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WP2 – Literature review and research methodology project

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

URBAN EUROPE

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1. Introduction

The SmarterLabs project aims to develop a Living Lab approach to effectively deal with two major risks to the successful, widespread implementation of smart mobility technologies. In summary, these two risks concern (1) unforeseen barriers to large-scale adoption and change of socio-technical transport systems, and (2) exclusion of social groups not matching the required 'smart citizen' profile. This report constitutes the first main substantive output of the project (more precisely, of project Work Package 2), namely the literature review of the key concepts, theoretical approaches and methodologies used in the project by all partners.

The dual problematic and challenge of 'upscaling' and social inclusion guides the full project and the case investigations in Maastricht, Brussels, Bellinzona and Graz. These challenges, of course, transcend the specifics of smart city projects and are core themes in the history of studies on urban change and development. In that respect, and prefiguring some of the issues to be discussed in more detail in the following chapters, the current smart city hype runs the risk of repeating many of the same mistakes that have been made before (though under different conceptual headings).

First of all, the current fascination with smart cities tends to rely on rather generic notions of 'the city': rarely is there a real debate and understanding of the historical geography of the city under investigation and the ways in which a specific smart city project contributes to the reproduction or transformation of existing uneven geographies. As a result, the solutions proposed also tend to be generic - increasing 'quality of life', reducing energy consumption, more efficient management of traffic flows, etc. – with little attention paid to the impact of these solutions on the existing socio-spatial structure of a city and its hinterland.

Second, all too often this leads to technocratic forms of government mainly aimed at the implementation and testing of new, 'smart' technologies. This has two effects: a) we can observe smart city projects that are highly selective in their inclusion of stakeholders: digital entrepreneurs as well as technologically savvy and usually highly educated citizens, rarely working or migrant communities or citizens with limited digital skills; b) despite the technocratic orientation, a mismatch between the ICT-driven nature of the smart city projects and the wider institutional governance structure of a city with the 'smart' knowledge produced not being integrated into everyday administrative and bureaucratic procedures. As a result, many smart city projects are socially exclusionary and fail to upscale.

And third, even though there are various smart city projects that do explicitly try to engage with a wider range of stakeholders through various techniques of citizen participation, co-creation and the like, in most instances there is very little space to radically depart from the fundamental coordinates set by the local government. It is tempting therefore to understand smart cities as simply another expression of the post-political condition (Wilson and Swyngedouw 2014) in which cities have lost their role as polis, i.e. a place for true political debate, and in which citizens are reduced to pawns in a governance game aimed at creating legitimacy for state action. A key challenge therefore in the SmarterLabs project is to avoid these three mistakes and to develop action-oriented urban Living Labs that are socially inclusionary and can upscale.

Having set the scene in this brief introduction, in the following chapters we will further unpack, deconstruct and reconstruct the key literatures that are relevant to our project. The report is structured as follows. Following this introduction, in chapter 2 we discuss the key concepts that inform our research: smart cities; Living Labs; upscaling and social exclusion. In chapter 3 we situate these concepts within broader theoretical approaches that guide our thinking and structure our empirical research: behavioural change; urban commons; participatory planning; and socio-technical transitions. Chapter 4 introduces the four case studies (Bellinzona, Brussels, Graz, Maastricht) and the key methodologies and data collection strategies adopted. Chapter 5 offers a summary and brief concluding statements.

2. Key concepts

2.1 Smart cities and smartness

2.1.1 Conceptualising smart cities

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 spread of the concept is related to the growth in urban population worldwide and the increase in the size of urban agglomerations and the high urbanisation rates. While these processes can drive wealth creation and economic growth, it also contributes to high rates of resource consumptions, and to related environmental and health problems, challenging city managers for effective provision of services in the fields of energy, mobility and waste management. Also, growth in population and urban density intensifies social conflicts among stakeholders and groups in the urban community, where limited resources and differing interests and expectations increasingly clash with each other.

City decision-makers are therefore facing a variety of problems and are called upon to ensure better living conditions and favour sound economic growth (Nam and Pardo 2011; Chourabi et al. 2012). In this context, the smart city concept has evolved substantially from the ICT-based definitions of the 1990s, 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 integrative 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". The concept of Smart Cities, therefore, comes to include a range of different dimensions, i.e. smart technologies, smart people, and smart collaboration:

- *Smart technologies*: smart cities deploy sensor infrastructures for real-time data collection, transmission and storage, together with algorithms for automatic analysis of data and decision-making optimisation. 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 performing (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). However, a totally technology-based smart city concept, brings a series of limitations with it that urges to consider "smartness" also in other terms.
- *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 encounter barriers related to language, culture, (digital) skills or other limitations. 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 (Nam and Pardo 2011, Carayannis and Campbell 2004). The potential of creativity and technology is in fact fully exploited when governing choices are 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 have coined the concept of "human smart cities" (Marsh et al. 2014; Duarte de Oliveira 2016).

Needless to say, this conceptualisation of smart cities is extraordinarily broad and raises the question what is new about smart cities, since by and large the terminology refers here to urban processes and phenomena already captured by other and older concepts: such as learning cities, local innovation, human capital or tacit and codified knowledge.

2.1.2 Smart city policies and projects

Despite or perhaps because of the vagueness and fluidity of the smart city concept, it has become an enormously popular conceptual reference in planning and policy documents as well as concrete projects across the world (and particularly so in the EU). Many of these projects, however, remain at the level of small-scale pilots or fragmented initiatives and are not effectively upscaled to the city-wide level (Kitchin 2015; March and Ribera-Fumaz 2014; Pow and Neo 2013). 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. 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).

2.1.3 Limitations of smart city initiatives

Hollands (2008) argues that smart city initiatives are often presented in self-congratulatory ways by 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 the main critiques and limitations as discussed in the 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 optimisation of infrastructure and services, while this is inherently impossible – besides being not 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). However, since no Pareto-optimal solutions can be found for complex systems as cities (Sen 1970), 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-politicisation of city planning and management, reduction of political conflict

and resistance and the 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.

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 a 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 marginalisation, 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). Marginalisation 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 polarisation, 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 marginalisation 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 the smart cities literature. However, there is 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 dissuade citizen from engaging in smart city initiatives. Therefore, smart cities projects can be successful only if they actively guarantee privacy protection.

Increase in overall resource consumption: 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 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, notes 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 weekend consumption patterns and travels.

2.2 Living Labs

2.2.1 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. (2007) 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, Niitamo, Kulkki & Hribernik 2006; Juujärvi & Pesso 2013; Liedtke, Welfens, Rohn, & Nordmann 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 & Horst 2013). Living Labs are now embraced as iterative user-centric ecosystems, through which co-creation is considered an ideal practice (Schuurman, Lievens, de Marez & Ballon 2012; Schuurman, Lievens, De Marez, & Ballon 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.

2.2.2 Urban Living Lab (ULL) 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 & Betsill, 2013; Hodson & 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. 2015; Bulkeley and Castan 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 & Castán Broto 2013). When combined with the significance placed on 'the city' as a forum for climate change and urban action, interest in ULLs as a form of governance is growing (Baccarne, Schuurman, Mechant, & De Marez 2014; Evans & Karvonen 2014). The pursuit of alternative strategies in urban areas for sustainability, and distinctly multi-faceted approach to urban experimentation associated with ULLs thus ensure an effective leverage for interdisciplinary European research funding (Veeckman & Graaf 2015; Voytenko et al. 2015).

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 2014a). They represent a concept, arena and practice of co-creating innovation to tackle societal challenges (Evans & Karvonen 2014; Voytenko, McCormick, Evans & Schliwa 2015). 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. 2015). 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 & Karvonen 2014; Nevens, Frantzeskaki, Gorissen, & Loorbach 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 & 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. 2015; Karvonen and van Heur 2014b). 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. 2015). 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 (Raven et al. 2008).

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 & 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 (Bulkeley et al. 2015; 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; Bulkeley et al. 2015; Feola 2014; Voytenko et al. 2015), there is recognition within the ULL literature that a systematic approach to learning on a case-based level is lacking (Bulkeley et al. 2015; McCormick et al. 2014). 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. 2015; 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. 2015). 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 & Doyle 2015; Raven 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 (Bulkeley et al. 2015; McCormick & Kiss 2015; Voytenko et al. 2015; Bos and Brown 2013; McCrory 2016).

2.2.3 Smart cities and Living Labs: towards SmarterLabs

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 & Lenhart 2016). Examples such as the Oxford Corridor, Manchester (Evans & Karvonen 2014), Smart Kalatasama District, Helsinki (Ojo, Curry & Zeleti 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.

Table 2.1 Limitations and Strategies

Limits to *smart cities* and *Living Labs*	*SmarterLabs strategies*
Excessive faith in technology and resulting neutrality of decision-making, implying risk of de-politicisation and lack of citizen empowerment.	Avoid heavy technology, infrastructure-led programmes. Instead, favour soft technology programmes 'owned' by citizens.
Lack of prerequisites for fair and proactive 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 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.
Wide diffusion of ICT infrastructures and services might increase natural resources and energy consumption.	Explicitly assess possible unintended, large-scale and life-cycle effects.

2.3 Smart mobility and urban systems

2.3.1 Development of urban (mobility) systems

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 1992), 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. Blowers 1993; 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 2002).

2.3.2 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 (May et al. 1998; OECD 2000). 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 1999, 2002, p. 201).

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)

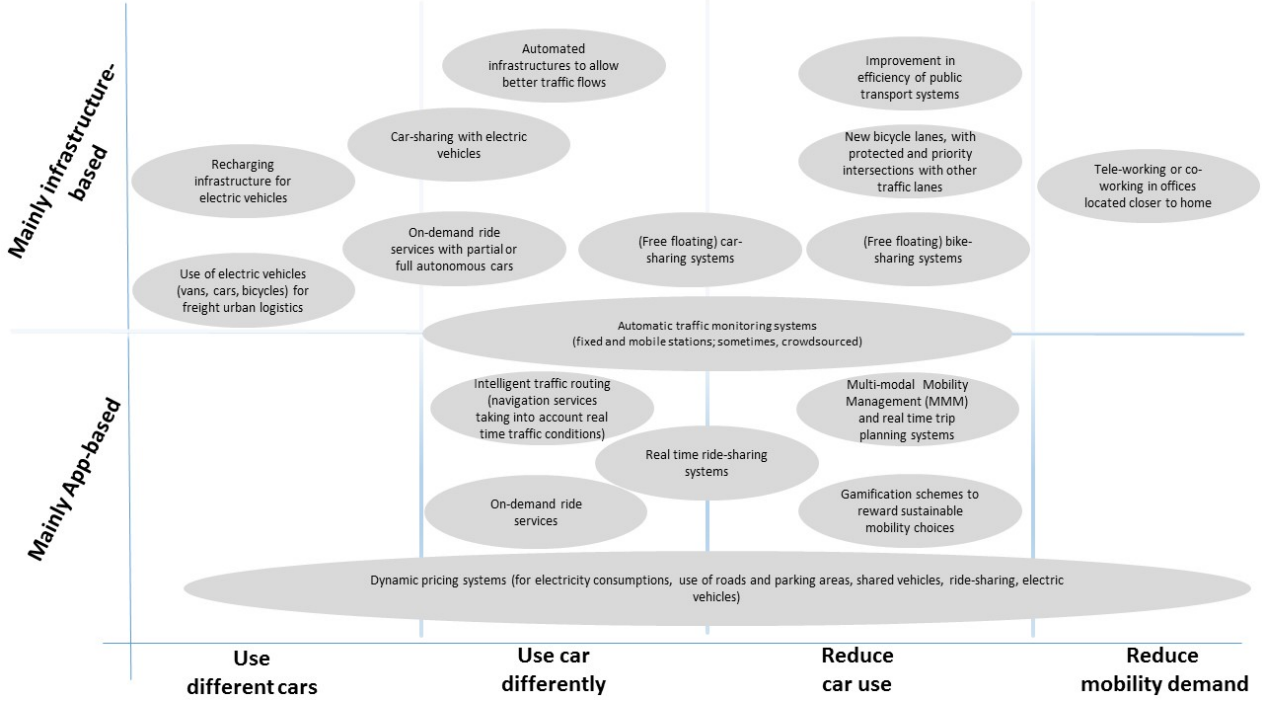
prefer living in central urban areas, where all the commodities are easily reachable within walking distance (Frontier Group and U.S. PIRG Education Fund 2012);

- 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 (OFS and ARE 2012) and favouring use of public transport (Frontier Group and U.S. PIRG Education Fund 2012; McDonald 2015).

