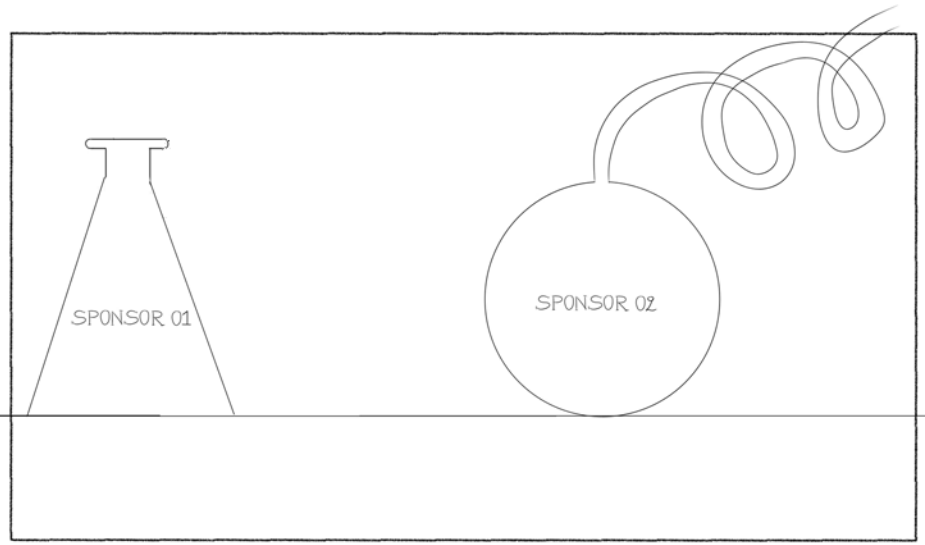
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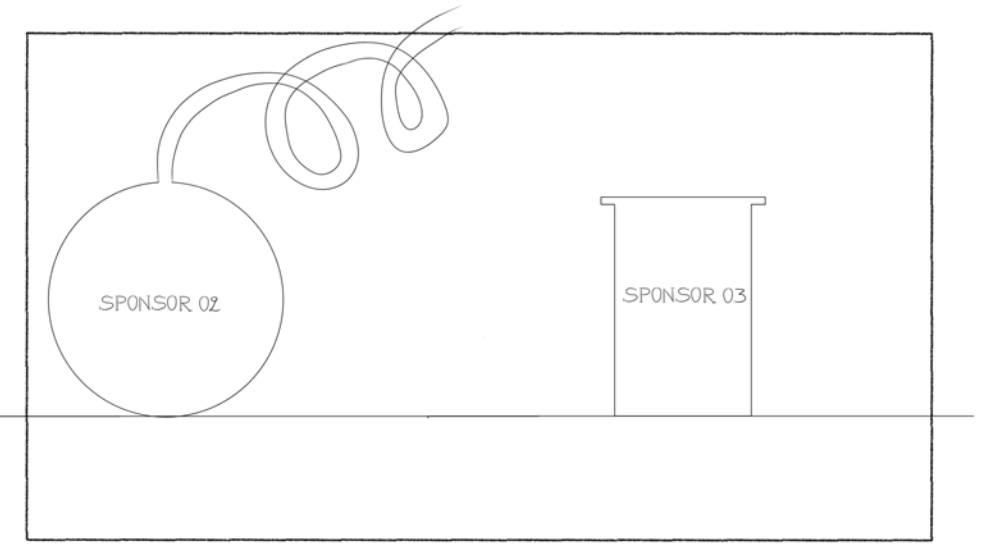
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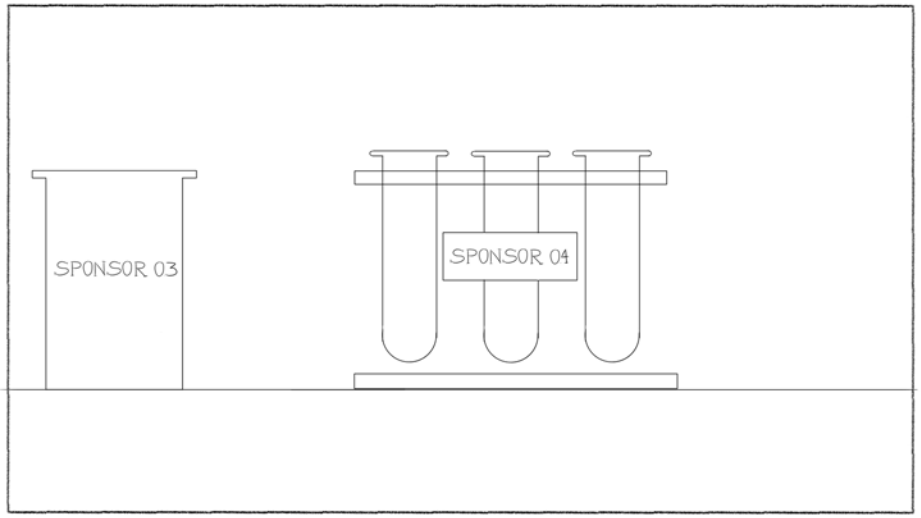
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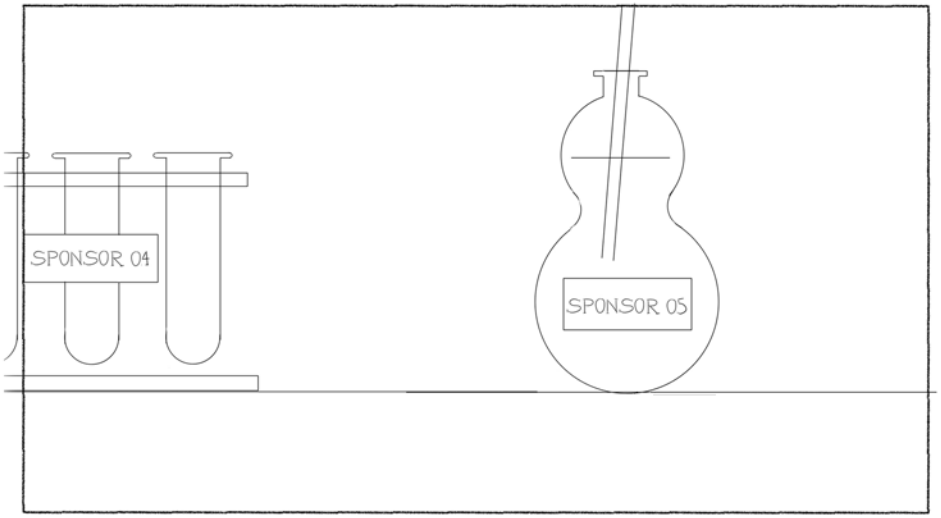
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12.4 Appendix 4 - The fan: the light SmarterLabs policy brief guidelines

How to anticipate constraints on upscaling inclusive Living Lab experiments

URBAN EUROPE

smarter labs

Ten constraints on upscaling and social inclusion in urban Living Lab experiments and ways to anticipate them

Download the detailed version of these guidelines at: **smarterlabs.eu**

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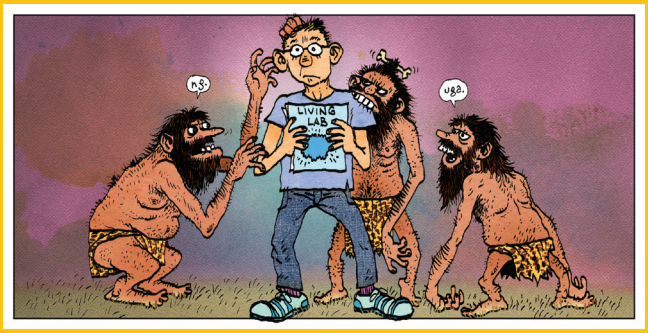
Social inclusion

#1 Citizens lack financial, intellectual and time resources to participate in the Living Lab

To participate meaningfully, citizens need time, energy and commitment, a certain level of understanding of the issue at stake or of the technology in use, and sometimes also specific economic and intellectual resources or skills. Certain social groups may therefore tend not to participate in Living Lab initiatives.



- **Apply stakeholder and requirement analysis tools (in relation to desired outcomes of the Living Lab) to identify types of exclusion, their motivations and coping strategies**

- **Include all Living Lab participants in such a reflection (not only the "institutional" initiators), across the Living Lab stages**

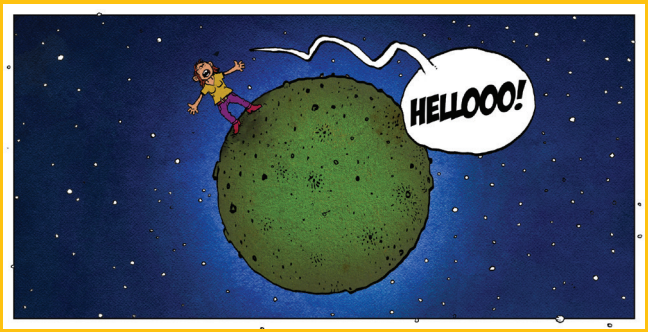
- **Strategically design Living Lab micro-practices, such as informative and educational material, choice of venue and schedule of meetings, language, provision of technological support to reduce digital divide**

#1

Social inclusion

#2 Relevant stakeholders remain out of the Living Lab

Certain groups might not be interested in joining Living Lab activities, since they do not share the urgency to discuss the issues at stake and take action, or even have conflicting attitudes or goals. The Living Lab may thus become a low conflict circle of people sharing priorities, attitudes and goals, while the large majority of citizens would ignore it.



- **Stakeholder analysis allows to identify the relevant target groups and the reasons why they might/might not be interested to join Living Lab activities**

- **This suggests how to frame Living Lab activities in public communication campaigns aimed at recruiting participants and to identify the specific actions needed to also raise the interest of less intrinsically motivated target groups**

#2

Social inclusion

#3 Groups and impacts outside the Living Lab context are overlooked

→ **The Living Lab project may lack or be poor of representatives from the larger urban context, though they might be impacted by the project. Likewise, effects beyond the Living Lab boundaries may be neglected (e.g. decrease of cars in one district shifts traffic to another).**

- **Explicitly consider the project's indirect and cross-scale effects in the broader urban context, by reflecting on the multiple scales relevant to the Living Lab and on the actors that might be included/excluded at each scale**

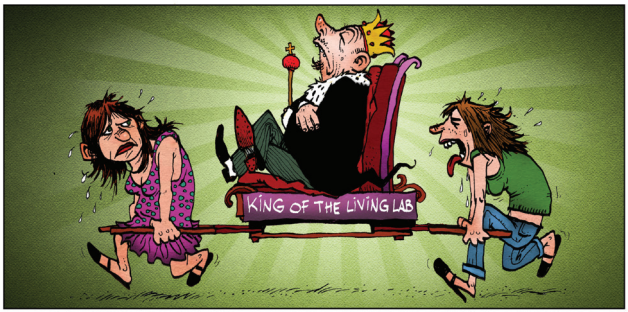
- **Adopt adequate logistic arrangements and outreach strategies to help minimize exclusion, such as convening Living Lab meetings at different locations and being open to reframe meetings to achieve a shared vision and increase motivation**

#3

Social inclusion

#4 Existing power structures are reproduced inside the Living Lab

The Living Lab setup and applied methods may not guarantee that any group or participant has equal opportunities for participating in the discussion, so that every voice is heard and seriously taken into account. For example, the Mayor, technical experts, or simply male Living Lab participants, may be given more weight than other participants.



- **Regularly perform a stakeholder group dynamics analysis, in order to understand group structure and leadership relations among group members**

- **Particularly, identify any dominant position among Living Lab participants, due to already existing institutional roles outside the Living Lab (political responsibility, lobbying activity)**

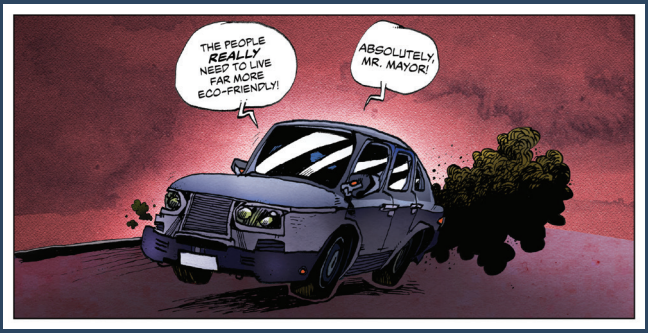
- **Design a communication and management strategy to address all identified target groups, keep flexibility, favor development of activities along different tracks, allowing each group to adapt to their speed of progress**

#4

Upscaling

#5 The Living Lab's potential for learning is underexploited

→ **If the lessons offered by Living Lab activities are not explicitly monitored, understanding of the innovation process, its implications and consequences, may be low. In this case, only limited transfer of learning is possible, thus precluding the diffusion of innovation across spatial scales.**



- **Develop a comprehensive learning strategy aimed at capturing and monitoring knowledge creation in the Living Lab (collective knowledge co-production) and transferring it to all relevant actors outside the Living Lab**

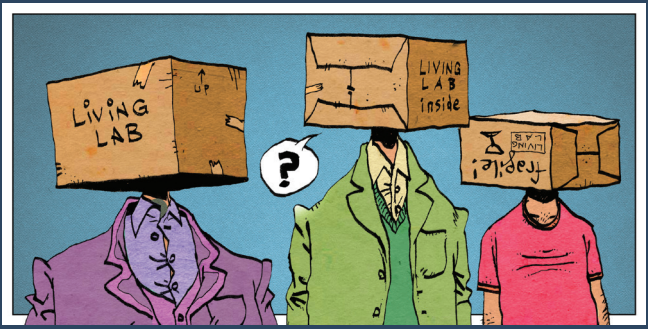
- **Knowledge exchange can be favored by people-to-people real-life interactions (i.e. physical meetings), which make learning more rewarding and comprehensive to all and also ensure tacit knowledge to emerge**

#5

Upscaling

#6 The Living Lab is disconnected from broader societal debate

→ **The Living Lab experiment may lack coordination with the social, economic, cultural and political conjuncture. In such a case, the policy climate may not support the adoption of the innovation pursued in the Living Lab. The broader public may either not share the Living Lab's goals and outcomes or find them irrelevant.**



- **Design and manage Living Lab activities with great care for the local conjuncture: consider broader socio-economic, cultural and political aspects, ensure links with the existing public debate, with what a community considers to be its priorities, and what stakeholders consider to be feasible**

- **Maintain a certain flexibility throughout the Living Lab, be ready to adapt to changing conditions in the outside social and political agenda. Ensure that both Living Lab objectives and its framing can be adjusted and continuously re-defined by all actors**

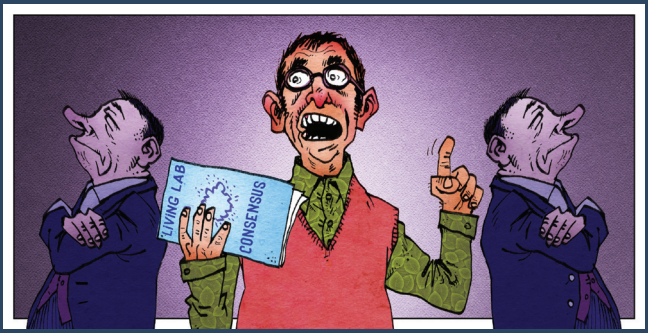
- **Place citizens at the core of the process and actively coordinate with other societal developments and initiatives related to the content of the Living Lab**

#6

Upscaling

#7 The Living Lab consensus is not reflected in policy and society

→ **Even if the topic addressed by the Living lab is a priority of the social and political agenda, persistence of conflicts on specific topics may preclude reaching agreements, either inside or outside the Living Lab. The outcomes of the Living Lab may therefore lack wide consensus, support and political majority.**



- **Open to participation as much and as early as possible and regularly update the stakeholder analysis whenever external conditions change, in order to avoid the exclusion of any relevant stakeholder group**

- **Favor emergence of any conflicting goals within Living Lab participants and between Living Lab participants and possible external stakeholder groups not actively engaged, and manage conflicting goals by multi-criteria decision-making techniques**

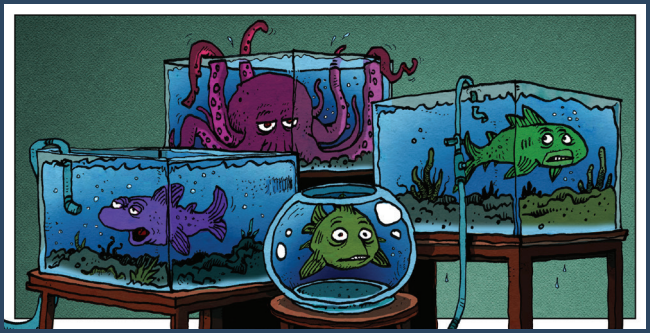
- **Always emphasize and give weight to potential community-level benefits of the options under discussion, against personal or partisan benefits. To this purpose, exploit already existing networks and coalitions and seek for new and unexpected alliances between groups of stakeholders, trying to build relationships with successful initiatives already developed by other actors**

#7

Upscaling

#8 Stakeholders and institutions are highly fragmented

→ **Fragmented institutional arrangements between and within institutions ("silo compartments") may preclude clear distribution of responsibilities among the actors involved in Living Lab activities, and effective cooperation between them.**



- **Foster transparency and collaboration between administrative units, organizations and stakeholders, right from the beginning of the Living Lab process**

- **Create occasions for them to interact and become familiar with the process, discussion topics and proposals emerging within the Living Lab**

#8

Upscaling

#9 The urban assemblage is sticky and locked-in

→ **Technical, infrastructural, legal or financial aspects, such as long-term contracts or legal lock-ins, may cause obduracy of the urban assemblage, thus precluding possibilities for practical implementation of the outcomes of the Living Lab.**

- **Activate a dialogue with relevant actors as soon as possible: by developing future visions with stakeholders and crucial decision-makers, the potential of more structural changes can be highlighted**

- **Local actors might be empowered by teaming up with supra-urban actors, such as municipalities with provinces or local NGOs with their national counterpart (scale jumping)**

#9

Upscaling

#10 The Living Lab meets low institutional receptiveness

Local governments and other actors involved in the Living Lab process might be unfamiliar with, or open to, co-creation approaches, favoring instead expert-driven way of thinking and agreement with powerful lobbies. If so, institutions may not have real commitment to implement Living Lab outcomes.

- **Seek for early inclusion of policy-makers and local institutions**
- **Provided that Living Lab organizers show genuine commitment and give voice, role and responsibility to diverse groups of citizens, civil society organizations and experts, institutions might start appreciating the approach and its benefit**
- **Carry out multiple successful pilot processes**
- **Build on existing practices and procedures of representative democracy to promote dialogue between stakeholders**

#10

12.5 Appendix 5 - The information sheets: the full SmarterLabs practitioners brief guidelines

How to anticipate constraints on upscaling inclusive Living Lab experiments

URBAN EUROPE

smarter labs

Ten constraints on upscaling and social inclusion in urban Living Lab experiments and ways to anticipate them

The "Urban Living Lab" is an emerging approach in European cities. Urban Living Lab projects or experiments are devised to design, test and learn from an innovative socio-technical practice (i.e. "a new way of doing something") in real-time and in urban contexts with a diversity of stakeholders. *Living Lab* refers to the institutional environment for open innovation that supports these projects. It may be organized in a variety of ways (long-term or short-term, independent from or embedded in the municipal organization, provider-driven or user-driven).

The current approach of Living Labs focuses on small-scale performance tests and technology-user interactions, mostly neglecting the larger social-institutional context. Therefore, successful implementation of new practices in the reality of a Living Lab does not warrant broader adoption outside the Lab (i.e. "upscaling"), required to reach their full innovative effect.

Another limitation is its focus on "smart citizens" as users and partners, namely citizens with both the cognitive and material resources to consume and co-produce the smart services. Citizens lacking these resources will normally not be included as co-creators in Living Labs, nor are they likely to be able to make use of the smart services once these are implemented on a largerscale. The consequences may not only be poorer design of smart technologies or their limited adoption and use, but also social exclusion, i.e. deprivation of part of the population from new services.

The SmarterLabs project has developed practical ways to effectively anticipate these two limitations in the Living lab approach. The next pages each discuss a typical constraint on upscaling or social inclusion and offer ways to anticipate them.

Note that social exclusion is a key constraint affecting upscaling itself. For the sake of simplicity, we keep them separate here. However, please keep in mind that addressing constraints on social inclusion is a pre-condition to effective upscaling.

Social inclusion

Typical constraints in Living Lab experiments	Ways to anticipate these constraints
#1 **Citizens lack financial, intellectual and time resources to participate in the Living Lab** To participate meaningfully, citizens need time, energy and commitment, a certain level of understanding of the issue at stake or of the technology in use, and sometimes also specific economic and intellectual resources or skills. Certain social groups may therefore tend not to participate in Living Lab initiatives.	▪ Apply stakeholder and requirement analysis tools (in relation to desired outcomes of the Living Lab) to identify types of exclusion, their motivations and coping strategies ▪ Include all Living Lab participants in such a reflection (not only the "institutional" initiators), across the Living Lab stages ▪ Strategically design Living Lab micro-practices, such as informative and educational material, choice of venue and schedule of meetings, language, provision of technological support to reduce digital divide
#2 **Relevant stakeholders remain out of the Living Lab** Certain groups might not be interested in joining Living Lab activities, since they do not share the urgency to discuss the issues at stake and take action, or even have conflicting attitudes or goals. The Living Lab may thus become a low conflict circle of people sharing priorities, attitudes and goals, while the large majority of citizens would ignore it.	▪ Stakeholder analysis allows to identify the relevant target groups and the reasons why they might/might not be interested to join Living Lab activities ▪ This suggests how to frame Living Lab activities in public communication campaigns aimed at recruiting participants and to identify the specific actions needed to also raise the interest of less intrinsically motivated target groups
#3 **Groups and impacts outside the Living Lab context are overlooked** The Living Lab project may lack or be poor of representatives from the larger urban context, though might they be impacted by the project. Likewise, effects beyond the Living Lab boundaries may be neglected (e.g. decrease of cars in one district shifts traffic to another).	▪ Explicitly consider the project's indirect and cross-scale effects in the broader urban context, by reflecting on the multiple scales relevant to the Living Lab and on the actors that might be included/excluded at each scale ▪ Adopt adequate logistic arrangements and outreach strategies to help minimize exclusion, such as convening Living Lab meetings at different locations and being open to reframe meetings to achieve a shared vision and increase motivation
#4 **Existing power structures are reproduced inside the Living Lab** The Living Lab setup and applied methods may not guarantee that any group or participant has equal opportunities for participating in the discussion, so that every voice is heard and seriously taken into account. For example, the Mayor, technical experts, or simply male Living Lab participants, may be given more weight than other participants.	▪ Regularly perform a stakeholder group dynamics analysis, in order to understand group structure and leadership relations among group members ▪ Particularly, identify any dominant position among Living Lab participants, due to already existing institutional roles outside the Living Lab (political responsibility, lobbying activity) ▪ Design a communication and management strategy to address all identified target groups, keep flexibility, favor development of activities along different tracks, allowing each group to adapt to their speed of progress