2.3.3 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 2.1 shows the resulting double-entry classification.

Figure 2.1 - 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.

2.3.4 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.

2.3.5 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) notices, 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 in sections 2.1 and 2.2, 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.

2.4 Upscaling and the politics of scale[1]

Having now discussed the key concepts of smart cities and Living Labs as well as the role of 'smartness' in mobility initiatives, in this and the following section we turn to two of the main explanatory interests of our SmarterLabs project: first, the problematic of upscaling often very small-scale and temporary smart city and/or Living Labs initiatives; and second, the challenge of developing these initiatives in a socially inclusionary manner.

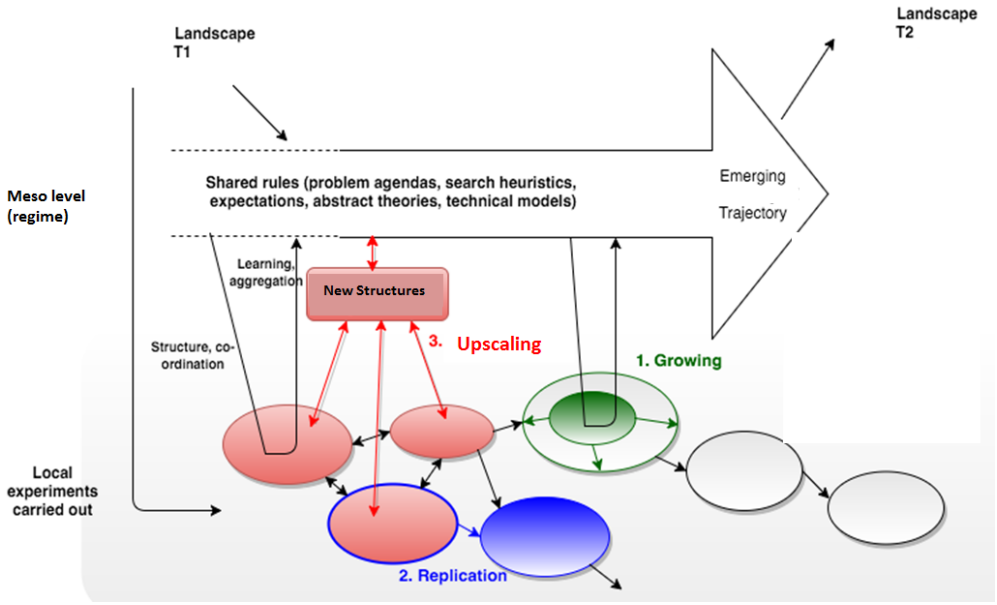
In this section our focus is on 'upscaling', which as a concept has been most explicitly theorized in the transition studies literature (also discussed in chapter 3). The conceptualisation of upscaling has evolved over time, and is still not uniform across different studies. The term was used first in 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 2.2 illustrates how we distinguish upscaling from diffusion and growth.

[1] We thank Rene Kemp, Joop de Kraker, Christian Scholl and Tim Strasser for their useful comments and discussions, which helped to improve this section.

Figure 2.2 - Upscaling, replication and growth (Figure is an adapted version of Naber 2016[2]; and Geels and Raven 2006)



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 the following table:

Table 2.1 Views on the transferability of knowledge and relation to upscaling

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

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 LL's 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 (e.g. 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.

[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).

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 (NESTA 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 5 categories have been identified from a set of 24 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 1997) 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 1993) 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" (946). 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 & 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).

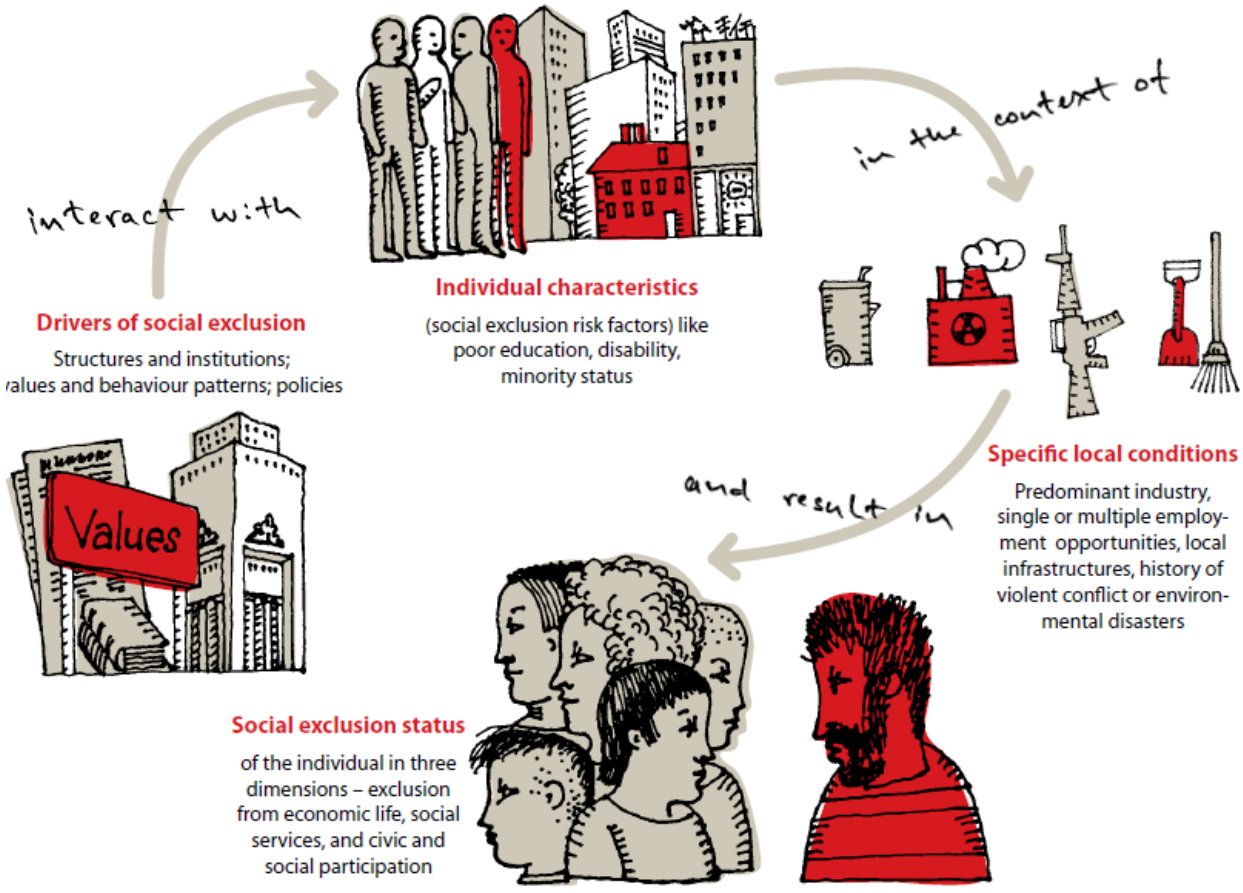
2.5 Social Exclusion

2.5.1 Inclusive and exclusive societies

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) 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.' (Levitas et al. 2007: 9)"*

In the UN report "Beyond Transition: Towards Inclusive Societies" 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.

Figure 2.3 - 'Social exclusion' chain (UNDP 2011, p. 13)



Important insights of the report are:

- 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.

The report captures the complexity of social exclusion through a multidimensional **Social Exclusion Index**, a measure that is based on 24 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 24 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 24 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.

2.5.2 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 & Karvonen 2013).

In the context of smart city Living Labs, attention for social exclusion can help policymakers, as it does in transport policy debates (Lukas 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.

When studying exclusion, the following questions are relevant:

- Who are the users and non-users?
- Are certain prospective users (who are deemed to use the technology or knowledge) excluded? If so, through what mechanisms did this occur (proximate and ultimate/structural factors)?
- Are all users equally well-serviced? Could those who are not well-serviced have been better serviced? What is the cause of poor servicing? Were the needs of certain people/groups ill-considered by smart mobility providers (and if so, how did this happened)?
- What design elements of the innovation are a ground for exclusion? What factors/considerations led the suppliers to opt for the design chosen?
- Was the exclusion anticipated?
- In retrospect, could certain types of exclusion have been prevented or reduced? How?
- Is the innovation reproducing or even reinforcing/deepening aspects of exclusion (of vulnerable groups) in society?

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.

3. Key analytical/theoretical approaches

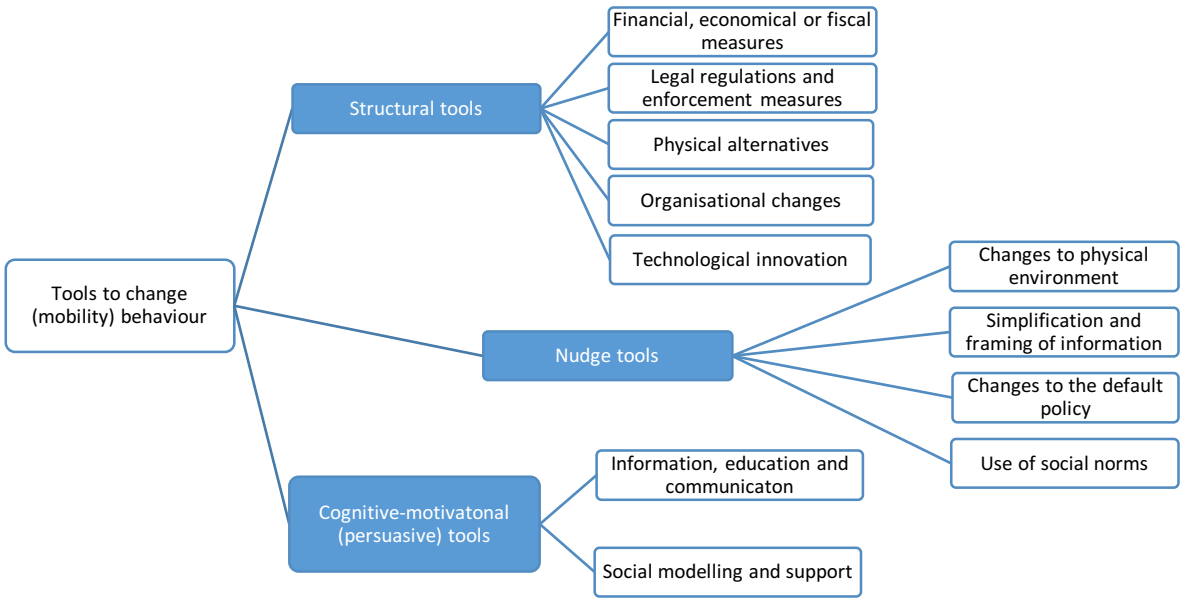
3.1 Behaviour change: towards a smart urban mobility

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.

3.1.1 A typology of policy tools for behavioural change

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 3.1 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 (Ezell, 2010). 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 (see chapter 4.1) 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.

3.1.2 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, 2009), 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.

3.1.3 Behavioural Change approaches and the SmarterLabs project

The reflection on different tools and approaches for behavioural change which were illustrated above are relevant for the SmarterLabs project. In all four cities, in fact, the activities carried out as part of the project will possibly contribute to change individuals' mobility behaviours, producing an overall impact on urban mobility toward the reduction of car use and the increase in use of public transport and slow mobility. In this context, the literature on behavioural change allows to frame different elements of the four Living Labs, possibly providing insights on their direct and indirect implications.

Both in Bellinzona and in Brussels, for instance, the Living Labs exploit "Cognitive-motivational (persuasive) tools", which possibly impact the participants behavioural pattern. In Bellinzona, in particular, participants to the Living Lab will be invited to develop an app offering possibilities to increase one's environmental awareness through eco-feedback (information on one's mobility patterns); to set individual goals; to compare own performance with other users; as well as a set of educational elements and individual challenges to reach the goals (i.e. "Information, education and communication" and "Social modelling and support"). In Brussels, in turns, LL participants will carry out a participatory campaign to measure exposure to pollution, the results of which will potentially increase their awareness and their understanding on the relation between mobility and air quality (i.e. through "Information, education and communication").

After this initial phase both Living Labs will move on toward a second phase where “Structural Tools” will be mobilised, the specific choice of which will depend on the set of measures that the participants will identify. Once developed the app, the Bellinzona LL will turn into a wider, more open arena, inviting also other local stakeholders (e.g. less digitally oriented) to join in, to discuss daily personal mobility experiences and think of the alternatives to car use available to them. This discussion will be a mean to build capacity and possibly enhance future local policies by identifying the structural elements (e.g. Urban planning measures, Organisational changes, Physical Changes, etc.) the local community would need in order to actually reduce car use. Similarly, in Brussels, LL participants will possibly build on the newly developed awareness and ask local decision-makers for “Structural tools” aimed at reducing traffic (e.g. financial, economic or fiscal measures, or the development of new, stricter, regulations and enforcement measures). In addition to that, the knowledge generated during the initial phase of the LL, could also potentially be used to persuade citizens who did not participate in the LL to change their behaviour (e.g. “information, education, communication” tools)

All activities of the Graz and Maastricht Living Labs, conversely, could be framed as “Structural tools”. In Graz, the redevelopment of Griesplatz will allow to turn an anonymous, congested urban square, in a liveable and lively high-quality public space, offering both an effective tram inter-change station and new opportunities for their leisure time. Besides improving accessibility to public transport, the re-design of the square will also allow improving effectiveness of public transport at the wider city level, thus stimulating citizens living outside the Gries neighbourhood to reduce their car use (i.e. “Physical alternatives” tools). Similarly, in Maastricht, the LL will focus on the participatory identification of “Structural tools” to be offered by the new railway station, which is being turned into an inter-modal transport hub. Renovation of the station area will in fact undergo both physical intervention on spaces and structures offered to travellers (e.g. “Physical alternatives”) and intangible intervention on public transport timetables, with the aim of increasing possibilities for multi-modal interchanges (e.g. “Organisational changes”). All interventions will possibly increase attractiveness of public transport, thereby promoting a behavioural shift of inhabitants of the wider area toward reducing car use.

3.2 The urban commons

This section briefly presents key issues of the debate surrounding the urban commons, and outlines how the term is understood and used. We then illustrate how the urban commons discussion refers to both the thematic areas of the SmarterLabs Project and in general to the Living Lab approach. Finally, we show how it also offers a relevant framework to disentangle urban and metropolitan governance dynamics, in particular in relation to the risks of social exclusions and to the barriers to upscaling.

3.2.1 Conceptualising the urban commons

In the last years, a combination of socio-economic and demographic urbanisation trends, and an increasingly vocal critique against the spread of neo-liberal approaches to the governance of cities has boosted interest in the urban commons in the academic debate, in policy making and in civic activism (e.g. see Kip 2015). The term 'urban commons' is being used by authors of different disciplines (law, history, geography, sociology, anthropology, economics, political science, urban planning, performing arts…) and, whilst a comprehensive and broadly accepted definition of the concept is yet to be found, a survey of the literature allows outlining the conceptual building blocks for the study of the urban commons. For the purposes of our analysis, in particular, we refer to the work of Dellenbaugh et al. (2015, 13) who present the urban commons as a construct constituted of **i) common resources, ii) actors/"pro-sumers", and iii) *commoning* institutions**, i.e. the process of collective negotiation on how to use that resource.

Organising the complex reality of urban and metropolitan governance along these lines is particularly helpful for scholars and policy makers interested in how different governance systems enable individual and institutional actors to solve problems collectively. The analysis of the nature of the resource is helpful, for instance, to disentangle issues related to its production and reproduction, and to the extent this can be (jointly) consumed. The analysis of the actors, in turn, is instrumental in understanding the capabilities of both individuals and organisations, their motivations, and how these shape their own choices and attempts to change other actors' behaviour. The analysis of the institutions, finally, allows to appreciate how formal and informal rules both are shaped by and shape the actors' strategies and the qualities of the resource. The analysis of the institutions can also lead to specific policy recommendations, based on examples of failure or of success.

The city as a common resource

When defining the commons, a reference that cannot be avoided is Ostrom's seminal work on the governance of the commons (Ostrom 1990). Ostrom typifies the commons by considering issues of resource scarcity and access: a commons is a good that is at the same time subtractable (i.e. its availability decreases with use)[3] and non-excludable (i.e. it is characterised by open access - at least at certain scales). Because of these characteristics, the commons are vulnerable to the tragic conditions famously depicted by Hardin (1968): the privatisation of the profits (i.e. individuals enjoy the full benefit of using a resource) and the socialisation of the costs (i.e. individuals share the cost of use with the whole community of actors) produce perverse incentives where an individual's optimal choice leads to sub-optimal collective results, unless adequate governance mechanisms are devised. (among others, see Foster 2011)

This characterisation has typically been used for natural resources such as fish stocks, timber, or water (generally referred to as common pool resources or CPR). In more recent years, however, other kinds of material and symbolic resources have started to be labelled as commons, leading to a fundamental reconsideration of the definition of the term. Hess (2008), for instance, speaks about "new commons", reviewing the variety of goods and resources that came to be labelled this way. Building on her map of the commons, a typology that is relevant to our research distinguishes the commons according to their origin, i.e.

[3] There are different nuances to the concept of subtractability, such as the (im)possibility of using the good in different moments, or of joint use up to a certain threshold. The bottom line, however, is always that the availability of a rival good decreases with use.

natural and man-made commons. Both of them share the essential conditions of scarcity and non-excludability. These two aspects, however take a somewhat different nuance for the man-made commons. Scarcity and availability of a man-made commons depend both on the level of consumption of that good (like the natural commons), as well as on the level of production. As far as access is concerned, the situation is also partially different inasmuch as the value of (certain) man-made commons is not only intrinsic, but also depends on people using them. Phrased differently, access does not only lead to consumption, but also to increasing the value of that resource (Foster and Iaione 2015, 23)(see also Rose 1986; Borch and Kornberger 2015).

Much like natural commons, the risks that man-made commons run also depend on scarcity and access, but the scope is somewhat broader. First, it is not possible to talk merely about over-consumption, but more generally of a situation of scarcity that depends on individuals overconsuming *and/or* underproducing the good. Second, the issue of open access, can either lead to a situation of congestion ("too much access") *and/or* of abandonment ("too little access"), both of which are detrimental for the sustainability of the resource. The commons' scarcity and open access, in other words, imply that its sustainability depends not only on how the community of actors moderate consumption and maximum access, but also on how the same community deals with issues of production and minimum access.

We subscribe to the definition of commons as resources that are typically non-excludable and scarce, and therefore vulnerable to risk related to inadequate levels of access and availability; and more specifically we look at the city itself as a common[4]. Indeed, quite unlike medieval walled cities, modern cities are in a situation where controlling access (and exit) of people, firms, capital and goods is virtually impossible: cities such as congested Paris or deserted Detroit offer meaningful example of the consequences of it. Scarcity of the urban space, conversely, becomes visible when looking at the land prices that characterise urban centres, but also at the consequences of crowding in the use of infrastructures and urban services (see, for instance Fennell 2014).

Actors

Man-made commons (i.e. the urban commons) are commons characterised by a community of actors that benefit from the resource and at the same time have full stakes in its production and reproduction. This leads to a substantial overlap between the group of those who produce the good (providers) and the group of those who benefit it from it (appropriators). In the context of the city as a commons, this appears evident when looking at a process that, according to Scott and Storper (2015), defines the very nature of cities: the process of agglomeration.

Agglomeration is the "basic glue that holds the city together" (Scott and Storper 2015, 7) and can be defined as a process that facilitates sharing (e.g. of large facilities), matching (e.g. of jobs and people) and learning (e.g. about more productive ways of working), giving rise to powerful economic gains (Duranton and Puga 2004). It results from countless explicit and implicit decisions of people and firms (i.e. the commoners?) that come together- however reluctantly and agonistically - to harvest the urban advantage, while making decisions that also contribute to produce it. At the same time, the same self-interested behaviour of people and firms seeking advantageous locations also leads to collective action problems such as congestion, free-riding, conflict, overuse, and pollution, which potentially compromise this advantage (On these issues, albeit from different entry points, see Harvey 2012; Foster and Iaione 2015; Fennell 2014; McGranahan and Satterthwaite 2014). This tension (i.e. a potential tragedy of the commons) implies that the long term survival of the urban common is only possible if adequate governance mechanisms are defined.

[4] The term Commons has been used in the urban context in different ways. On one hand, there is the research that is concerned with commons that are physically located in cities and on the peculiarities that depend on their location (urban commons as 'commons in cities'); and on the other the research, to which we wish to contribute, that focuses on the city itself as a commons. While the two nuances are not mutually contradictive, they indicate two different entry-points to the study of the urban commons.

The diversity and abundance of households and firms co-producing the city and appropriating the urban good through their choices and behaviours is reflected in the number of actors that in one way or the other contribute (or aspire to contribute) to its governance. Indeed, while the literature offers different analyses of the process and of the costs and benefits it implied, there seems to be a certain consensus that (local) governments are not the sole actor that steer the governance of the city. Indeed, the *de jure* or *de facto* increased role of other stakeholders, ranging from the civil society, to the business community, and the academia (also referred by some as the process of scaling out, see Reed and Bruyneel 2010), is increasingly being acknowledged both by those who commend and by those who criticise this shift.

The governance of the urban commons

A key element in the discussion on the (urban) commons concerns the way these are governed. Traditionally, scholars and policy makers would argue that the only mechanisms to ensure the long term survival of the commons were either regulation by a third party (i.e. most typically public institutions) or the attribution of property rights and the privatisation of the commons for the market to address scarcity related issues. Ostrom's 'Governance of the Commons' (Ostrom 1990), is arguably one of the most famous studies that challenged this view and illustrated the existence -and the success- of a "third way", namely the collective governance of the commons (also referred to as commoning practice). In the last 25 years the discussion on the governance of the commons has evolved substantially, engaging numerous researchers to investigate the success and failure of collective approaches to govern a number of different commons, including the urban commons.