Upscaling

Typical constraints in Living Lab experiments	Ways to anticipate these constraints
#5 **The Living Lab's potential for learning is underexploited** If the lessons offered by Living Lab activities are not explicitly monitored, understanding of the innovation process, of its implications and its consequences, may be low. In this case, only limited transfer of learning is possible, thus precluding the diffusion of innovation across spatial scales.	▪ Develop a comprehensive learning strategy aimed at capturing and monitoring knowledge creation in the Living Lab (collective knowledge co-production) and transferring it to all relevant actors outside the Living Lab ▪ Knowledge exchange can be favored by people-to-people real-life interactions (i.e. physical meetings), which make learning more rewarding and comprehensive to all and also ensure tacit knowledge to emerge
#6 **The Living Lab is disconnected from broader societal debate** The Living Lab experiment may lack coordination with the social, economic, cultural and political conjuncture. In such a case, the policy climate may not support the adoption of the innovation pursued in the Living Lab. The broader public may either not share the Living Lab's goals and outcomes or find them irrelevant.	▪ Design and manage Living Lab activities with great care for the local conjuncture: consider broader socio-economic, cultural and political aspects, ensure links with the existing public debate, with what a community considers to be its priorities, and what stakeholders consider to be feasible ▪ Maintain a certain flexibility throughout the Living Lab, be ready to adapt to changing conditions in the outside social and political agenda. Ensure that both Living Lab objectives and its framing can be adjusted and continuously re-defined by all actors ▪ Place citizens at the core of the process and actively coordinate with other societal developments and initiatives related to the content of the Living Lab
#7 **The Living Lab consensus is not reflected in policy and society** Even if the topic addressed by the Living lab is a proiority of the social and political agenda, persistence of conflicts on specific topics may preclude reaching agreements, either inside or outside the Living Lab. The outcomes of the Living Lab may therefore lack wide consensus, support and political majority.	▪ Open to participation as much and as early as possible and regularly update the stakeholder analysis whenever external conditions change, in order to avoid the exclusion of any relevant stakeholder group ▪ Favor emergence of any conflicting goals within Living Lab participants and between Living Lab participants and possible external stakeholder groups not actively engaged, and manage conflicting goals by multi-criteria decision-making techniques ▪ Always emphasize and give weight to potential community-level benefits of the options under discussion, against personal or partisan benefits. To this purpose, exploit already existing networks and coalitions and seek for new and unexpected alliances between groups of stakeholders, trying to build relationships with successful initiatives already developed by other actors
#8 **Stakeholders and institutions are highly fragmented** Fragmented institutional arrangements between and within institutions ("silo compartments") may preclude clear distribution of responsibilities among the actors involved in Living Lab activities and effective cooperation between them.	▪ Foster transparency and collaboration between administrative units, organizations and stakeholders, right from the beginning of the Living Lab process ▪ Create occasions for them to interact and become familiar with the process, discussion topics and proposals emerging within the Living Lab
#9 **The urban assemblage is sticky and locked-in** Technical, infrastructural, legal or financial aspects, such as long-term contracts or legal lock-ins, may cause obduracy of the urban assemblage, thus precluding possibilities for practical implementation of the outcomes of the Living Lab.	▪ Activate a dialogue with relevant actors as soon as possible: by developing future visions with stakeholders and crucial decision-makers, the potential of more structural changes can be highlighted ▪ Local actors might be empowered by teaming up with supra-urban actors, such as municipalities with provinces or local NGOs with their national counterpart (scale jumping)
#10 **The Living Lab meets low institutional receptiveness** Local governments and other actors involved in the Living Lab process might be unfamiliar with, or open to, co-creation approaches, favoring instead expert-driven way of thinking and agreement with powerful lobbies. If so, institutions may not have real commitment to implement Living Lab outcomes.	▪ Seek for early inclusion of policy-makers and local institutions ▪ Provided that Living Lab organizers show genuine commitment and give voice, role and responsibility to diverse groups of citizens, civil society organizations and experts, institutions might start appreciating the approach and its benefit ▪ Carry out multiple successful pilot processes ▪ Build on existing practices and procedures of representative democracy to promote dialogue between stakeholders

Bellinzona: Bellidea

A Living Lab to co-design a smartphone app promoting sustainable individual mobility patterns

GOALS

For the past years, the City of Bellinzona (Southern Switzerland) has been devoting considerable efforts to reduce individual car use, especially by creating new cycling infrastructures and improving bus/train inter-changes. Although necessary to promote a change in the dominant mobility patterns, such interventions were not sufficient to make a relevant change. Therefore, city managers were interested in also exploring the effectiveness of cognitive-motivational tools, in particular by relying on smartphone-based approaches. Smartphone apps are in fact ideal devices for a city to deliver persuasive messages supporting the transition from car-dependency: while providing citizens with persuasive feedback, they also allow city managers to get real life data on the citizens' mobility patterns, to inform scenario building and future policy-making. The City of Bellinzona therefore opted for developing a mobile app. To favor its large diffusion and sustain its use over time, they teamed up with the local University of Applied Sciences (SUPSI) and a Non Governmental Organisations advocating bicycle use (Provelo Ticino) and launched a Living Lab to co-design app features with any interested citizens.

ACTIVITIES

Citizens of Bellinzona were invited to join the *Bellidea* Living Lab, to co-design a mobile app to promote sustainable mobility patterns among their peers. One year later, the resulting app was launched to the whole population. Overall, forty-six citizens answered the public invitation to join the Living Lab, and fifteen of them were regularly active in the seven monthly meetings performed. Activities in the *Bellidea* Living Lab were organized in three phases:

- in *Phase 1 - App co-design*, Living Lab participants co-designed the *Bellidea* app; once available, the app was launched to the whole population;
- in *Phase 2 - Scenario building*, Living Lab participants were invited to reflect on the specific barriers and opportunities towards sustainable mobility they experienced while testing the *Bellidea* app. As an outcome of such a collective brainstorming, a "Charter of principles for sustainable mobility in Bellinzona" was developed, as a reference for future policy-making and land and mobility planning activities;
- *in Phase 3 - Evaluation*, a comprehensive assessment of *Bellidea* and its outcome was performed.

UPSCALING

Three types of upscaling were identified for the *Bellidea* Living Lab:

1. in the short-term, the *Bellidea* app is launched to the population, and a large number of citizens started interacting with it, for a sufficiently long period of time;
2. in the short-term, scope and complexity of the issues under discussion in the Living Lab are broadened to address future mobility scenarios and include the relevant stakeholders;
3. in the medium-term, the set of participatory governance practices and tools experimented in the Living Lab are institutionalized and replicated in other local decision-making processes.

OUTCOMES

Thanks to the communication efforts and the specific activities aimed at favoring large diffusion of the app among the wider population, once the *Bellidea* app was launched to the population, it became pretty popular, with an average of 180 regular app users per week. Also, the "Charter of principles for sustainable mobility" will likely be taken into account in the future revision of the land planning Masterplan of the Bellinzona area. Finally, seeds for a virtuous circle promoting local economy were planted as well, with the idea of using the *Bellidea* points and prizes as a virtual currency for local shops and services.

Brussels: AirCasting Brussels

→ A Living Lab against air pollution

GOALS

The Brussels Living Lab aimed to raise and support citizen empowerment and mobilization for a cleaner air through a citizen science approach. On the one hand this allowed the participation of citizens to urban democracy to be backed by a process of collective learning; and on the other hand, it strengthened the quality and the relevance of air pollution research and its relevance through the collaboration between researchers and citizens in the definitions of the objectives and in the co-creation of knowledge.

ACTIVITIES

The Brussels Living Lab took the form of a platform of cooperation between the university (the Cosmopolis Centre for Urban Studies - VUB), the local civil society (BRAL), and various groups of citizens using a citizen science methodology. Activities included:

- *To get to know:* a series of workshops for 4 to 5 months to let participants get a better understanding of the issues related to pollution. During the workshops, participants shared their experiences and interests, ask questions and try to respond jointly. They were also provided with portable measuring devices, linked to an online crowd map (**www.aircasting.org**);
- *To let others know:* as part of the Living Lab, participants organized a series of a follow-up activities, on the basis of their finding and of their context. Examples include public events, (creative) mediatisation of the results, discussion with policy makers, pedagogical activities;
- *Collective reflection:* all groups were also invited to combine this action research exercise with a reflection on the potential and the limits of this methodology, and participated in a number of of focus groups and in-depth interviews.

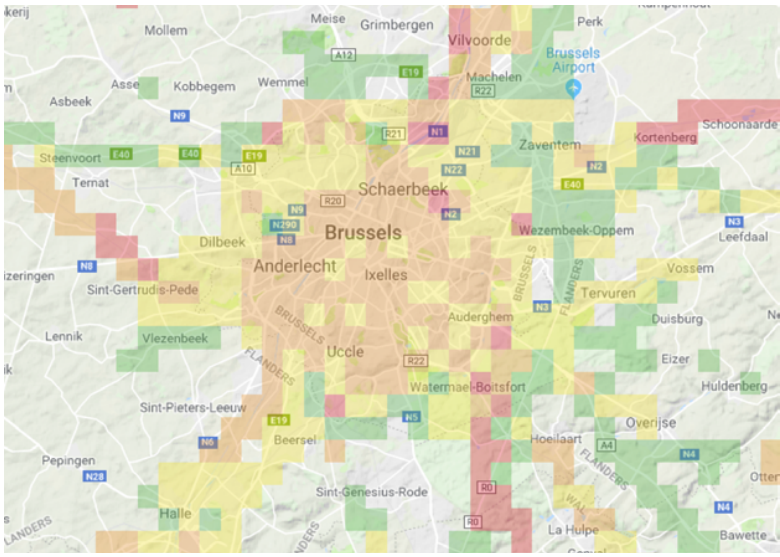
UPSCALING

The Living Lab scaled up in different ways and different directions, summarized as follows:

1. *Replication*: the interest for the topic and for the citizens science approach drove a multiplication of groups replicating (part of) the Living Lab methodology;
2. *Scientific production*: the learning process carried out through the Living Lab scaled up to become a recognised form of knowledge , through the collective preparation of a scientific paper;
3. *Replication of citizen science approach on other domains:* a group started to engage in other forms of activism-backing knowledge production, including a survey on mobility;
4. *Use of Living Lab findings results in policy:* a group was asked to be partner of the local government in pilot testing a "School street" in their municipality, and to use the Living Lab's methods to measure the impact of the policy on air pollution;
5. *Scaling out:* the Living Lab was one of different initiatives focused on citizen engagement and air pollution. Together with the other activities, the Living Lab contributed to make a fertile ground for a broad citizens mobilisation for better air;
6. *Use of Living Lab lessons in scientific and political engagement:* BRAL and Cosmopolis took the lead in the organisation of a national network of scientists on air pollution and citizens science, a process of citizen lobby, and a large event on the topic of citizen, science and air pollution.

OUTCOMES

Considering the decision taken to blur the boundary between the Living Lab and the broader movement for cleaner air, isolating the outcomes of the Living Lab alone is a complex and potentially irrelevant exercise. *Inter alia*, the Living Lab activities contributed towards the organization of a conference with presentations by professionals and citizen scientists; a citizens science scientific paper; a documentary screening and a debate with elected officials; different awareness raising and information activities in schools; several hundreds of PM2.5 measuring sessions for a total of more than 1 mio data points in a map of Brussels AirPollution.



Graz: Living Lab Griesplatz

→ **Redesign of a square through a Living Lab**

GOALS

The Living Lab experiment in Graz aimed to improve quality of life in the district of Gries including a redesign of the Griesplatz. The Griesplatz is a highly frequented traffic hub in the urban area of Graz, which serves various purposes: private vehicle mobility, public transportation, pedestrian and cyclist zones, local goods supply, housing and many services and institutions of all sorts. The district is characterized by social, economic and structural deficits, with educational and income levels below average and a high percentage of migrants.

The Living Lab Griesplatz tested a new approach to urban development projects in Graz by focusing on a broader involvement of key stakeholders into a long-term co-design process. The participatory approach was to reduce the risk of a socio-technical "misfit" as well as the risk of excluding certain social groups (especially marginalized groups), and to also increase the legitimacy of the final design.

ACTIVITIES

Initiated by the city government, the team of Living Lab Griesplatz consisted of three external participation experts and one employee of the Executive Directorate for Urban Planning. Researchers from the RCE Graz-Styria supported the team and strengthened the scientific (transdisciplinary) backbone of the Living Lab. A temporarily installed "city district office" located next to the Griesplatz was the starting point for manifold activities. These aimed to reach as many people as possible but above all to involve diverse stakeholders (social inclusion). Over an extended period of time the Living Lab team facilitated workshops, mental maps, social safaris, city walks, pop-up markets and an online survey. The activities were partly open to the general public and in other cases stakeholders (e.g. Non Governmental Organisations, citizen groups, local businesses) were directly approached. Taking into account the multicultural character of the district, also informal events including non-verbal elements were included. All these activities helped to shape what the organizers called the "Gries DNA". Always keeping that in mind, short- and middle-term measures were developed and partly quickly implemented (e.g. new benches), while a complete redesign of the Griesplatz was envisaged for a later stage after the end of the Living Lab process.

UPSCALING

The Living Lab Griesplatz was strongly connected to the "guidelines for citizen participation" – a set of voluntary measures the city government applies to foster involvement of citizens in decision-making. In the context of the Living Lab these guidelines were analyzed especially in terms of institutional upscaling (i.e. how the city government could improve their use in future projects).