Foster (2011), for instance, illustrates the rationale and the limits of collective management (e.g. community gardens, neighbourhood park groups of friends, or neighbourhood foot patrols among others) in comparison with public regulations (e.g. public space zoning) and privatisation (e.g. gated communities or private inner city neighbourhoods). Focussing on collective/actors-driven governance systems for the city as commons, Foster and Iaione (2015) present a number of key pillars, including horizontal subsidiarity, collaboration among stakeholders and polycentricism. While the authors acknowledge that no system alone can fully resolve the collective action problems of the urban commons, they outline a number of solutions towards "an alternative vision of city governance in which heterogeneous individuals and institutions can collaborate together to co-create or co-govern the city, or parts of the city, as a common resource" (Foster and Iaione 2015, 50). A collaborative logic in urban governance includes a process of identification of common goals, of the means to achieve those goals, and of the mechanisms to share roles and responsibilities in the implementation of them. While the institutions of representative democracy still play a key role in this process, other civic arenas become important to increase and deepen public participation. Living Labs (LL) provide an example of such arenas, where citizens, associations and research institutions jointly develop knowledge on the urban commons and become co-creators of innovative approaches to their governance.

3.2.2 Urban commons and the SmarterLabs project

Urban mobility and the commons

While it might be straightforward to illustrate the governance of resources that are well defined in scope and size (e.g. timber, fishery resources or even a housing lot), the question of city governance remains an elusive proposition, quite difficult to operationalise. "The city", in fact, is made of a conundrum of symbolic and material components that do or do not have the characteristics of the commons. This is why it is often the case that the governance of the urban commons comes to refer, for instance, to the organisation of certain dimensions of urban common living or the management of institutional and physical infrastructures that have been established as a form of mediation between the commons and the commoners, e.g. a city's mobility system.

Different aspects of urban mobility have already been looked at through the lenses of the commons. Gutscher et al. (2000), for instance, writes about traffic space as a CPR being appropriated continuously -but temporarily- by drivers. Congestion, he argues, is a consequence of local and temporal overuse of the resource

(i.e. open access of the street means that there are too many drivers, whereas scarcity means that the street fills up resulting in congestion), which in turns leads to drivers' psychological stress, accidents, emissions, and excessive economic costs in the form of unproductive work down-times. His study outlines some preliminary results of an awareness raising campaign aiming to reduce road use at peak times. The campaign is presented as a way to avoid overuse through citizens' coordination rather than through regulation imposed from above. In other words, the governance of the street (i.e. the control of how many drivers can use it and for how long) is not in the hands of an external authority. Rather it is left to the drivers themselves to decide on their own behaviour, based on a distributed knowledge of the collective impact of their choices.

Künneke and Finger (2009), moreover, argue that many infrastructures services (including some component of the transport network) can be perceived as CPR, and include in their analysis not only final users but also the stakeholders responsible for assuring the functioning of the system. They also illustrate how infrastructures suffer from typical CPR problems that, given the observed limitations of state and market, could be addressed through forms of decentralised governance. Building on this approach, Glover (2011) writes on public transport, as a collection of infrastructures, in terms of CPR. In particular, he illustrates how public transport suffers from collective action problems, both in the provision and the appropriation of the resource at different scales.

Four Living Labs

The discussion on the urban commons offers a relevant entry point to look into the dynamics of the SmarterLabs project. The cases of Bellinzona, Brussels, Graz and Maastricht offer examples where different urban stakeholders join hands to participate in urban decision making and to devise mechanisms of collective governance. Indeed, a key objective of the SmarterLab is precisely to test a methodology to fully engage different groups of city-users into decision-making. In the four LL, the city is a commons, and the mobility is a set of infrastructures, institutions and individuals' practices that mediate between the citizens and the common resource. In the Graz and Maastricht case, more specifically, the commons resource is a specific neighbourhood within the city, which is used by passerby and commuters and at the same time co-produced by the same people. In the Bellinzona and in the Brussel LL, in turn, the focus is broader and concerns the city as a whole. In those two cases, though, participants collaborate to develop a shared knowledge on specific issues related to the production and the appropriation of the common resource (e.g. mobility behaviours and choices), as well as to (un)desired outcomes of collective behaviour (i.e. accessibility, congestion, pollution).

The conceptual lenses of the urban commons are also relevant to explore the underlying dynamics among the different stakeholders that are engaged in each lab. All LL engages directly and indirectly with different actors, ranging from policy makers, to universities, associations, businesses and citizens (actors). In this context the urban commons framework can help to understand the different motivations and capabilities that the various actors are likely to have, as well as collective action problems (e.g. freeriding, moral hazard…) that are likely to result, and the potential of coping strategies.

As mentioned above, finally, Urban Living Labs have been presented as an innovative form of collective governance, that complement the institutions of representative democracy and help to increase and deepen public participation (Foster and Iaione 2015, 53). In this context, the collaborative process between researchers and practitioners, potentially allows looking in a reflexive manner into the process of collective identification of shared goals, the means to achieve those goals, and the mechanisms to share roles and responsibilities in implementing them. The SmarterLabs, in all four cities, offer a platform to test said cooperation, to identify its potential to steer the city toward a more sustainable future, as well as the limitations in terms of effectiveness but also of exclusion and inclusion of different social groups.

3.2.3 Understanding the barriers to social inclusion and upscaling

The urban commons discussion also offers an entry point to understand issues related to social inclusion and upscaling, which is the analytical focus of the SmarterLabs.

Urban commons and social exclusion

Exclusion has been treated in the urban commons discussion from different angles. For the purpose of our analysis, it is relevant to focus particularly on issues of exclusion from the governance of the urban commons. The renewed impetus in reclaiming the city as a commons is often framed in the context of fighting social exclusion: collective governance would be presented as an inclusive solution vis-à-vis state-based and market-based solutions that allow for (and even lead to) exclusionary results as a consequence of unevenly distributed political and economic power (e.g. see Harvey 2003; Kratzwald 2015). In this context the Living Lab can be regarded as an explicit attempt to minimise exclusion in the governance process.

A second, more nuanced, perspective looks at issues of exclusion in the practice itself of collective governance. While, in principle, collective governance implies the engagement of all actors in the exercise of power, in practice it might happen that collective governance mechanisms replicate the power imbalances that exist in society and certain groups are *de facto* excluded from the decision making process. For example, this can happen when an actor (individual or collective) gets excluded at the project design level, or when explicit or implicit barriers prevent the actor to fully participate (e.g. lack of time to participate in a meeting, lack of intellectual resources to fully understand the issues at stake, lack of financial resources to support implementation of decisions…) (Evans and Karvonen 2014). In urban mobility projects another element of potential exclusion concerns the place of residence of an actor or its relation to the city. In this context exclusion would materialise along fracture lines such as those between residents and commuters, or between citizens and city-users.

There is a growing interest in Living Labs as a way to counterbalance distributions of power, for example through the very way that experiments are constructed, and the mechanisms that are adopted. Through visioning processes, joint problem framing, and typically horizontal decision making, SmarterLabs as a conceptual framework represents an explicit attempt to account for the processes of exclusion that are typical in participatory settings. Furthermore, as a form of collaborative governance that rests upon experimental learning and reflection, SmarterLabs can be considered in our analysis as a concept that is conducive to inclusion in theory, and as a method, attentive to the risks of exclusion in practice.

Urban commons and upscaling

Urban commons scholars also regularly speak about issues related to the existence of multiple scales, and in particular on the question on how this conceptual framework can "jump" between scales, both in terms of the nature of the commons and in terms of its governance. When scaling up or down, the nature of a resource in terms of scarcity and access can change. This is the case, for instance of land trusts, an alternative model of land ownership where a portion of land is owned and managed internally as a commons, but which exists at a broader scale as legal private property. These cases are often referred to as "commons on the inside, property on the outside" ("About the Commons | On the Commons" 2016). Another element that can change at different scales is the kind of actor that competes and cooperates for the use of a resource, ranging from single individuals, formal or informal groups of individuals, coalitions of groups and so on; at different scales, the urban commons framework (or more broadly collective-action theory) remains relevant to illustrate the capabilities, motivations and strategies of all kind of actors.

Similarly, the normative prescription and the actual governance of the commons is likely to be different at different levels. The possibilities that exist at one scale, indeed, do not necessarily carry over to other scales,

as the very nature of the commons problem and of its solution change significantly (Harvey 2012, 69)[5]. In this context, the literature often focuses on the extent to which is possible and legitimate to "nest" governance mechanisms into each other, preserving or not the principles of collective and collaborative governance, through solution such as polycentric systems, subsidiarity, confederations (ibid).

This discussion is particularly relevant to understand and to frame the process of translation of the experience of the Living Lab as a collaborative experience between a limited number of actors, into in the way the city (or specific aspects of urban common living) is governed. In other words, while the urban commons discussion offers analytical lenses to look at the individual and collective behaviour within a specific project (i.e. SmarterLabs); it also helps framing how this approach carries over (or fails to carry over) to the next level, namely to the existing urban and regional governance structure.

[5] Interestingly, in some cases, the discussion on scales intertwines with issues of social exclusion. This happens talking the governance of certain goods (e.g. gated communities) which are managed as commons at the scale of individuals or households, but are treated as de facto private goods at the urban, where they prevent access (i.e.) to non-users.

3.3 Participatory planning

3.3.1 Urban Planning

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. 2009, p. 782).

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, that is 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.

3.3.2 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 E. 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).

3.3.3 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 (e.g. Rowe and Frewer, 2000). Other approaches focus more on the theoretical frameworks, especially distinguishing between normative and/ or pragmatic participation (e.g. 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; Garcia 2006; 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; Garcia 2006). 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).

3.3.4 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 (European Commission 2001, p. 7). 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 Marising et al. 2006).

3.3.5 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.

3.3.6 Co-Creation and Living Labs

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, p. 296).*

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; Kerkhoff and Lebel 2006), such as translation of knowledge from one community to the other(s) by various types of knowledge brokers (Pielke 2007; Jasanoff 1990), exchanging knowledge in participatory platforms, and by forms of knowledge co-production (e.g. Hessels and Van Lente 2008; Gibbons et al. 1994; Kemp and Rotmans 2010; Scholz et al. 2006). 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.

3.4 Socio-technical change

3.4.1 Overview

Studies of socio-technical change originate from sociology and history of technology. From the 1980s onwards, authors in this strand have emphasized the social context in which technology is created and used (Bijker, Hughes, Pinch, Latour). A key concept is *social construction of technology* (SCOT), where 'technology' is viewed not as an objective entity (as in economic and technical studies), but rather described 'through the eyes of social groups'. These authors demonstrated how various social interpretations of technology shape (and are shaped by) various directions of technological development (see for instance Bijker 1995 on the historic development of the bicycle).

Since the middle of the 1990s a socio-technical transition perspective was developed by combining a socio-technical perspective with elements of evolutionary economics (Rip and Kemp 1998; Hoogma et al. 2002; Geels 2002, 2005; Geels and Schot 2007). Transition studies have highlighted more than previous studies the patterns in which established technologies are sometimes abandoned and overthrown by emerging niches. Transitions are considered societal processes of fundamental change not only entailing new technologies but also changes in markets, user practices, infrastructures, cultural discourses, policies and governing institutions. There are continuous dynamic interactions and co-evolutionary processes between different structures and practices of the system and its subsystems (Kemp 1994; Geels and Schot 2007). Transitions are usually long-term processes (one or more 'generations'). Research on transitions offers insights about processes, events and agents and their role in influencing or building-up on a transition as well as how processes, events and agents interact throughout a transition.

The transition perspective has been applied to explain dynamic *stability* and incremental change on the one hand, and radical innovations and system *change* on the other. To explain stability, the notion of sociotechnical regime plays an important role. It refers to the socio-technical system that has grown between the hardware, user perspectives and practices (reflecting their preferences and endorsed social connotations), producer capabilities, business models and production technologies, regulations, and supporting institutions, etc. Regimes are socio-technical *ensembles* that have been aligned and, over time, reproduce the conditions for their own continuation. For example, for the practice of travelling the prevailing passenger mobility regime is based on private vehicles with internal combustion engines, an example of a socio-technical system in which dynamic stability is obtained through economies of scale and scope, sunk costs (in production tools, infrastructures etc.) and social expectations and learning (in travel times, cost and convenience etc.). Although alternative regimes can be contemplated, they are not easily realized because they would have to go through a process of emergent realignment during which they must compete against well-developed alternatives.