OUTCOMES

Considering the heterogenic socio-technical structure, various activities were aimed to create a common vision among the stakeholders in the district of Gries. The pro-active approach of the Living Lab and the variety of applied tools contributed to achieve this goal. The Living Lab helped to collect numerous ideas for the redesign of the Griesplatz and contributed to a more positive attitude about the future in Gries in general. Local residents became more sensitive to participatory processes and engaged themselves together with other people thus fostering integration among the residents in Gries.

From an institutional point of view, the application of the guidelines for citizen participation delivered valuable experiences which future projects can benefit from.

Maastricht: new City and Railway plan

→ Participatory visioning exploiting a visualization tool

GOALS

The goal of Maastricht's Living Lab experiment related to one of the key aims of the recent City and Railway plan of the City of Maastricht. In summary it implied constraining "car only" trips and upscaling inter-modality, cycling and walking in the larger station area over the next two decades. Our analysis showed how the plan tended to neglect a number of "Maastricht-specific" factors that might constrain the upscaling of inter-modal mobility, cycling and walking. Therefore, the University of Maastricht applied a new Living Lab approach to test how to anticipate these constraints.

ACTIVITIES

The Living Lab experiment in Maastricht consisted of a series of activities:

1. Co-developing the experiment by university (Living Lab expertise) and municipality (policy makers and mobility experts), including a smart visualization tool (by engineers);
2. Pre-interviews with stakeholders, to activate knowledge and experiences with participatory visioning for policy making;
3. A two-staged participatory visioning exercise;
4. Post-interviews with stakeholders, to evaluate their experiences with SmarterLabs' participatory visioning approach;
5. Session with municipality to discuss relevance of SmarterLabs' lessons learned for the *City and Railway plan*.

UPSCALING

Before activating the Maastricht Living Lab experiment, one street and square facing the station were renovated with an underground bicycle garage, removed parking spots, and more space for walking. This small intervention could be seen as a first (pilot) phase for the City and Railway plan. Our attention focused on upscaling inter-modality, cycling and walking from the street level to the much larger station area over the next two decades.

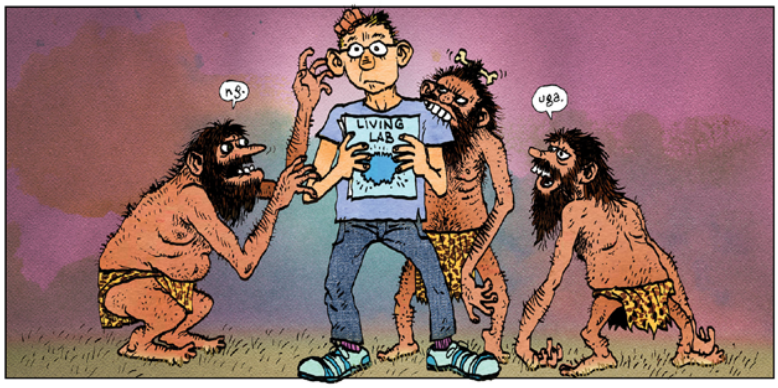
OUTCOMES

The "smarter" participatory visioning exercise clearly highlighted non-consensus around the role of the car in the future and therefore brought in the hidden conflict of aims in the current City and Railway plan (i.e. upscaling inter-modality, cycling and walking versus keeping car accessibility high) into the planning debate. One can't have it all. All in all, the experiment (making integrated visions for mobility explicit, including the assessment and reflections provided on this) was successful in highlighting to all stakeholders the pros and cons of basically two types of visions, but it didn't bring the two types closer to each other. There was some evidence that the municipality learned more arguments for a larger car-free area in the city center.

#1

Social inclusion

Citizens lack financial, intellectual and time resources to participate in the Living Lab



- → **Apply stakeholder and requirement analysis tools (in relation to desired outcomes of the Living Lab) to identify types of exclusion, their motivations and coping strategies**
- → **Include all Living Lab participants in such a reflection (not only the "institutional" initiators), across the Living Lab stages**
- → **Strategically design Living Lab micro-practices, such as informative and educational material, choice of venue and schedule of meetings, language, provision of technological support to reduce digital divide**

THE CONSTRAINT

Living Labs can be complex and long lasting. To participate meaningfully, citizens need time, energy and commitment, a certain level of understanding of the issue at stake or of the technology in use, and sometimes also specific economic and intellectual resources or skills (e.g. a smartphone or language proficiency). This means that certain groups of the population can happen to be excluded from the Living Lab.

People with no, low or very discontinuous revenues might be excluded, considering that ensuring their livability can leave little space to participating in a Living Lab. Also people with precarious employment or residential conditions might lack the possibility to plan for long term and therefore commit to participate in a Living Lab. People who are responsible for taking care of elderly or children, as well as people working during non-office shifts, are also at risk of exclusion as they lack the material time to join the Living Lab. Foreigners and newcomers can be excluded because of their limited proficiency in the language spoken in the Living Lab. In addition, people lacking a minimum understanding of the issue at stake, or acquaintance with the technology used in the Living Lab (e.g. because of low education level, or age) are also at risk of exclusion from or of limited participation in the Living Lab.

WAYS TO ANTICIPATE

A Living Lab that is inclusive of all relevant groups is virtually impossible, at the same time it is desirable to minimize exclusion throughout its lifetime. Barriers to broad inclusion in a Living Lab can be of many different kinds and require a fully-fledged strategy to be addressed. It is important to reflect on desired outcomes and apply **stakeholder** and **requirement analysis** tools to identify potential types of exclusion and adequate coping strategies. While this exercise is primordial in the design phase, it requires to nourish an ongoing reflection at different stages of the Living Lab. All Living Lab participants need to participate in an explicit reflection concerning the causes and outcomes of exclusion, and in the identification of solutions.

Overall, the micro-practices of the Living Lab need to be strategically designed. These range from the choice of venue and schedules of the Living Lab meeting, to the language and the style of Living Lab moderation, to the time spent in all sorts of capacity building. Other methods to ensure broad inclusion include targeted calls for participants, through the channels that are more likely to be used by the target group or technological fixes, to provide the tools to all (e.g. purchase of smartphones or computers).

Brussels

In the Brussels Living Lab, efforts to minimize exclusion were at the core of the process since its early beginning. Different adjustments were also made in progress, considering unexpected circumstances.

At very early stages, Living Lab organizers (the local university and a city movement) reflected together to identify potential barriers to inclusion, and decided to establish different sub-groups, precisely to include the broadest variety of population. Throughout the process, regular reach out efforts were made toward groups at potential risk of exclusion. The role of a focal person for each group was given to the most suitable person (depending on language skills, residence, family situation, work experience...), and the different workshops were designed depending on the different type of participant.

A key element, for instance, was the strategic choice of venues and schedule for the different groups: for EU officials, meetings were convened in the EU premises at lunchtime; for groups of parents and shopkeepers, small meetings were organized in the early morning, just after leaving the children in school/just before opening the shop; for young professionals, meetings were organized at early evening in a central neighborhood.

Several smartphones were purchased to ensure that those who did not have one, could still take part in the Living Lab. Tablets were also purchased, to serve as pedagogical device and to be used for demonstrative purposes. More time for training was dedicated to the least acquainted with the use of smart technologies groups/people. In some cases, it should be noted, the time dedicated by the Living Lab facilitator was not enough to bridge the gap, resulting in participants not using the technology.

Exclusion from the Living Lab was also part of the reflection that the participants engaged in. In a focus group interview on the topic, they were invited to identify potential drivers of exclusion, the possible implications, as well as suggestions for coping strategies.

Graz

The City of Graz aimed to take action in a district with challenging circumstances: high proportion of migrants, various cultures and ethnics, education levels and incomes below average. The strategy to reach out to marginalized groups such as migrants, elderly people and children was to offer various communication channels (newspapers, Facebook, public events and direct interaction with people via the Living Lab's district office) and different formats of Living Lab activities: online questionnaires, workshops, **social safaris**, **mental maps**, etc. The overall strategy was to establish a long-term participatory process with several possibilities for citizens to bring in their opinions in manifold ways. The Living Lab organizers did not wait for people to show up, but actively approached them on the street, literally bringing the Living Lab to the people. By repeatedly offering possibilities for stakeholders to participate and actively approaching them, over an extended period of time also marginalized groups were included.

Bellinzona

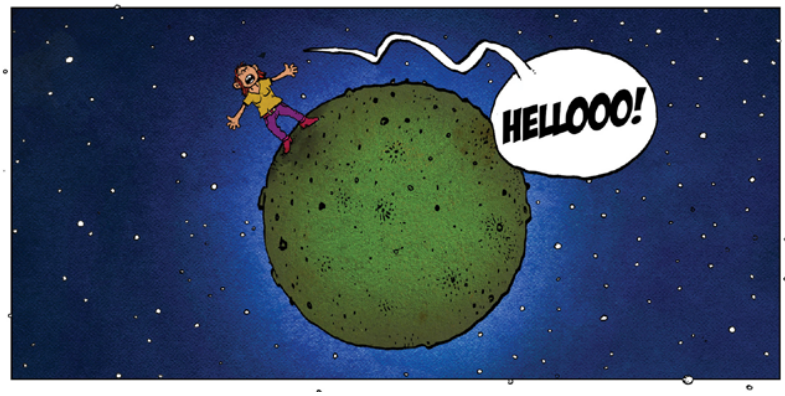
In the Bellinzona Living Lab, social groups at risk of exclusion were identified in elderly and young people and migrants. To favor their participation, a targeted recruitment strategy was applied. Flyers introducing Living Lab activities were distributed at places where computer literacy courses for elderly people are offered, and personal contacts with high school teachers and a local association supporting migrants were established. The aim was to exploit the already existing formal (computer literacy courses, teacher-student relation) and semi-formal (local migrant association) social networks to capitalize on the existing trust relationships, as well as to provide specific assistance (e.g. language mediating support). Considering the young generation's natural inclination to interact with the digital world, it was expected that students would be the easiest segment to include.

Resulting numbers suggest that the performed recruitment strategies were not enough to favor a significant participation of the groups at risk of exclusion. For instance, while young generations are the most inclined with technological innovation, they are also less used to participation and engagement in public processes. The limited engagement of students (two out of around forty participants, but not in a continuative way) suggests that further efforts could have been dedicated to specifically outreach students directly by means of informal networking, instead of involving intermediary persons such as school teachers. Providing also stronger in-person contacts to elderly people would probably have helped to trigger more active engagement than just relying on flyering mediation. In fact, even though flyers specified that no specific computer competences were needed, they probably were not as convincing as a person would have been. As for migrants, even in this case, a more direct interaction and personal invitations (face-to-face or telephone) could have reinforced the supportive action and thus engagement.

#2

Social inclusion

Relevant stakeholders remain outside the Living Lab



→ **Stakeholder analysis allows to identify the relevant target groups and the reasons why they might/ might not be interested to join Living Lab activities**

→ **This suggests how to frame Living Lab activities in public communication campaigns aimed at recruiting Living Lab participants and to identify the specific actions needed to also raise the interest of less intrinsically motivated target groups**

THE CONSTRAINT

Due to the intrinsic innovation nature of Living Labs, large shares of the population and the relevant stakeholders might not be interested in joining them (or remaining active within them for a long period of time), because either they do not share the sense of urgency to discuss the issues at stake and take action (they have different priorities), or they even have conflicting attitudes or goals.

As a consequence, the group of Living Lab active participants risks being monopolized by people with strong personal commitment to the issue at stake and/or people already used to (critically) interact with public authorities and institutions. Ultimately, the Living Lab might become a low conflict circle of people sharing priorities, attitudes and goals, while the large majority of citizens would simply ignore the Living Lab process. Dissenting groups might also explicitly opt for keeping themselves out of the Living Lab, in order to be able to later criticize its outcomes and the introduction of policy measures based on them, according to a well-experienced and more comfortable to them "Decide-Announce-Defend" (DAD) framework.

In both cases, level and intensity of debates within the Living Lab would be trivialized and upscaling possibilities of its results would be strongly inhibited.

WAYS TO ANTICIPATE

In the process of setting up a Living Lab fundamental questions need to be clarified, above all the objectives and who could effectively contribute and therefore should be involved in order to be able to define clear goals and guarantee transparency and an open communication inside and outside the Living Lab.

In particular, a **stakeholder analysis** should be performed in order to identify the relevant target groups, together with the reasons why they might (not) be interested to join Living Lab activities.
Analyzing the reasons against a participati on in the Living Lab helps to define

- how to frame Living Lab activities in public communication campaigns aimed at recruiting participants,
- and specific actions in order to also raise the interest of less intrinsically motivated target groups and achieve their active engagement in Living Lab activities.

Aiming to involve a variety of people, special attention needs to be paid to their individual demands and desires. The objectives of the Living Lab have to be negotiated in order to prevent mismatching expectations between the Living Lab and its potential participants, as well as to avoid the possibility of generating misleading information (e.g. from Living Lab opponents). This is important to attract people in the first place as well as to keep them active in the process. Ultimately, transparent communication helps the Living Lab to obtain the right motivation and loyalty from its participants.

Brussels

In Brussels, an initiative for "Smart Mobility" was reframed by Living Lab initiators as one where air quality and people health were at the core. Adopting the right problematization approach favored raising commitment also among those citizens who would not engage in a smart mobility-related process, perceiving the topic as outside their own priorities. Instead, they genuinely and very proactively engaged in an air pollution-related process, since their cared very much for their health, and especially the one of their kids. Reframing the focus of the Living Lab helped reaching out to a rather broad variety of citizens, with different geography, and socio-economic, demographic, cultural background. Overall, though, participants could not be considered as a representative sample of Brussels population, with an overrepresentation of the educated and socially active middle class as opposed to other groups.

Bellinzona

The Living Lab in Bellinzona was largely at risk of just attracting people who had already reduced their car use, thus resulting in a very polarized sample of participants possibly jeopardizing the efforts made to keep the Living Lab as open as possible to the entire population. Particularly, there was the risk to mainly involve only cyclists, since the local association lobbying in favor of regular bicycle use was among the Living Lab initiators, and participation to the Living Lab was open to any interested citizen, on a voluntary basis. However, how could a group of urban cyclists have been able to co-design an effective smartphone app targeting reduction in car use among mainstream car drivers?

To favor large diversity and high representativeness of the local population among the Living Lab participants, Living Lab organizers opted for a hybrid recruitment campaign, relying on both bottom-up and top-down activities. First of all, a **stakeholder analysis** was performed, in order to identify the key target groups to be engaged. As a result, commuters, car drivers, bicycle riders and public transport users were identified and the relevant associations representing their interests were involved, with the aim of mobilizing them in the outreach of Living Lab participants. Posts in their newsletter and articles in their bulletins were published, to amplify and support the press release delivered by the City of Bellinzona at the launch of the public campaign for Living Lab recruitment. The campaign explicitly remarked that all citizens were welcome and desired – especially car drivers, the claim targeting those citizens being "always stuck in the car". The emphasis was put on co-creation activities, and on the key idea behind the app, that was rewarding citizens with tangible prizes, if they opt for (more) sustainable mobility patterns. Highly attractive prizes (extrinsic motivational factors) were supposed to raise the interest in mainstream commuters and car drivers up to the level of already intrinsically motivated bicycle riders and public transport users.

To reinforce and integrate such bottom-up, spontaneous self-applications, a top-down selection of diverse and overall representative citizens was also made. By referring to their wide network of personal contacts, city authorities identified a set of around fifty citizens to be personally invited to join the Living Lab, being sufficiently diverse in socio-economic characteristics as well as mobility patterns, to be considered representative of the variety and differences among the whole population. Not all of them accepted the invitation, but, together with the totally self-selected participants, the group of participants in Living Lab activities was sufficiently diverse to avoid typical "preaching to the converted" limitations.

It is to be remarked, however, that the top-down selection of the citizens to be invited was performed by the City civil servants and policy-makers themselves. Notwithstanding reassurances on their good faith, opting for a fully transparent selection process, or maybe even for a random selection process, such as the ***"citizens jury"*** or ***"planning cell"*** participatory techniques, would have endowed the whole process with additional fairness and reliability, further attracting other participants.

#3

Social inclusion

Groups and impacts outside the Living Lab context are overlooked

- → **Explicitly consider the project's indirect and cross-scale effects in the broader urban context, by reflecting on the multiple scales relevant to the Living Lab and on the actors that might be included/excluded at each scale**
- → **Adopt adequate logistic arrangements and outreach strategies to help minimize exclusion, such as convening Living Lab meetings at different locations and being open to reframe Living Lab meetings to achieve a shared vision and increase motivation**

THE CONSTRAINT

Urban Living Labs can be situated in a specific geographic context, ranging from a building block, to a neighborhood, a commune or a whole urban area. While there is a certain flexibility in choosing the scale within which to operate, any choice implies the definition of boundaries that exclude people living beyond them.

While this exclusion happens sometimes by design, it is more often due to self-exclusion: people living outside or faraway the project context might relinquish to join the Living Lab either because it takes too much of an effort to go to the locations where the Living Lab meetings are held, or because – though they might be impacted by the project – they do not feel immediately concerned.

This constraint represents also a barrier to successful upscaling of the Living Lab, as replicating pilot projects in the broader urban area can be prevented because generated knowledge is very much related to the specific context of the Living Lab or because the whole Living Lab process only focused on the pilot project, neglecting or forgetting the effects beyond its boundaries.

WAYS TO ANTICIPATE

Exclusion based on participant residence can be either a matter of logistic or of personal concern with the stakes of the Living Lab. In both cases, it is important to reflect on desired outcomes and **apply stakeholder analysis** and **requirement analysis** tools to identify potential types of exclusion and adequate coping strategies. In other words, this implies a thorough reflection on the multiple scales relevant to the Living Lab and on the actors that might be included/excluded at all scales.

In the former case, adequate logistic arrangements can help to minimize exclusion. Living Lab meetings can be convened at different locations, to target different audiences. In the latter case, a constant outreach effort might be necessary. This includes both communicating the Living Lab purposes, but also adapting them and adjusting the frame.

Overall, constantly negotiating with participants and potential participants the objectives and the frame of the Living Labs can be particularly helpful in defining a shared vision, thereby increasing motivations and buy in of a broader audience.

Organizers, in particular, need to estimate and take into account projects' indirect and cross-scale effects, also outside the boundary of analysis. To adequately cope with them and anticipate any negative impact, they also need to actively engage with stakeholders of the broader urban context that might be affected by the Living Lab or by an upscaled version of its results.

STORIES FROM "SMARTER LABS"

Brussels

In the Brussels Living Lab, the citizens' place of residence was one of the most solid barriers to broad inclusion. In particular, the city is characterized by a great inflow of workers commuting in and out the city from the metropolitan area. These commuters are immediately impacted by air pollution in the city, and largely contribute to it. At the same time – with some exceptions – the Living Lab failed to include them in the activities because of lack of time and resources to identify suitable locations at the urban periphery, and because of their relatively lower concern for the issue at stake (i.e. widespread perception that suburban living is less impacted by air pollution).

Given its main focus (i.e. air pollution), the Brussels Living Lab was characterized by the overlapping presence of multiple scales. To minimize exclusion based on participants' place of residence, different arrangements were made. To begin with, the Living Lab ateliers were held in different locations, depending on the participants' place of residence and employment. In one case (group of parents of children at school age), the group was split in two, based on the location of the school, and the information between the groups was constantly being relayed by the Living Lab facilitators. These included places throughout the regional territory. In one case (EU officer citizen group), rather than building the group based on place of residence, it was built based on the shared place of work. To do so, meetings took place during office hour at the office location: this allowed for participation of people living in many different locations to interact around common questions. It also allowed to have a discussion on different scales: while it started from a concern about the air at place of work, it soon included the commute, and finally their place of residence.

Despite the outreaching efforts, the Living Lab was eventually not successful in including participants from all neighborhoods of the region, nor participants living outside of the regional borders. To complement for this shortcoming, constant efforts of networking and coordination with other organizations were made, to share good practices and lessons from the Living Lab: by experience sharing with organizations in nearby cities, the conditions were created for replication in other contexts.

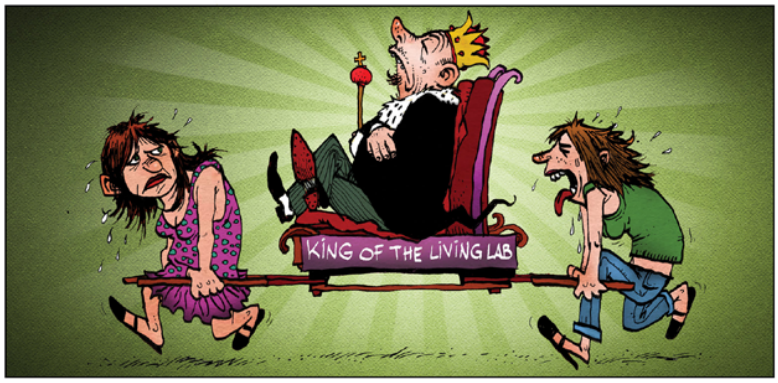
Maastricht

In Maastricht Living Lab, although the station area was of main concern, the visioning assessment Living Lab experiment initially focused on the city of Maastricht as a whole. Later on, the scope of the visioning exercise was narrowed, and participants were specifically asked to consider implications for the station area. Also, the **stakeholder analysis** identified people from different areas (residents of city center, of outer districts, commuters) as relevant stakeholders for the vision of Maastricht, and these actively participated. This helped to include effects on other areas than the station area, hence anticipating this constraint.

#4

Social inclusion

Existing power structures are reproduced inside the Living Lab



- **Regularly perform a stakeholder group dynamics analysis, in order to understand group structure and leadership relations among group members**
- **Particularly, identify any dominant position among Living Lab participants, due to already existing institutional roles outside the Living Lab (political responsibility, lobbying activity)**
- **Design a communication and management strategy to address all identified target groups, keep flexibility, favor development of activities along different tracks, allowing each group to adapt to their speed of progress**

THE CONSTRAINT

One fundamental aim of Living Labs is to involve citizens and establish a democratic structure that guarantees that every voice is heard and taken into account. However, in practice, instead of achieving real participation, various circumstances can lead to a mere reproduction of existing power structures inside a Living Lab. For example, if the city Mayor joins Living Lab meetings, his vision and proposals might end up dominating and conditioning Living Lab outcomes. Similarly, the position of a technical expert might be given more weight than that of laypeople. Gender also often influences group dynamics, with men taking more often a central position.

This can be the result of deliberate management in the Living Lab, if it is only run as an alibi activity. On the other hand, Living Lab organizers might not be aware of the heterogeneity of stakeholders and of the importance of taking the right precautions to guarantee any group or participant equal opportunities for participating in the discussion.

WAYS TO ANTICIPATE

To avoid reproducing existing power structures, as a first step, these need to be assessed by carrying out a **group dynamics analysis**, in order to understand group structure and leadership relations among group members.

Particularly, it is important to identify any dominant position among Living Lab participants, which could be due to already existing institutional roles, such as political responsibilities, lobbying or expertise. If people in such positions attend Living Lab activities, their ideas should be given no more attention than those of the other citizens without a leading societal role.

The Living Lab organizers have to design a communication and management strategy to address all identified target groups, applying tailor-made methods for each of them. To ensure fair and equal participation, flexibility in the use of methods is a key requirement (e.g. not only conversation or only ICT tools). Inviting people at various levels and occasions and building trust and social cohesion plays an important role for a long-term success of a Living Lab. Organizers should facilitate development of activities along different tracks and allow each group to adapt to their speed of progress: equal opportunities are often the result of different – not identical – processes. In general, **group facilitation techniques** help guarantee that everybody is engaged and contribute to a good learning and planning process. Next to the methodology, also the locations should contribute to setting a plain ground. For example, if city representatives actively participate in Living Lab activities, meeting at the city hall might indirectly reinforce existing power structures, involuntary putting hosts in a dominant position. Meeting in places such as schools, or maybe changing locations over time, helps counter-balancing existing power structures.

STORIES FROM "SMARTER LABS"

Graz

The City of Graz aimed to take action in a district with challenging circumstances: high proportion of migrants, various cultures and ethnics, education levels and incomes below average. Reaching out to marginalized groups such as migrants, elderly people and children turned out to be difficult. At events organized by the Living Lab, the people who showed up represented an incomplete sample of the actual target group. Even more so, a couple of persons repeatedly "sabotaged" events by excessively raising their voices and acting as opinion leaders.