To explain change, transition studies use concepts such as 'niches', which are protected spaces where potentially radical innovations emerge, and 'socio-technical landscape', which are external developments that can create pressure on existing regimes. The key idea is that a regime shift (i.e. transition) emerges from the interactions between niche, regime and landscape dynamics. These interactions can proceed in various forms, but one pattern has received most attention in early transition studies (Geels 2002), comprising of three interrelated processes: (1) niche innovations build up internal momentum over time, (2) landscape changes put the regime 'under pressure', and (3) regime destabilisation offers windows of opportunity for niche innovations to be scaled up, displace the old and establish a new regime. Outside the field of transition studies – in studies of socio-technical change and urban studies- a similar notion as regime (stability) has been labelled obduracy (Hommels 2005).

3.4.2 Socio-technical transition

In studies of transition (especially those from an MLP perspective) there is often an implicit emphasis on national or sectoral scale transitions, neglecting other spatial scales. In cities, for instance, there is a meta-regime for urban planning and governance that tries to coordinate the spatial interaction and competition of sectoral regimes (mobility, energy, housing, water, industry etc.) (Raven 2016). Transitions approaches have

said little about cities and what the multi-level perspective on systemic transitions can contribute to understanding urban social-technical transitions.

Nevertheless, various scholars have applied the concept of social-technical transition to promote sustainability in practice, including urban mobility practice. Approaches such as strategic niche management and transition management, address how policy and governance can shape the multi-level dynamics. The first process, niches building up momentum, has received most consideration. Kemp et al. (1998) described how niche innovations can gain momentum through the building of social networks around a new practice in which more and more diverse actors become enrolled, and through collective learning processes. Through practical experiments – for instance, the introduction of 350 lightweight electric vehicles for everyday use in Mendriso, Switzerland, in the 1990s (Hoogma et al. 2002) – niche actors learn about technical design, production, infrastructures, markets, cultural meaning and regulation and policy-making. Policymakers should act as enablers and catalysts rather than regulators or technology sponsors. Price incentives have a role to play in transitions, but are insufficient to trigger them. Transition management (TM) has a broader scope than strategic niche management, applying the transition concept to promote sustainability initiatives, policy and activism. It tries to empower and mobilize the undercurrent of sustainable development by offering a framework and language for systemic change (Loorbach 2007), such as long-term thinking, multiple domains and actors, learning, system innovation and maintaining a wide playing field (Rotmans et al. 2001)[6].

3.4.3 Upscaling

How will new urban experiments then, depicted as socio-technical niches, co-evolve with the established, the urban regime? What may be knock-on effects of the niche scaling up? Geels and Schot (2007) have proposed a typology of transition pathways (i.e. of multi-level interaction patterns). Interpreting their typology with the Regime Evolution Framework (Dijk et al. 2015) we can sketch six different stylized urban pathways (see Figure 3.2):

Pathway 1: Stable, but minor add-on. In this pathway, the niche scales-up but stays relatively small, co-existing with the (sub)regime(s) in a neutral way. The niche simply forms an additional practice in the sector. An example is the introduction of Park & Ride facilities in Amsterdam, as in many cities.

Pathway 2: Niche dies soon. After some growth of the niche based on initial enthusiasm, challenging the regime, upscaling stalls and success is regarded unlikely when facing the regime, causing disappointment and implosion of the niche practice. An example is Aramis, a Personal Rapid Transit system in Paris in the 1970s.

Pathway 3: Stable, but minor regime innovation. In this pathway, the niche grows but within the regime, and stays small. An example is the introduction of bus lanes in many cities.

Pathway 4: Battle towards regime incorporation. The niche continues to scale up but triggers acceleration of innovation in the regime as well. Innovation momentum alternates between niche and regime, with symbiotic relations between niche and regime elements occurring. In the end regime elements benefit most from the symbiosis, and the regime stays in place although in a reorganized way (with many niche elements incorporated; i.e. hybridisation). An example is the introduction of a metro system in Stockholm amidst a composite regime of car, bicycle and tram/bus mobility 1950-1980).

Pathway 5: Battle to transition. The niche continues to scale up but triggers acceleration of innovation in the regime as well. Innovation momentum alternates between niche and regime, with symbiotic relations between niche and regime elements occurring. In the end niche elements benefit most from the symbiosis, and a new order in the sector based on the niche practice emerges (with many old regime elements having a

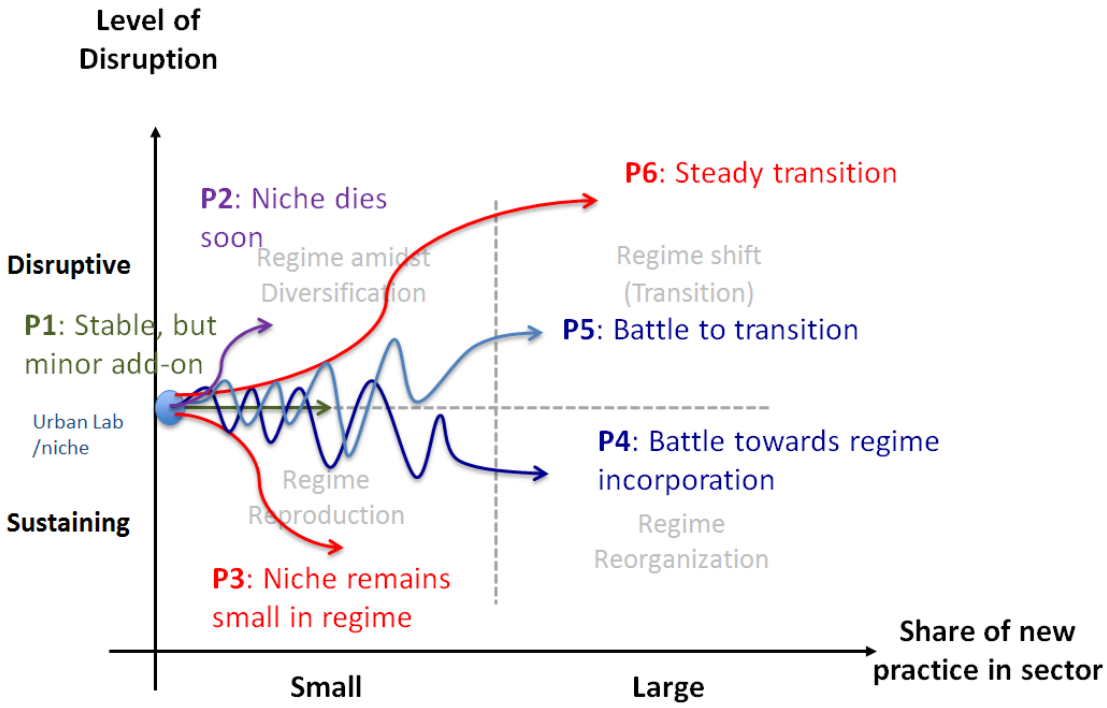
[6] TM has been employed in a range of contexts in practice, but this was practically always as an additional project to the established policy cycle, so contrary to the philosophy of TM as meta-governance (see e.g. Kemp et al. 2011). Nevens et al. (2013) have proposed to apply TM at urban level, relabelling some of the elements (e.g transition arena as 'urban transition lab'), but the merits of this are only expected over the next years when the planned experiments will be evaluated.

role in the new order). An example is the transition from horse-drawn mobility to automobiles in US cities (1880-1930).

Pathways 6: Steady transition. The niche continues to scale up but triggers no acceleration of innovation in the regime. A new order in the sector based on the niche practice emerges (with hardly any old regime elements having a role in the new order). An example is the transition in urban planning in cities in Eastern Europe (1990-2000) amidst the shift of national context from socialism to liberal-capitalism.

In the SmarterLabs project, this typology may help in reflecting on the various alternatives to the particular upscaling process envisaged in the four cities.

Figure 3.2: Six stylized urban pathways



3.4.4 Constraints on Upscaling and Exclusion

As the above figure indicates, in the socio-technical transition perspective fundamental change and stability is explained through protected niches that are or are not scaled up. An important question is what are constraints to upscaling, as a key mechanism for a pathway to unfold, and how may these be anticipated? Vreugdenhil et al. (2010) discuss constraints on the effectiveness of pilot projects (in many ways very similar to LL projects), in the sense of factors that limit upscaling one or more dimensions of the project into the policy process and or repetition of the project on a comparative scale. They group constraints in five categories. The first is *limited representativeness*, which implies that the design, conditions and results of pilot projects are of only limited applicability to new projects and so the usefulness of the pilot projects in new situations is subject to doubt (Martin and Sanderson 1999, Hoogma et al. 2002). In addition to the general issue of the contextual dependency of knowledge (Flyvbjerg 2006), reasons for the limited representativeness lie in the specific conditions and design of the pilot project. By using confined scales that reduce uncertainties and risks or by enhancing the availability of resources, the representativeness of pilot projects for standard projects is reduced. Scaling up from the pilot project conditions implies that the complexity of the problem increases (e.g. Mitleton-Kelly 2003, Collins and Ison 2006). Strategies to reduce or cope with this hurdle include the provision of explanations about the contextual dependency of the knowledge. The particulars of the context help to determine what is transferable and what is not. Additionally, the inclusion of future users through open governance styles and co-financing arrangements increases their commitment. At the same time, the innovation can be tailor-made for further implementation, because users are involved in the design process.

The second constraint on upscaling, *limited learning*, implies that the different types of knowledge developed within the pilot are not transferred to future users. Reasons include the low quality and short duration of monitoring; problems with attributing change to specific factors (Martin and Sanderson 1999); a lack of comprehensive knowledge, that is, no single actor has an overview of all the options, mechanisms and impacts; and the limited impact of information on decision making in contrast to ideology and interest (Weiss 1980). Knowledge of a soft or tacit nature is particularly difficult to transfer. Pilot initiators indicated that they developed enthusiasm during the pilot project, but were not able to influence users positively afterwards. Social learning and its associated open governance style can – at least in theory- function as a means to reduce or prevent such a hurdle from arising in the actor network (Muro and Jeffrey 2008), but the concept of social learning is in need of better operationalisation in order to accomplish this in practice.

Thirdly, *lack of institutionalisation* can limit effective upscaling, which implies that the innovation has not been internalized as an option on the list of options of a future user. Many users, particularly governmental bodies, are restricted to choosing from an approved list of options. If the innovation has not yet received an official stamp of approval, it may not represent a feasible option for such a user. Strategies to reduce this hurdle include the early identification of potential future users or application sites and of the nature of what ought to be diffused, such as an artefact or soft knowledge. These users can then become familiar with the pilot project and can indicate their requirements for institutionalisation. Additionally, the development of multiple successful pilots means that the successful innovative practices have become common practice. Moreover, despite the idea of tolerating failure so as to encourage learning, successful implementation of an innovation is needed for diffusion. Failures are difficult to sell.

A fourth possible constraint, *poor timing*, implies that by the time the pilot is finished, the policy climate no longer supports the adoption of the innovation, because the policy climate has changed during the course of the pilot (Liebowitz and Margolis 1995, Morris and Chiu 2001, Cabinet Office 2003). More generally, the market is lacking. This is also reflected in a lack of urgency to change existing practices. A potential strategy to deal with this hurdle is to maintain flexibility in the pilot so that it can be adjusted to developments that may arise.