The Living Lab in Graz involved a lot of stakeholders including residents, shop owners, bus operators, city entities and politicians. All of them filled out certain roles that contained different levels of power. The Living Lab organizers aimed to blur the borders between them, enabling each person to participate equally. This was achieved by offering different formats of Living Lab activities: online questionnaires, workshops, **social safaris**, **mental maps**, etc. By repeatedly offering possibilities for stakeholders to participate and actively approaching them over an extended period of time, also marginalized social groups (e.g. migrants) were included. Locations of events were carefully selected. In particular, a city district office was installed next to Griesplatz and was used as a neutral place for diverse activities throughout the whole project duration, complemented by outdoor activities in the district, literally bringing the Living Lab to the people. These measures created awareness for the Living Lab and social cohesion among the people involved.

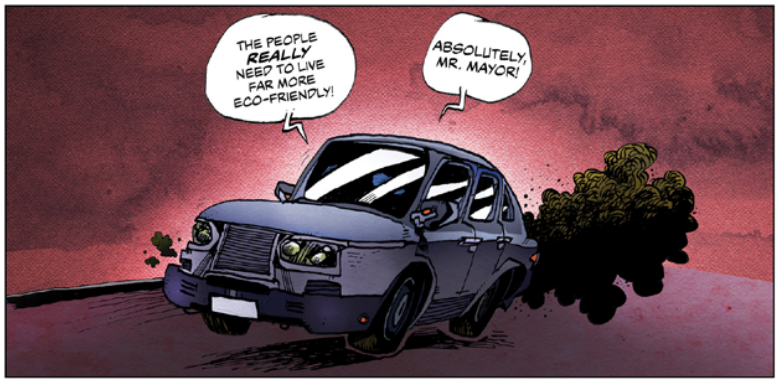
Maastricht

In Maastricht, the university (i.e. a relative outsider) arranged the invitations and facilitation of the visioning workshops, whilst treating the municipality as just one of the six stakeholder groups (others were: entrepreneurs, mobility operators, and three types of residents/travelers). All groups made their own vision and these were presented and discussed as equivalent outputs. A facilitator was present at each of the six tables to manage the discussion among very different types of people and make sure everyone was included in the discussion. In the post-interviews all participants stressed they felt they could express themselves well. The municipality enjoyed their freer role as participant and not being the facilitator. No one mentioned (s)he felt overruled by another group.

#5

Upscaling

The Living Lab's potential for learning is underexploited



- **Develop a comprehensive learning strategy, aimed at capturing and monitoring knowledge creation in the Living Lab (collective knowledge co-production) and transferring it to all relevant actors outside the Living Lab**
- **Knowledge exchange can be favored by people-to-people real-life interactions (i.e. physical meetings), which make learning more rewarding and comprehensive to all and also ensure tacit knowledge to emerge allowing each group to adapt to their speed of progress**

THE CONSTRAINT

Some stakeholders tend to reduce Living Labs to pilot project "to try out something new", without an agenda on what exactly they like to learn. Although the label of Living Lab is used and the importance of learning is acknowledged, local authorities taking part in such bottom-up experiences may not fully recognize opportunities offered by Living Labs, thus neglecting to systematically assess the process, to improve their future work. Performing structured evaluations and drawing lessons from Living Lab activities would instead allow them to get a broad understanding of specific innovation processes, including their implications and consequences, thus supporting diffusion of the innovation across spatial scales.

Often, local authorities lack the farsightedness and political will to perform explicit monitoring of the lessons learnt throughout the process, since this would imply accepting the potential of shared (stakeholder) knowledge and could imply challenging the status-quo system.

When single Living Lab participants draw their assessments and conclusions, they often lack a comprehensive view of the process, and therefore no comprehensive knowledge is generated and the lessons learnt are partial or biased. If no single actor has an overview of all options, mechanisms and impacts emerged during Living Lab activities, limited transfer of learning is possible to future users, precluding upscaling.

WAYS TO ANTICIPATE

Explicit comprehensive learning strategies are needed, including a learning agenda (i.e. a co-created set of learning goals), capable of capturing and monitoring knowledge creation and transferring it to the engaged actors, in order to empower them and supporting the transfer of lessons to other contexts.

Living Lab managers should first formulate the learning goals, understand who has to be involved in learning, with respect to the final goal of upscaling Living Lab outcomes, and then make sure that the experiments are designed in such a way as to answer the learning goals. In other terms, this means developing a strategy to favor collective knowledge co-production.

To this purpose, first goals and ambitions of each actor need to be understood. Then, period reflection sessions can help to monitor the learning process. Especially people-to-people real-life interactions (i.e. physical meetings) make learning more rewarding and comprehensive to all and also ensure tacit knowledge to emerge.

Bellinzona

The Living Lab in Bellinzona was a pilot project, run on a voluntary, politically non-binding base. On the one hand, this favored acceptance of the Living Lab approach by the City, but on the other hand it made also responsibilities and commitment by the City to contribute to the participatory knowledge-sharing process less pressing. This made the process of capitalizing on the "lessons-learnt" from the Living Lab and integrating them into the City's policies more difficult. Thus, a learning strategy was explicitly designed, with the aim of monitoring knowledge co-created within the Living Lab. This implied analyzing the project's impacts according to a multi-criteria framework, assessing the level of engagement and satisfaction by Living Lab participants and reporting and communication of results, both internally to all actors involved, as well as externally, through local media.

Similar activities were also planned for the period following the launch of the app to the whole population: regular statistics regarding app use and its effect on local mobility (who, when, how, how much, ecc.) were envisioned. Special attention was dedicated to avoiding "unbiased and neutral" assessment by external experts driving a one-way learning process, by defining "their problem", providing "their knowledge and technology", and preparing "their solutions". Therefore, such statistics would at first be summarized within traditional report documents, though they were planned to be publicly made available, within an online dashboard, showing anonymized key indicators, data and maps, and therefore also fostering a public debate on the future of local mobility and land development.

To further avoid a traditional "expert-driven" learning process, a user-centered approach to learning was adopted, and focus of the Living Lab was put on co-creation activities themselves, through the co-design of the persuasive app. In particular, during Living Lab meetings inclusive participatory techniques were adopted (division in small groups, favor round-robin interactions, voting, short discussions for different topics, etc.), to better stimulate the participation and knowledge-sharing of all the different personalities present in a heterogeneous group of participants. Results of a final evaluation survey were planned to be openly shared with all Living Lab participants, in order to attract their further feedback and comments. Overall, such an approach was expected to help increasing intrinsic motivation, enduring participation and learning and knowledge-sharing between participants.

Maastricht

In Maastricht the Living Lab consisted of two physical meeting sessions with the stakeholders, with a combination of plenary meeting and subgroup meetings. The stakeholder knowledge was captured by asking them to make their vision for 2040 explicit in the first session. In the second session, they learned about each other's visions, they received reflections from practitioners about their vision (including implications on cost, environmental quality and accessibility) and they received visualizations of their vision. Possible adaptation of the visions they thus decided to introduce were monitored. The expression of the visions in the first round nicely mapped a diversity of stakeholder views on mobility in the future. However, in the second round most groups stuck to their vision of the first round. Only the urban planners (i.e. the municipality) adapted their vision, mostly based on feedback from practitioners. This lack of learning could be because:

- the groups were quite strongly convinced of their vision developed in the first round, with changes only likely on longer time frames (than four weeks);
- the format of feedback on their visions was not sufficiently "tailor-made" to be absorbed by the participants.

#6

Upscaling

The Living Lab is disconnected from broader societal debate

- **Design and manage Living Lab activities with great care for the local conjuncture: consider broader socio-economic, cultural and political aspects, ensure links with the existing public debate, with what a community considers to be its priorities, and what stakeholders consider to be feasible**
- **Maintain a certain flexibility throughout the Living Lab, be ready to adapt to changing conditions in the outside social and political agenda. Ensure that both Living Lab objectives and its framing can be adjusted and continuously re-defined by all actors**
- **Place citizens at the core of the process and actively coordinate with other societal developments and initiatives related to the content of the Living Lab**

THE CONSTRAINT

Urban Living Labs are forms of societal experiments that take place in real life conditions. While they can and should have an innovative flavor, they will successfully scale up only through existing windows of opportunity.

If an experiment is designed as if it was to take place in a vacuum, disregarding the social, economic, cultural and political conjuncture, or if the external conditions change (the windows of opportunity close), the Living Lab is unlikely to scale up.

In such cases of "disconnected Living Labs", even though Living Lab outcomes are positively assessed by participants and aligned with original plans and expectations, the broader public is unlikely to share the Living Lab's objectives, understand and replicate its methods, and to find it relevant in addressing current priorities.

Under such shifts in policy windows, instead of proactively supporting upscaling of Living Lab outcomes, decision-makers might adopt a "wait-and-see" attitude, maybe not opposing the Lab launch and management, but intentionally avoiding to develop and implement any strategy specifically designed to favor the active diffusion of its results.

WAYS TO ANTICIPATE

A Living Lab should be designed and implemented with great care for the local conjuncture. No immediate replication of Living Lab examples of best practices is likely to be successful if it is not adequately customized and adapted to changing conditions in the outside social and political agenda. This includes broader socio-economic, cultural and political considerations, but also ensuring links with the existing public debate, with what a community considers to be its priorities, and what is considered to be feasible by stakeholders. Efforts to connect the Living Lab with the broader societal developments need to be done while designing the Living Lab, but also throughout its development. This requires a degree of flexibility and adaptability to changing external conditions, involving – when needed – adjustments and re-framing. In particular, what can reasonably be scaled up should be identified since the very beginning of Living Lab activities and an upscaling strategy should be designed, together with the relevant communication and dissemination measures.
Consistently, such a strategy should be kept flexible and open to the evolution of activities in the Living Lab as well as the external dynamics, and tailored to the specific context where Living Lab results are to be upscaled, by choosing the right channels, time and language.
In this context, an important precondition is to place citizens at the core of the process, as they are likely to have the most detailed understanding of the local context. In addition, it also requires to actively coordinate with other societal developments and initiatives related to the content of the Living Lab. This can be done at different levels ranging from simple information sharing, to building bridges and identify possibilities of cooperation.
As a corollary, ensuring the Living Lab is well linked to the broader societal debate, is also a way to ensure Living Lab participants feel recognized, thereby strengthening internal dynamics and empowering them. In turn, this further favors their active engagement in the diffusion of Living Lab outcomes and the implementation of the upscaling strategy.

Brussels

In Brussels, Living Lab activities have been coordinated from the onset with the broader citizen movement for a cleaner air in the city. To begin with, an initiative for "Smart Mobility" was immediately reframed by the local partners in order to put air quality and people health at the core. Adopting the right problematization approach favored raising commitment among those citizens who would not have voluntarily engaged in a mobility-related process, perceiving the topic as outside their own priorities. Instead, they genuinely and very proactively engaged in an air pollution-related process, since they cared very much for their health, and especially the one of their kids.

From very early on, in addition, the Living Lab initiators (the local university and a citizen movement) engaged in an open dialogue with all stakeholders active on the topic, contributing to establishing both a platform for discussion for all civic movements active for better air, and a network of researchers working on air quality and citizen science. Both efforts contributed to reaching out to a broad audience and ensure that the Living Lab was immediately part of a broader discussion.

Throughout the process, finally, the Living Lab was fully co-conducted by the project partners and by the various groups who decided to join. While the broad structure was proposed by the organizer (i.e. getting to know pollution, letting others know), different groups decided to fill it in in different ways, for example by raising different questions (e.g. the level of pollution in school, while commuting, or throughout the day) and identifying different communication forms (i.e. a citizens science paper, a public conference with experts, or creative ateliers).

Maastricht

In Maastricht, Living Lab organizers decided to run a visioning assessment experiment to anticipate this constraint on upscaling smart-intermodality. Being well aware of the fact that the Municipality was one of the most relevant stakeholders in this process, Living Lab managers first waited about a year until the topic achieved visibility in the societal debate, thus leading the Municipality to accept participating in it and get interested in its results.

Then, by organizing the Living Lab around visioning in the far future (2040) and inviting stakeholders relevant for urban mobility, Living Lab managers sought to make the lessons relevant for the coming years – not just the project plan for the station area that was due in July 2018. This way, they manage to nourish and enrich the ongoing debate on the creation of shared visions for the future.

Graz

The Living Lab in Graz was initiated by the city government which aimed to improve the quality of life in the traffic-dominated area of Griesplatz. The city's Executive Directorate for Urban Planning was responsible for organizing a participatory process around a Living Lab. The concept was well prepared and applied by the Living Lab team. However, after one year, priorities in the city government changed towards other projects and the future of the Griesplatz was uncertain. The Living Lab continued but it was difficult to maintain a clear line in communication that would not promise too much but still encourage citizens to be active in the lab. Demonstrating flexibility, the city district office, where the lab was based, was turned into an exhibition room to show all collected results and ideas so far. As a direct reaction based on feedback from the exhibition, the lab organizers facilitated an additional social safari dedicated to the local economy in the district of Gries. In their overall communication strategy that comprised various media and channels they emphasized that "no idea is lost" and that everything would feed into the public architectural competition after the end of the Living Lab.

#7

Upscaling

The Living Lab consensus is not reflected in policy and society

- **Open to participation as much and as early as possible and regularly update the stakeholder analysis whenever external conditions change, in order to avoid the exclusion of any relevant stakeholder group**
- **Favor emergence of any conflicting goals within Living Lab participants and between Living Lab participants and possible external stakeholder groups not actively engaged, and manage conflicting goals by multi-criteria decision-making techniques**
- **Always emphasize and give weight to potential community-level benefits of the options under discussion, against personal or partisan benefits. To this purpose, exploit already existing networks and coalitions and seek for new and unexpected alliances between groups of stakeholders, trying to build relationships with successful initiatives already developed by other actors**

THE CONSTRAINT

In some contexts or for some specific topics, outcomes of the Lab might not find consensus beyond Living Lab participants. Even when the need for intervention on a specific topic is well acknowledged by the population and the interested parties, and addressed as a priority of the social and political agenda, persistence of conflicts might preclude reaching an agreement on a specific solution.

Conflicts might appear both within the Living Lab itself, thus leading to no shared outcomes, or outside, when trying to upscale the shared Living Lab outcomes across the city. In both cases, Living Lab outcomes would lack support or agreement by the population, as well as of the political majority needed to activate the envisioned upscaling measures.

WAYS TO ANTICIPATE

Living Labs should open to participation as much and as early as possible, by activating participatory processes already from the development of visions, selection of methodologies and identification of the actions to be performed. A “participation policy” (e.g. guidelines for participation) at city level can support citizen involvement in the first place and give structure to ongoing processes.

A **stakeholder analysis** should be performed at the start of Living Lab activities, and regularly updated whenever external conditions change, in order to avoid the exclusion of any stakeholder group.

Participatory processes should then be designed as to favor emergence of any conflicting goals among Living Lab participants, first of all, and then among Living Lab participants and any external stakeholder groups not actively engaged in Living Lab activities.

Management of conflicting goals could then be performed by means of **multi-criteria decision-making techniques**, which support Living Lab participants and policy-makers towards a transparent and thoughtful choice among different goals. In doing so, community-level benefits should always be emphasized and already existing networks and coalitions between groups of stakeholders should be exploited. Relying on a multi-criteria approach might also favor the creation of new and unexpected alliances between groups of stakeholders.

Finally, also building relationships with successful initiatives already developed by other actors would be beneficial.

In case these strategies fail in conflict resolution within the Living Lab, political authorities will be called to make decisions.

STORIES FROM "SMARTER LABS"

Maastricht

In Maastricht, Living Lab managers invited all those stakeholders that are relevant for urban mobility to attend the Living Lab and organized activites in a first session around visioning in the far future (2040). This was meant to help make the information emerging relevant for the coming decade– not just the project plan for the station area that was due in July 2018. This approach helped discussion not to get stuck on current conflicting issues, favouring instead a creative and less conflictual co-creation of visions for the future. In this context, by asking partcipants to draw their vision for 2040, Living Lab manageres were also able to make the diversity of stakeholder perspectives explicit. In the second session, participating stakeholders learned about each other's visions, they received an assessment from practitioners about their vision on multiple criteria: implications on cost, environmental quality and accessibility. Showing the pros and cons of each vision was helpful to prevent one stakeholder hijacking the debate, but it didn't lead to overall consensus either. Although final convergence of visions was not achieved, involved stakeholders learned arguments to better understand each other's point of view.

Bellinzona

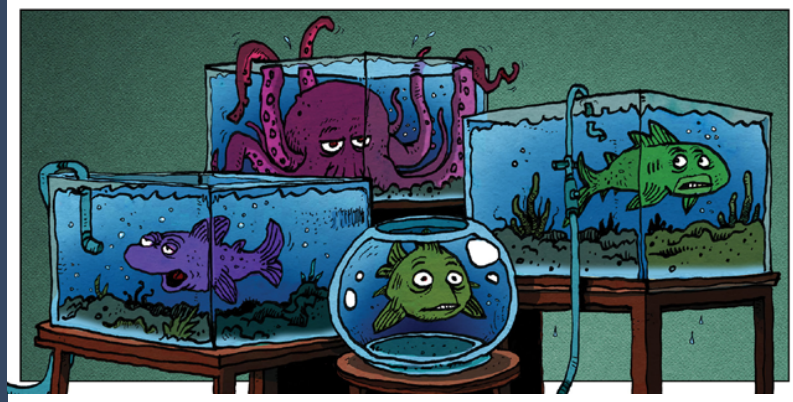
In Bellinzona discussion on the future of mobility and land use planning in general is perceived as a very conflictual topic, with highly contrasting positions among stakeholders and an equally heated societal debate, as shown by the amount of municipal referendum processes activated in the last years against decisions made by local authorities.

In such a context, local authorities would have not accepted to launch and support a living lab shared with citizens and dealing with scenario-building for the future of mobility in Bellinzona. However, Living Labs can provide significant benefits exactly in such contexts, where achieving consensus is critical. Therefore, to start activating a Living Lab process, Living Lab initiators opted to first focus on a practical, technologically-oriented topic, such as the smartphone app development. Perceived as a low-conflict topic, it was easily supported. Scenario-building activities were instead introduced later on, capitalizing on the fact that a multi-stakeholder process had already been activated for the development and test of the app. At that stage, it was easier to ask Living Lab participants what they would have needed to make mobility more sustainable in Bellinzona, thus spontaneously upscaling discussion to future mobility scenarios and policy-making. This way, highly conflicting discussions were spontaneously introduced in the Living Lab.

#8

Upscaling

Stakeholders and institutions are highly fragmented



- → **Foster transparency and collaboration between administrative units, organizations and stakeholders, right from the beginning of the Living Lab process**
- → **Create occasions for them to interact and become familiar with the process, discussion topics and proposals emerging within the Living Lab**

THE CONSTRAINT

Usually a series of different stakeholder networks and institutions are involved and need to interact with one another to pursue management and development of urban processes. Acknowledging this interdependency, however, coordination between these many actors is often difficult, fragmented, and may lack horizontal cooperation among the different sectors.

Fragmentation may be due to different reasons: a given legislative or hierarchical framework, lack of trust and/or communication, financial constraints, poor knowledge or strategic vision. Particularly, this phenomenon is detectable at the institutional level itself: it is not uncommon to experience vertical fragmentation in units and departments ("silo compartments") within and between public administration institutions. Consequently, even when policy-makers embrace a Living Lab participatory approach, its outcomes might suffer from limited diffusion due to fragmented institutional arrangements, which hinder clear distribution of responsibilities and effective cooperation between involved city departments. This makes both horizontal and vertical dissemination of results rather difficult. As such, nurturing the interaction between different stakeholders and institutions represents an important key to success for Living Lab processes.

WAYS TO ANTICIPATE

Transparency and collaboration between administrative units and organizations should be actively fostered from the very beginning to create the atmosphere of "a common endeavor".

To overcome problems of fragmentation, it is essential to acknowledge interdependency between different actors, institutions, units and departments and to strengthen and reinforce these networks and their specific roles.

In addition, it might be necessary to build a comprehensive vision outside the administration, by putting the wished-for changes of citizens at the heart of the debate and then address specific issues to specific institutions.

STORIES FROM "SMARTER LABS"

Maastricht

In Maastricht one constraint is high institutional fragmentation, in the sense that key stakeholders (residents, commuters, businesses) normally do not meet and discuss on these matters in an organized way, although probably having very different views on this. Typically, the municipality bilaterally speaks to business actors and citizens for policy input. The visioning assessment experiment was designed to help anticipating this constraint on upscaling smart inter-modality. In two sessions the stakeholders came together in both a plenary meeting and sub-group meetings, and the diverse visions were developed, presented, discussed, assessed, re-developed in an open and equivalent way.

In the post-interviews all participants stressed they felt they could express themselves well and freely. About half of the participants said they had heard some interesting points from other participants. At the same time, business actors found the residents "too ignorant for such a visioning exercise" and residents' visions "just dreams". This can be seen as a type of institutional fragmentation through a classic framing of "experts" and "non-experts". A few participants remarked they liked the format of separate stakeholder groups to first work with peers, before a larger discussion with a mix of stakeholders, because it helps to better structure arguments.

The Living Lab was successful to bring the different stakeholders in a dialogue amidst institutional fragmentation, by showing all participants the pros and cons of their vision. Although the experiment did not show convergence of visions, it did show the municipality learned more arguments for a larger car-free area in the city center. Possibly, two sessions are not sufficient to enable convergence of visions, and a follow-up is needed.

Bellinzona

In Bellinzona, administrative organization at the City level was the main obstacle preventing diffusion of the Living Lab approach to other fields than mobility and institutionalization of new governance practices. The strategy to overcome the "silo compartments" barrier was to actively engage councilors and civil servants, instead of waiting for them to spontaneously express interest in processes or results. Thus, it was planned to invite them to attend Living Lab meetings, in order to personally experience how they work and the effort needed, and guess their potential in addressing complex or conflictual topics.

In the end, the envisioned strategy was not put into practice, mainly due to "low institutional receptiveness" (see constraint #10). However, this gap was at least partially closed, by planning a final meeting targeting civil servants of other City departments than the Living Lab promoter, and the related political decision-makers. The meeting was aimed at presenting and discussing the approach, the results obtained and the final evaluation of the performed activities, and was supposed to reduce fears and prior oppositions by the city managers, thus favoring larger uptake of participatory approaches in future decision-making processes.

#9

Upscaling

The urban assemblage is sticky and locked-in

- **Activate a dialogue with relevant actors as soon as possible: by developing future visions with stakeholders and crucial decision-makers, the potential of more structural changes can be highlighted**
- **Local actors might be empowered by teaming up with supra-urban actors, such as municipalities with provinces or local Non Governmental Organisations with their national counterpart (scale jumping)**

THE CONSTRAINT

Changes in urban contexts are sometimes tricky to achieve, due to technical, infrastructural, legal or financial interlinkages. In fact, frequently obduracy to urban assemblages can occur, due to persisting infrastructure, long-term contracts or legal "lock-ins". Decisions need to be taken by multiple stakeholders or entities on a political level and cannot be attached to the outcome of a participatory process only. Depending on the specific situation in a city, several obstacles might exist at the same time, which makes it difficult for Living Lab activities to take effect.

WAYS TO ANTICIPATE

To find out about possible barriers for a Living Lab's objective, a dialogue with relevant actors has to be initiated. By developing future visions with stakeholders and crucial decision-makers, the potential of more structural changes can be highlighted. Also, local actors can be empowered by teaming up with supra-urban actors, such as municipalities with provinces or local Non Governmental Organisations with their national counterpart (scale jumping). They might also assume different roles, e.g. as decision-maker and personally concerned citizen at the same time.

If still circumstances do not allow big changes, a Living Lab should focus on what is actually possible. Also providing legal flexibility at least for a limited amount of time to experiment with temporary measures can be useful (e.g. permission for markets). Communication strategy and methodology have to be designed accordingly, in order to avoid wrong expectations among Living Lab participants. Finally, also collecting ideas and concepts to apply in future when circumstances will allow it, can be a strategy.