Fifth and finally, is a *wait-and-see attitude*. In many of the pilot projects, a wait-and-see attitude to diffusion occurs. Either diffusion is expected to occur by itself or strategies to enhance the diffusion of knowledge and learning are put in place after the pilot ended. Reasons included: (1) it is common practice to consider knowledge dissemination only after a project is concluded, (2) diffusion goals are not explicitly included in the pilot and so no budget is made available for achieving them, and (3) pilot projects are approached as routine projects that can be closed after pilot implementation and monitoring ends and participants return to their daily work. Accordingly, the overarching strategy related to this hurdle is a meta-strategy with two components, namely: (1) to include diffusion strategies within the pilot and (2) to put them in place at an early stage, because many of the strategies need time to become effective.

Transition studies have not devoted particular attention to the threat of social exclusion during transition. On the contrary, TM literature suggests starting a transition process with a small, leading group of normatively likeminded actors, who share the ambition for a particular transition, surpassing legitimacy issues and the threat of social exclusion of certain groups. Social in- and exclusion has however received attention in socio-technical studies under the label of 'politics' and 'democracy' of technological innovation. A classic example of social exclusion in this field is the low bridges of Long Island. Langdon Winner argued ([1980] 1999) that project developer Robert Moses deliberately designed low bridges across the parkways to the Long Island beaches to prevent buses, which were normally used by the lower classes and ethnic minorities, from going there. Long after Moses's death, the low bridges will continue to produce an exclusionary effect.

3.4.5 Applicability of the 'socio-technical transition lens' to the four case studies

In general, the SmarterLabs cases do not focus on transition as such, because the timeframe of the project is three years, much too short to study transition pathways through 'real-time' experiments. However, the notion of upscaling – applied in various transition studies – is useful and central in the SmarterLabs proposal. The specific definitions of the upscaling processes foreseen in the four lab experiments are inspired by the

'transition lens', and the five upscaling constraints offer a point of enquiry for each of the city cases, reflecting which constraint is most applicable, and how it can be anticipated. As Evans & Karvonen (2011) note, Living Labs constitute classic niches for innovation in this sense, as arrangements 'built between actors to support the innovation in very specific time and space contexts' (Beveridge and Guy: 675) that shelter it from wider political and economic pressures. As in SNM and transition management approaches, LL's are explicitly experimental, but this is different from niches described in various historic transition studies in which there was usually no deliberate strategy to create spaces for experimentation.

What the upscaling, transformative process looks like, in the sense of *what* exactly is envisaged to be scaled up, differs, of course, from case to case, and needs to be determined in each particular context. For instance, in the Living Lab in Bellinzona, the process of co-designing a smartphone App for mobility behaviour change with a limited group of participants, aims to move towards (1) broader use of persuasive mobility apps to an extent that it contributes to decreased modal share of car mobility at an urban level and to (2) broaden the application of the use of citizens' real-time mobility data by the City of Bellinzona (including discussing such data with the citizens) into mobility policy development.

In the case of the Living Lab with participatory measurements of air quality in the Brussels-Capital Region, the process of upscaling envisaged is neither just replicating the lab in every street, nor copying the experiments conducted by particular groups to all citizens of Brussels. Rather, this involves matters on higher scale level, and the process towards (1) broader application of participatory measurements into urban level policymaking to (2) improve air quality for Brussels as a whole.

In both the case of renovation of a central train station in Maastricht, the major public transportation hub of the city (including train, bus, bicycle share, Park+Ride, car sharing), and the co-creation project redeveloping the Griesplatz area with smarter public transport connections, the Living Labs do not envisage a quality improvement for current travellers ('make things more convenient through smart technologies'), but rather the process towards (1) the expansion of inter-modal travel practices (i.e. trips that combines modes like train, bus, car, bikes etc.) at the urban level and (2) towards broader application of co-creative processes in urban policymaking and more permanent public-private structures for urban governance.

4. Smart Methodologies for the Living Labs

Part II of this document illustrates the details of the Living Labs that will be conducted in the four project cities. Part II is structured in four chapters, dedicated respectively to the four different case studies. All chapters include theoretical elements, the details of the methodology, as well as the strategies to observe and minimize risks related to social exclusion and to barriers to upscaling. At the same time, the structure of the document also reflects the different city-specific objectives and the heterogeneity among project partners and research teams, all of which resulted in different methodological approaches.

Table 4.1 - Key concerns and operationalisation for Living Lab

Element	Question	Indicators
Collaboration	Who are the collaborators? What mechanisms support collaboration? How does collaboration occur?	a) Types of collaborators b) selection procedure Collaboration settings a) Collaborator roles and b) collaborator interactions
Learning	Have specific learning goals and expectations been agreed upon and set? Have explicit practices been targeted to foster learning? Is this a 'good' learning process?	Technical and social learning parameters Participatory settings, collaboration, sharing Challenging assumptions, co-production, recognising complexity
Evaluation	Has this ULL established baselines through which essential evaluation guidelines structured? 2. Is there a reflexive component to monitoring and evaluation? 3. Have robust and transferable evaluation parameters been applied?	Ex-ante diagnosis (social exclusion and barriers established) 2. Observation and mitigation of risks in monitoring 3. Evaluation against a) fixed goals (learning, collaboration, ULL design, social exclusion) and b) unforeseen barriers

4.1 Bellinzona

Project partners: University of Applied Sciences and Arts of Southern Switzerland – ISAAC; City of Bellinzona; Pro Velo Ticino

4.1.1 Introduction and theoretical approach

By deploying Living Labs as a catalyst for user-inclusion, coupled with retrospective analysis to inform Living Lab design, the SmarterLabs project will engage with conditions that have proven problematic in both the smart city as concept and ULLs as a method. This extends beyond stakeholder selection, further relating to the mechanisms through which collaboration is subsequently supported. SmarterLabs depart from the normative assumption that surrounds learning by incorporating reflexivity and iteration in the Living Lab approach. The SmarterLabs mobility project aims to consolidate case-based Living Labs in a way that can facilitate our understanding of upscaling in a number of ways. Firstly, by employing citizen-centric smart experiments and creating a network of cities in this European Consortium, there is a clear intention of Smart City Living Labs as a driver for innovation uptake. Secondly, reflexivity and collaboration in the Living Lab approach as a policy intervention aims to directly target aspects of smart governance, staying true to the ideals of the next

generation smart city. Thirdly, by producing Smart City Living Labs in the context of mobility, we circumvent the blueprint status of common Smart Cities on the discursive level, and translate this into the urban fabric. The findings from the SmarterLabs project are valuable beyond the participating cases by generating meaningful mobility findings that can be used on a European scale. Furthermore, by deploying Urban Living Labs with topical foci of citizen science (Brussels), participatory design (Graz), technical and social complexity (Maastricht) and behavioural change (Bellinzona), this project places civil society at the heart of smart city interventions, with 'technology as the enabler' (Schaffers et al. 2011). In so doing, and in line with our conceptualisation of 'the smart city', SmarterLabs critically embraces elements of learning, upscaling and social inclusion within and across contexts when investigating actor collaborations, goals, visions and evaluation of specific labs.

Motivation

The City of Bellinzona seeks to improve mobility alternatives to cars to counteract local and global problems associated with traffic and energy-intensive lifestyles. In particular, the City has 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, City managers are aware that such structural and regulatory tools are not sufficient to produce a systematic reduction in car use at the population level. 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. Moreover, if the whole approach, methodologies and tools will prove successful, in the end the City of Bellinzona will be endowed with a new set of governance practices, applicable to future decision-making processes in other fields than mobility.

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 (ICT). ICT in fact allows 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; Sergici and Faruqui 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; Raubal 2011; 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 4.2.

Table 4.2 - List of persuasive apps developed in the mobility field with the aim of reducing individual car use

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

Limitations acknowledged in literature 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 4.3).

Table 4.3 - Limitations and barriers to social inclusion and uptake at the society level and suggestions to overcome them

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	Develop fully transparent user agreements explaining how personal data will be treated by the apps and which

privacy is negatively affected.	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.	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.

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.

So, favouring self-selection might 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.

Lessons learnt and proposed approach for the Bellinzona LL

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 review suggests that it is 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.

We will also focus on general findings from literature review about Living Labs, which highlights that anchoring findings of Living Lab experiences as a new set of practices and policies into the institutional frame of the involved actors is a difficult task; however, it represents the way forward to ensure the possibility of upscaling pilot initiatives and turning them from *niche* into a *new regime* transition.

To overcome such critical aspects, the Bellinzona LL will adopt the following strategies:

- encourage social inclusion of population segments that are not particularly sensitive to mobility issues through (i) extrinsic, tangible rewards and (ii) exploitation of already existing real-life relationships and natural social groups (e.g. work & school communities);
- favour empowerment, retention of interest and enduring engagement of the participants by involving them in (iii) Participatory Design Workshops aimed at promoting innovative mobility services for the City: participants will not be limited to passively test an innovative app; instead, they will be stimulated to co-create it and to further contribute to the co-creation of future mobility scenarios for their City.

The Bellinzona LL will therefore integrate findings emerging from a smartphone app led LL into a wider social context, profiting from already existing real-life relationships and natural social groups (e.g. work & school communities) to make them more representative of a wider population spectrum, as well as promote a concerted action with already existing transport and mobility planning tools (Agglomeration plan for the Bellinzona area, Plan for slow mobility for the City of Bellinzona, School mobility programmes, etc.) to ensure possibilities of upscaling possible constructive results by means of wider, committed thematic workshops. Furthermore, such an approach will encourage citizen's understanding of why social innovation in the mobility sector is required, how to adopt the new services and the benefits they will derive from this behavioural change.

Ultimately, the aim is 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 needs to be initiated. Consequently, from discussion on an app, with a limited group of citizens, activities in the present LL will evolve to discussion on future mobility scenarios, involving the relevant stakeholders at the city and regional level: this will imply enlargement of the scope, complexity and conflict level of the issues under discussion.

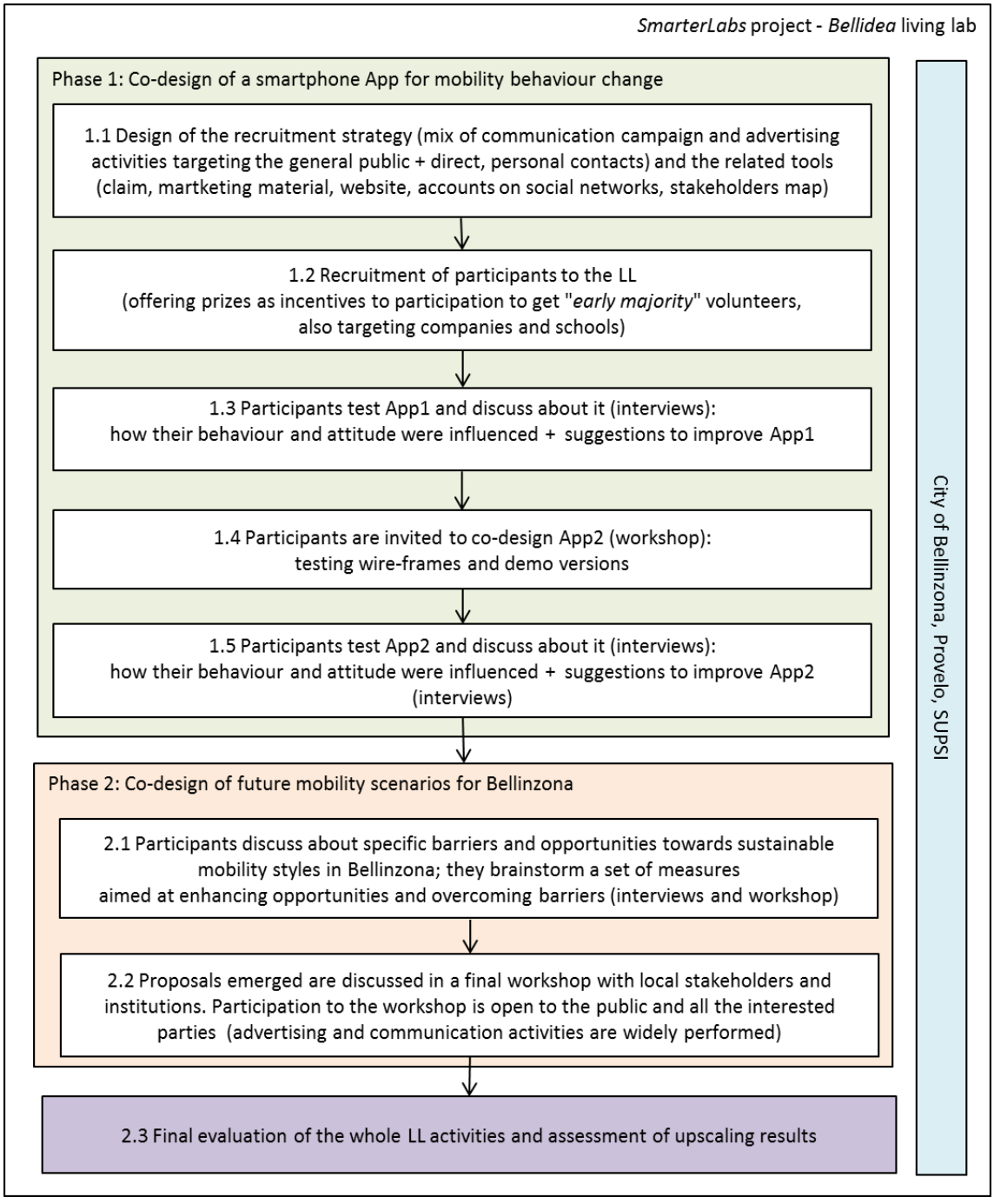
A further upscaling possibility might derive from replication of the LL participatory approach, methodologies and practices in other fields of intervention than transport and mobility: the City might in fact adopt the new set of procedures also for policy-making in other domains of intervention, such 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.