STORIES FROM "SMARTER LABS"

Graz

The Living Lab in Graz aimed to improve the quality of life in the traffic-dominated area of Griesplatz through infrastructural changes. As a consequence of its purpose as traffic hub, not all infrastructural elements could be replaced according to citizens' desires. In addition, long-term contracts with bus operators forced the organizers to wait. Living Lab participants started to feel that elaborated discussions ended up in little outcome. The organizers remained flexible and changed their strategy by focusing on short- and middle-term measures. In order to deliver visible outcomes of the participatory process, they provided small and quick improvements for the Griesplatz area such as a bike lane, a new lightening system in one street, enlargement of a public space and street furniture. Also temporary awareness-raising measures were taken, e.g. organizing a pop-up market. They released press articles ensuring that "no idea is lost". That means that ideas created in the Living Lab will be remembered and put into place at a later stage in the course of a public architectural competition, once the bus contracts had expired.

Maastricht

In Maastricht one constraint on upscaling inter-modality is the "urban assemblage" around car use and parking in the inner-city, which is rather obdurate. This refers to the interlinking of traffic circulation plans that are adapted to the operation of the many underground parking garages; visitors expecting to be able to park in the center; shop owners who like cars passing by their stores; urban planners' expertise around developing over- and underground parking; and operational contracts (mostly running until 2032) of the garages, also reflecting significant financial interests. This interlocking bundle of social and technical elements tends to resist change of the whole assemblage, only allowing "add-ons" that leave the rest in place.

The visioning assessment experiment was designed by considering a year in the further future, 2040, in order to move beyond the interests and structures of today, and to allow envisioning more structural change.

The experiment found that there are broadly two different future visions:

- entrepreneurs and mobility operators envisioned incremental development toward more underground parking refining and strengthening the current urban assemblage;
- on the other hand, residents and commuters envisioned structural change towards an (almost) car-free city center. The group of urban planners had a compromise in the middle. The urban planners did learn that there is more support for a larger car-free zone than they thought, and in a second session they reduced urban parking. This was also based on the reflections that showed the ineffectiveness of park and ride (P+R) projects, without reducing urban parking.

#10

Upscaling

The Living Lab meets low institutional receptiveness

- **Seek for early inclusion of policy-makers and local institutions**
- **Provided that Living Lab organizers show genuine commitment and give voice, role and responsibility to diverse groups of citizens, civil society organizations and experts, institutions might start appreciating the approach and its benefit**
- **Carry out multiple successful pilot processes**
- **Build on existing practices and procedures of representative democracy to promote dialogue between stakeholders**

THE CONSTRAINT

Institutions may not show (or indeed not have) real commitment for a Living Lab approach.

Sometimes barriers might be due to the lack of open-mindedness and receptiveness by institutions involved in Living Lab activities. Local governments, as well as other actors involved in the process, including Non Governmental Organisations (NGOs), universities and companies, might in fact be unfamiliar with, or open to, co-creation approaches, believing that interaction with other stakeholders adds unneeded complexity to policy development.
Low receptive institutional contexts tend to favor expert-driven ways of thinking and agreement with powerful lobbies, in traditional Decide-Announce-Defend (DAD) approaches.

In such contexts, even if Living Labs are activated and developed, they might lack full support of key institutions, who might support them as a façade tactic, indeed being unwilling to implement their outcomes.

WAYS TO ANTICIPATE

To cope with such constraints on the process institutional context, early inclusion of policy-makers and local institutions should be sought for. Provided that activities in the Living Lab are adequately designed, namely that Living Lab organizers show genuine commitment and give voice, role and responsibility to diverse groups of citizens, civil society organizations and experts, policy-makers and institutions might start appreciating the approach and its benefits.

Then, it would be a matter of repetition. Once multiple successful pilot processes are carried out, institutions and policy-makers would embrace approaches and processes, supporting their outcome.

If instead policy-makers and institutions do not accept invitations to engage in Living Lab practices, try to bring Living Lab outcomes into traditional channels of democratic representation, fostering a public discussion with and within elected political representatives.

Bellinzona

The City of Bellinzona was formally owning the Living Lab process; however, due to the lack of familiarity with participatory approaches, they were not fully aware of the potential of participatory Living Lab projects in supporting policy development. Therefore, they lacked leadership and predominantly relied on advice and superintendence by the local university. They mainly perceived the Living Lab as a technology innovation testing ground: a single, small-scale, closed and controlled process, aimed at developing and evaluating the mobile app prior to its rollout at city-level.

In particular, local decision-makers tended to cling to authoritative governance styles, rather than opening up to more consultative, cooperative or even facilitative approaches, mainly due to the fear of losing formal power and responsibility on the decision. Their main concern was to avoid possible financial and personal drawbacks and, inadvertently or not, the tendency was to keep the Living Lab in the policy periphery. However, leadership can only be learnt through experience: providing first-hand opportunities of experiencing public participation processes is a first start. Thus, researchers involved in Living Lab organization tried to promote a new political culture by ensuring the presence and active participation of representatives of the Municipality (civil servants, politicians) in Living Lab meetings. This helped getting local authorities and decision-makers gradually acquainted with the concept that Living Labs may represent a valuable learning-by-doing tool and a constructive and enriching means for reflection on practices or policy.

Also, to favor Living Lab acceptance by decision-makers, the strategy was to focus at first on an app development: practical and technologically oriented, this was perceived as a low-conflict topic and therefore easily supported. Later on, capitalizing on the actor- and context-dependent knowledge created while Living Lab participants were testing the app and concretely experiencing new mobility behaviors, discussion in the Living Lab was upscaled to policy-related topics regarding future mobility scenarios ("What would we need to make mobility more sustainable in Bellinzona?"). This way, also potentially scaring and far-reaching discussions were spontaneously introduced in the Living Lab with the support of the institutions.

Maastricht

In Maastricht, although found cumbersome, there is already experience and (at least among part of the civil servants) appreciation for more Living Lab-type of approaches. The tool of visioning and participatory visioning is also applied in Maastricht, although not very often. One constraint for further use is that not the municipality, but stakeholders like the national railways and local businesses, prefer to exclude citizen groups (see constraint #8 "Stakeholders and institutions are highly fragmented").

A further constraint on upscaling of Living Lab approaches was anticipated by refining specific details in the experiment in Maastricht, most notably:

- separate stakeholder groups to first work with people with similar perspective, before a larger discussion with a mix of stakeholders, helping to better structure the arguments;
- build further on output of the first session in the second one, whilst receiving reflections;
- include the municipality as one of the participants since the very beginning.

These characteristics were indeed new and appreciated by civil servants, because they helped them to participate in an equal, more fruitful way. Normally, when the municipality facilitates participatory sessions, they either tend to be under pressure and criticism due to policies in the past (raising frustration at the side of citizens and others), or they risk (at least the impression of) "reproducing existing power structures" (see constraint #4). Therefore, civil servants are now open for wider application in other policy fields.

Brussels

During the first year of the Brussels Living Lab, different attempts were made by Cosmopolis and BRAL (respectively, the local university and a city movement) to engage with regional governmental institutions responsible for mobility, environment and smart city. These included various meetings with staff of the cabinet's and of the administration, and official letters with different proposals for cooperation and joint activities within the Living Lab. The institutions did not answer to any of the proposals, for reasons that, at this point, we could only speculate on. On this basis, it was decided to approach institutions through a different channel: via the political production of the Brussels movement for cleaner air. Rather than approaching directly the regional institutions, BRAL and Cosmopolis contributed to facilitate a dialogue between citizen groups and political parties in the context of the local and regional elections, thereby scaling up the Living Lab via the consolidated practices of democratic representation. This was done, for instance, through, a process of citizen lobby in view of the regional election (series of facilitated dialogues between citizens groups and parties' representatives), and of a large event on the topic of citizen, science, and air pollution.

GLOSSARY

→ The elements introduced here are **underlined** in the document.

Group dynamics analysis
An analysis of how individuals included in a certain group interact with each other and react to changing circumstances. Particularly, influence of power structures and formal and informal relations have to be taken into account.

Group facilitation techniques
Specific techniques aimed at making discussion within groups of people easier, less conflictual and overall more creative and productive. Depending on the specific step of a decision-making process, such techniques support groups of people in brainstorming ideas, in estimating and assessing their effects, and in comparing and discussing them, with the aim of getting as much as possible shared group decisions.

Map of actors
A graph visually representing the relations between the stakeholder identified to affect or be affected by a certain topic.

Citizens jury
A participatory methodology supporting decision-making on complex and conflictual topics, based on reproducing practices of a jury in a legal trial. A jury of random selected citizens is invited to make a judgement about a specific topic, based on elements provided by a group of experts, who debate in front of them about possible alternatives to address it.

Mental map
A representation of a specific area, from the point of view of individual perceptions. It allows to identify subjective perceptions towards a place, leaving room for feelings and emotions.

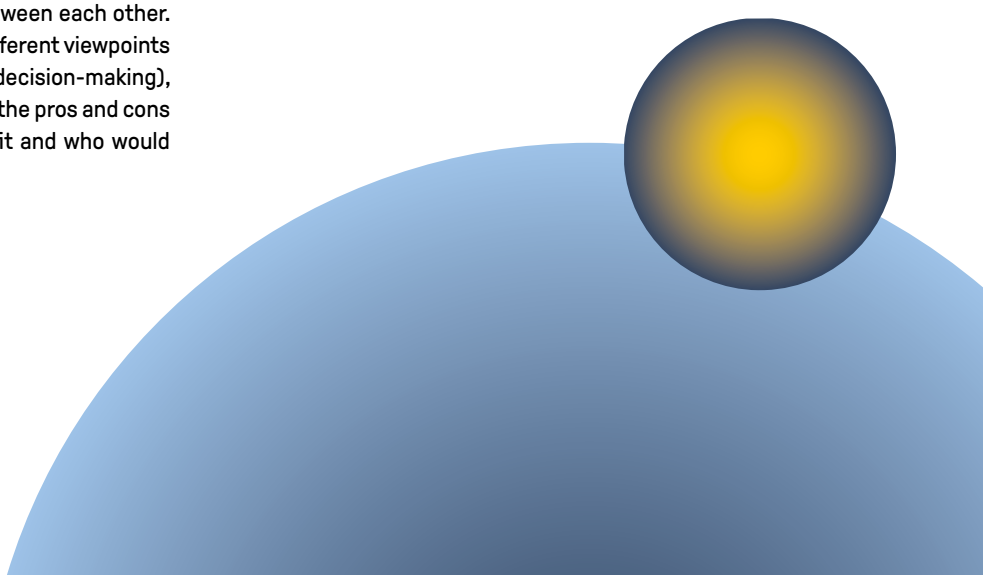
Multi criteria decision-making techniques
A decision-making methodology that supports considering all relevant aspects, and not only purely monetary parameters, when making a decision between alternatives options. It requires to first identify the relevant aspects to be considered (criteria), with respect to a specific decision-making process, then to estimate the effects the available options produce on them and to turn them into satisfaction values, and finally to weigh the relative importance of criteria between each other. It can easily be arranged in order to account for the different viewpoints by different stakeholder groups (multi-criteria group decision-making), thus allowing the final decision-makers to be aware of the pros and cons of each available option, as well as who would benefit and who would suffer negative consequences.

Planning cell
A participatory methodology supporting decision-making on specific topics, involving a group of twenty-five citizens randomly selected to debate on such a topic and look for effective solutions. The cell lasts for a few days, therefore participating citizens need to be offered a monetary compensation, which guarantees no biases in the composition of the group.

Requirement analysis
An analysis aimed at identifying the needs of all the stakeholders involved in a certain process, which also takes into account any internal or external condition affecting them.

Social safari
A participatory methodology supporting land planning and development processes. A group of 20-30 citizens from different target groups (for example, residents, shopkeepers, representatives of local associations, city managers etc.) spend some hours exploring together a specific site. During the exploration, they collect data, gather information, interview people, document observations. The collected material allows to better address existing problems and develop creative solutions.

Stakeholder analysis
A process aimed at identifying all the relevant parties with interests at stake around a specific topic, that might be affected by it either directly or indirectly (namely, the stakeholders). These include public and private bodies and organizations, as well as associations. Besides identifying who the stakeholders are, the analysis also aims at identifying how they relate to each other, as well as their position on the topic under discussion.



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