4.1.2 The Bellidea methods and operations

The Bellinzona LL is tentatively 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 is intentionally generic and does not refer to transport and mobility, so that the City might use it in the future also for additional governance processes in other fields. Figure 4.1 summarizes activities we plan to perform. The entire process is subdivided into two major phases: in Phase 1, participants are invited to co-design a smartphone app for mobility behaviour change that fosters a reduction in use of private motorized means of transport (cars) and favours more energy-efficient mobility choices; then, in Phase 2, they are invited to further reflect on mobility issues in their City and to co-design future mobility scenarios for the Bellinzona area.

Regarding organisational aspects: the City of Bellinzona will actively promote *Bellidea* LL activities, especially favouring recruitment of volunteer participants and stimulating discussion during interviews and workshops. SUPSI-ISAAC will coordinate the LL activities, guaranteeing quality and respect of the time-schedules, and offering scientific support. ProVelo will follow all the LL activities, in particular supporting the recruitment of the volunteer participants and contributing to discussion in interviews and workshops with their specific expertise on slow mobility, which both allows to advance innovative ideas and to assess technical feasibility of the proposals by the participants.

Figure 4.1 - Activities proposed within the „Bellidea!" Living Lab



Phase 1: Co-design of a smartphone app for mobility behaviour change

Activity 1.1 Design of the recruitment strategy

As emerged in literature review, activities for the recruitment of participants are critical for the overall effectiveness of the LL. They will be performed with the aim of addressing the barriers indicated in Section 0 and to mainly stimulate "early majority" individuals, according to the theory of "diffusion of innovation" by Rogers (1962). To this purpose, the City will build on already existing real-life relationships, which are expected to reduce both drop-out rates as well as to be more inclusive also of non-environmentally sensitive people being involved: the City will in fact build the communication and marketing activities focusing on prizes and

tangible incentives, and will also address companies and schools (students and their families) as the main target groups.

In such a context, we envision to adopt a mix of communication and advertising activities targeting the general public and direct, personal contacts targeting specific people/institutions/associations which represent a stake in local mobility. To this purpose, key elements for the recruitment campaign are designed: a map of influential (from different perspectives) citizens and stakeholders is developed; a communication campaign is built: claim and main motivational message are developed, together with a dedicated webpage on the City's website, flyers and posters, and accounts on major social networks. Direct contacts with institutions and associations are crucial for the success of the recruitment campaign and to ensure the requested variety in the participants' socio-economic and environmental awareness background. Table 4.4 shows the target groups already identified and the related institutions and associations to be contacted.

Table 4.4 - Key target groups involved and related institutions and associations to be contacted during the recruitment campaign

Target group	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
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)

Activity 1.2 Recruitment of participants

Recruitment will be based on both the communication campaign and direct invitation of the influential stakeholders and citizens identified above. Access to mass media (press, radio and TV) is quite easy in Ticino and the City of Bellinzona will definitely manage to gather citizen's attention. We expect that recruitment of participants will conclude with around 30-50 individuals, so that on average, for each phase of the LL process at least 30 participants will be active.

Activity 1.3 App1 testing

Participants to the LL will be invited to join a series of Participatory Design Workshops and Interviews to test a prototype smartphone app (App1) aimed at fostering a reduction in the use of private motorized means of transport (cars) and at favouring more energy-efficient mobility choices.

Such an App exploits automatic mobility tracking opportunities offered by the GPS and accelerometer devices embedded in smartphones and it is already available, being developed within the *GoEco!* research project by SUPSI and ETH (http://www.goeco-project.ch). As key motivational factor, App1 leverages gamification concepts and tools based on intrinsic motivation to change, such as eco-feedback, definition of personal objectives for change, individual challenges with intangible rewards (badges), comparison with the performances of other users. App1 is therefore targeting individuals who are already interested in changing their mobility patterns.

Activity 1.4 App2 co-design

Based on their experience and impressions with App1 testing, participants to the LL will be invited to create together and discuss functionalities for the new App2: the learning-by doing process activated will provide the City with insights on their experience with App1 (semi-structured interviews) and will be stimulated to support and co-design (workshops) functionalities and motivational elements of App2.

In particular, LL participants will be proposed to reflect on the motivational elements offered by App1 and to co-design effective motivation elements targeting more materialistic users. In fact, even though research in social and environmental psychology has shown that exploiting intrinsic motivation is more effective in producing a long-lasting behaviour change, App1 might not raise the interest of the segment of population that has never had any personal motivation to change – namely, those who are actually more in need of awareness raising in regards to their mobility habits. Therefore, with the aim of producing an app which is effective with a variety of segments of the population – thus resulting in an easier and wider uptake at the society level – the City of Bellinzona aims at endowing the app with extrinsic motivational elements for change.

To this purpose, the new App2 might for example attribute points when sustainable mobility choices are performed, and points might be converted into tangible prizes offered by the City, such as bicycle maintenance services, safe cycling courses organized by local not-for-profit associations (for instance, ProVelo), vouchers for walking tours and holidays, tickets for cultural events organized by the City itself and similar activities. The idea is that prizes offered by such an app should be as strongly connected as possible with cycling and pedestrian mobility and, from a wider perspective, with sustainable lifestyles in general.

Activity 1.5 App2 testing

Based on suggestions emerged from the above workshops, an App2 test version will be produced by external software developers, appointed by the City. Once App2 will be available, participants to the LL will be invited to test it and, again, to provide their suggestions for improvement, to be directly integrated by software developers. Once App2 will have been evaluated as viable, the City of Bellinzona will be equipped with an analytical tool, useful for future mobility data gathering activities at the city level or maybe to be directly integrated in the City's policies in the mobility field (though this upscaling phase is not contemplated in the present LL project). Since App2 contents and motivational elements will have been directly designed by a selection of citizens and will contemplate features capable of establishing, to some degree, an improved communication and cooperation between the local Institution and its citizens, we expect pro-active promotion by the local authority, as well as a more successful diffusion to a larger group of citizens and high level use maintenance over time than reported in past experiments' literature.

Expected results

- Around 30-50 volunteers are engaged to actively participate in the LL. These numbers guarantee that, on average, for each phase of the process at least 30 participants are active.
- A set of concrete suggestions to develop App 2 are gathered (in particular regarding how to guarantee effective functionalities and motivational elements).
- App2 is developed and then further improved, based on direct feedback by the participants' experience.
- As a final result, an updated version of App2 will be available to the City of Bellinzona, which might decide to include it among its mobility management policy measures, promoting its use at a wider society level (first upscaling level, short term result).

Research questions

What is the effectiveness of smartphone-based attempts to persuade individual behaviour change towards non-car dependent mobility lifestyles?

Which motivational factors do they need to exploit in order to be appealing for common citizens and to foster real-life sustainable mobility behaviour?

Phase 2: Co-design of future mobility scenarios in the Bellinzona area

Activity 2.1 Barriers and opportunities towards sustainable mobility - brainstorming measures

Once a bi-directional communication channel will have been opened between the City and its citizens, discussion in the LL will be broadened: participants to the LL will be invited to take part in workshops aimed at a wider discussion on possibilities to change mobility patterns in the Bellinzona area. First, their perceptions and attitudes on specific barriers and opportunities towards sustainable mobility styles in Bellinzona will be explored; then, they will be asked to brainstorm a set of measures aimed at enhancing opportunities and overcoming barriers for change – that is, to co-create visions and measures for future land-use and transport plans and policies. In such a process, possible ways to use the app resulting from LL activities will also be investigated.

Activity 2.2 Widening discussion with key stakeholders - discussing and assessing measures

The result of such a creative process will be opened to discussion with a wider set of stakeholders and the whole population, during a last workshop aimed at discussing and assessing concrete possibilities for mobility behaviour change, to inform future mobility plans developed for Bellinzona and its surroundings (Plan for slow mobility, School mobility programme, Agglomeration plan for the Bellinzona area, etc.). Depending on the amount of elements to be discussed, and the expected conflict level among the population, such a workshop might be split into more than one session, as to guarantee that the outcomes are really shared by the population – or, at least, that it is clear who supports and who opposes them. Enlarging the base of involved citizens, opening to individual, associations and institutions which were not directly engaged in apps testing and co-creation, will address the risks of social exclusion and will guarantee that proposals are not reflecting needs, perceptions and interests of specific sub-groups of the population, but have a general value.

Activity 2.3 Final evaluation of the whole LL activities and assessment of upscaling results

At the conclusion of LL activities, a double-level assessment is performed: from one side, a survey targeting participants to the Living Lab is developed, with the aim of assessing their overall satisfaction regarding the participatory process and their expectations for future municipal decision-making processes. Results of such a survey are discussed with councillors of the City, in a focus group-style meeting. Such a meeting also gives the possibility to investigate the overall level of satisfaction by the City councillors regarding: the new app resulting at the end of Phase 1 and the possibility to adopt it as an official policy tool by the City (fist upscaling level); the mobility scenarios and measures resulting at the end of Phase 2 and the possibility to integrate them in future land and mobility plans and programmes (second upscaling level); the possibility to replicate the Bellidea participatory approach and adopt it also for other decision-making processes at the City level.

Expected results

- Second upscaling level (short term result): from an app to mobility scenarios: Future mobility scenarios and related sets of concrete measures aimed at enhancing opportunities and overcoming barriers for change are identified. Possible conflicts regarding such mobility scenarios are made explicit and positions by different social groups are publicly discussed.
- Third upscaling level (medium term result): from an app to a new set of decision-making practices at the City level: Participatory approaches, methodologies and tools are experimented and the "Bellidea brand" is created. If they are assessed as positive and satisfactory by both participants and City managers, new decision-making set of practices and approaches to governance might be used by the City also for other urban decision-making processes,

such as for example water or waste management, ending to be internalized in the City of Bellinzona official government procedures

Research questions

Which are the main drivers and barriers to individual mobility behaviour change, in the specific area of Bellinzona?

How can they be addressed in order to facilitate changes in individual mobility behaviour and to produce tangible changes at the collective level?

How can constructive findings of this *Bellidea* LL be best integrated into the city's transportation policies in order to guarantee an effective upscaling of desirable outcomes in the diffusion of "slow mobility" approaches in the City of Bellinzona?

How can the *Bellidea* LL approach, methodology and tools (in short: the *Bellidea* set of practices) be effectively replicated in other urban complex decision-making processes (different fields of intervention or different contexts)?

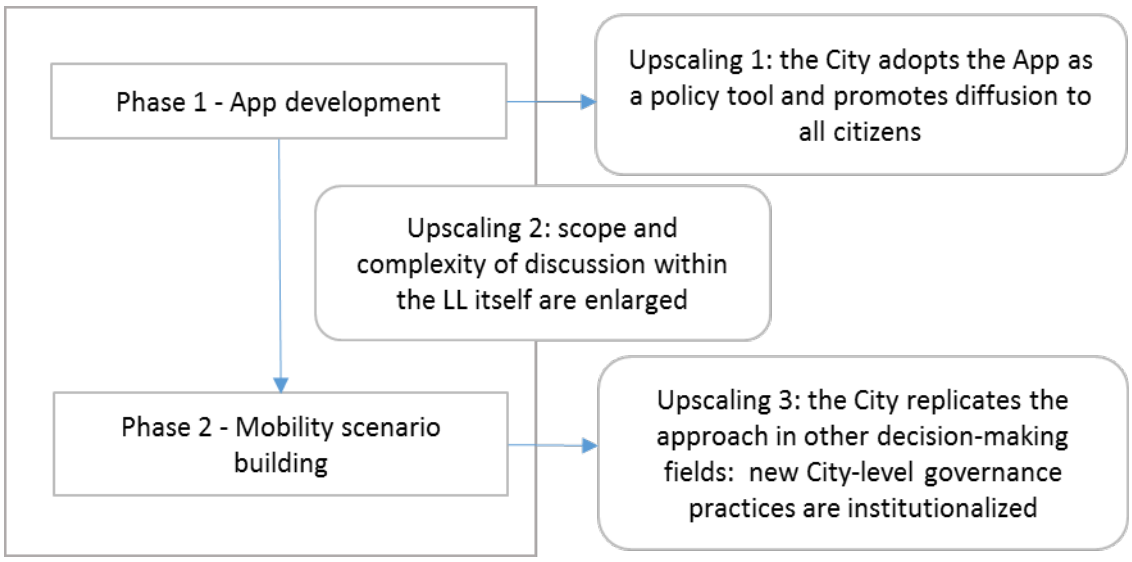
The SmarterLabs challenges for the Bellinzona Living Lab

As a conclusion, here we remark how the Bellinzona LL will face the key *SmarterLabs* challenges, namely: how to guarantee social inclusion; how to guarantee effective upscaling; how to anticipate specific barriers and obstacles precluding overall effectiveness of the process.

In order to do this, we also need to make our understanding of upscaling explicit and to recall which specific barriers we consider. Figure 4.2 summarizes the three levels of upscaling we have identified:

- upscaling 1 takes place in the short term, soon after the conclusion of LL activities, when the City decides to offer App2 to the wider population, as one of the policy tools adopted to reduce traffic congestions: it is therefore related to increasing the number of App2 users;
- upscaling 2 takes place directly during LL activities, when moving from Phase 1 to Phase 2: from discussion on an app, with a limited group of citizens, activities will evolve to discussion on future mobility scenarios, 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 LL itself;
- upscaling 3 takes place in the medium term, after the conclusion of LL activities, and refers to institutionalisation of the new set of governance practices and tools and to their replication into other decision-making fields.

Figure 4.2 - The three upscaling levels related to LL activities in Bellinzona



Regarding specific barriers, the ones identified for the Bellinzona LL are those typical of behaviour change processes exploiting persuasive apps, already highlighted above: high drop-off rates and early loss of interest in using the app; difficulty to involve those who would most benefit by using persuasive apps ("preaching to the converted" phenomenon) and lack of general representativeness of app users. Table 4.5 shows how we plan to face all such aspects, anticipating barriers and effectively addressing social inclusion and upscaling issues from the very beginning of LL activities, starting with recruitment of participants.

Table 4.5 - Summary of how we plan to face the SmarterLabs challenges in the Bellinzona Living Lab

	Phase 1 - app development	Phase 2 - Mobility scenario building	Upscaling 1	Upscaling 2	Upscaling 3
Social inclusion	When recruiting participants, also target groups traditionally marginalized from public decision-making, such as migrants, elderly people, young generations	Widen discussion by involving relevant stakeholders and actors who have not been involved in Living Lab activities so far	Favour interest in the app by population segments with low environmental awareness, by: - designing app functionalities so that it includes tangible prizes to app users (extrinsic incentives to retain their interest towards using the app); - involving target groups already mobilized to recruit LL participants; - exploiting already existing real-life relationships of LL participants and natural social groups (e.g. work & school communities). Diffusion of the app will be favoured since it has been developed by a group of citizens, characterized by different socio-economic backgrounds, needs and attitudes regarding mobility, therefore able to suggest effective motivators to change, respect to different target groups.	Effectiveness of such an upscaling outcome is favoured by the fact that by developing and testing the app, participants to LL are led to critically reflect on their mobility choices and the characteristics of the mobility system whit whom they interact: upscaling discussion to mobility scenarios and tangible measures which could favour individual change will occur spontaneously and will be the natural outcome of Phase 1 activities.	Effectiveness of such an upscaling outcome depends on the level of success achieved by LL activities and especially by success in Phase 2.
High drop-off rates and early abandon	- Favour retention of interest and enduring engagement by involving the participants in Participatory Design Workshops aimed at co-creating a new app for their City, instead of passive testing an app. - Also, exploit extrinsic motivation factors and offer prizes to participants who remain active until the end.	- Favour retention of interest and enduring engagement of the participants by involving them in Participatory Design Workshops aimed at co-creating future mobility scenarios for their City. - Also, exploit extrinsic motivation factors and offer prizes to participants who remain active until the end.			
***Preaching to the converted* and lack of representativeness**	- Favour inclusion of population segments that are not particularly sensitive to mobility issues by exploiting already existing real-life relationships and natural social groups (e.g. work & school communities) during recruitment. - Also, exploit extrinsic motivation factors and offer prizes to participants to who remain active until the end.				

4.2 Brussels

Project partners: Vrije Universiteit Brussel – Cosmopolis Centre for Urban Research; Brusselse Raad voor het Leefmilieu (BRAL).

4.2.1 Introduction and theoretical approach

Overview

The Brussels Living Lab experiment will take place in the context of recent and scheduled interventions in the capital region's mobility–space nexus, aimed at reducing the dominance of car mobility. In particular, the Living Labs aim to work with citizens, organisations, experts and public authorities to i) develop a common understanding on issues and trends related to air pollution and urban accessibility; and ii) co-design urban mobility solutions that contribute to address those issues. In line with the broader objectives of the SmarterLabs project, the Brussels Case Study will therefore serve as an opportunity to test a Living Lab methodology for smart mobility, against its capacity to mitigate the risks related to unforeseen barriers to large-scale change in socio-technical systems, and to the exclusion of social groups not matching the 'smart citizen' profile (hereinafter generally referred to as risks of exclusion and barriers to upscaling). In other words, beyond the Living Lab experiment, we envisage an upscaling process towards (1) broader application of participatory measurements into urban level policymaking to (2) improve air quality for Brussels as a whole.

Literature study: participatory measurements of air quality

Ultimately, the Brussels Case Study will contribute to the literature on pollution, mobility and access, the role of (citizens produced) knowledge in urban mobility governance processes. A key element of the Brussels case study, and possibly its main added value, is to be found in the campaign to measure air quality through a participatory approach engaging citizens, NGOs and the academia.

Clean air is considered a basic requirement of human health and well-being (WHO 2005). While its average chemical composition is almost constant, its quality changes significantly from location to location. In particular, it depends on the presence of certain compounds, which exist in nature, but may adversely affect human health or the built and natural environment beyond a certain concentrations level (Kennes and Veiga 2001, 3). The term air pollution refers precisely to the excessive concentration of these compounds (ABC for Sustainable Cities 2016), which in turn results from a complex interaction between natural and anthropogenic conditions that influence the emission and transmission of contaminants (Mayer 1999). While air pollution is not a new phenomenon, in the last 70 years its urgency has become increasingly evident for two reasons. Firstly, because of an increase in severity, and secondly due to a growing level of awareness amongst policy makers and the general public. In particular, air pollution is related to a series of problem, including human health, climate change and agricultural productivity (Krzyzanowski, Kuna-Dibbert, and Schneider 2005; Melamed, Zhu, and Jalkanen 2013). The problem is particularly severe in urban regions, as the density of population and economic activities leads to a higher concentration of pollution sources, as well as to larger amounts of affected people (Fenger 1999). The range of different contaminants that are monitored depends on the capacity and interest of the responsible institutions, which typically prioritise those contaminants that are most common and most harmful for human health. Currently, the concentration of particulate matter (PM), small particles floating in the air and usually classed as PM 2.5 (particles with diameters smaller than 2.5 micrometres) or PM10, are considered to be a good indicator of ambient air pollution, and are probably the most commonly used (Karagulian et al. 2015). Other contaminants that are measured include Sulphur dioxide (SO2), Nitrogen oxides (NOx), Carbon monoxide (CO), volatile organic compounds (VOC), Ozone (O3) and lead. (Melamed, Zhu, and Jalkanen 2013; Fenger 1999).

In the last decades, governments in Europe and throughout the world have started routinely monitoring urban air quality, using either measurements of the mean concentrations of selected contaminants based on daily measurements or data which could be aggregated into annual means (Karagulian et al. 2015). These measurements, however, have two fundamental limitations. First, the spatial resolution of the sampling methods is often low (e.g. Brussels capital region, for instance, only has 11 active monitoring sites ('Qualité de L'air : Le Pollumètre' 2016). This implies the need for mathematical models to estimate the regional average,

an output that is often complex and inaccurate. Second, these methods do not reflect actual exposures experienced by individuals, which are influenced by spatial heterogeneity of pollutant concentrations and individuals' mobility patterns among other things (Sivaraman et al. 2013). A different methodology, which is very much in line with the C.S. approach we take in our project, is to crowdsource air quality information. This approach has been carried out in different cities, with methods that reflect the availability of resources, the priorities of the committer (e.g. measuring pollution, measuring people exposure, raise awareness….) and the state of the technology. *AIRbezen*, for instance, is a project conducted by the University of Antwerp, Belgium, to measure air quality through the analysis of strawberry leaves from 500 plants distributed among volunteers ('AIRbezen 2014 - Universiteit Antwerpen' 2016). After two months, the volunteers were requested to return the leaves to a laboratory and fill out a questionnaire with information about the sampling location. The university in turns conducted analysis of magnetisable particles on each leaf to estimate air quality in the city. A similar project was carried out in 2015 in Gent, Belgium, using ivy leaves as bio-monitors (Amber 2016).

Another approach, generally referred to as participatory sensing (PS), consists of engaging ordinary citizens to collect information on their surrounding environment through portable devices and share it through their phone (Kanhere 2013). PS methodologies lie between more traditional approaches to measurement through *ad hoc* monitoring devices and the citizens-led ones introduced above, and offer a number of advantages. The use of *ad hoc* devices allows for a certain degree of comparability among the measurements; at the same time the methodology is cost-effective as it partially builds on existing sensing and communication infrastructure (smartphones equipped with GPS, timer, wireless network). The inherent mobility of the sensors, moreover, provides an extremely wide spatiotemporal coverage. Including people in the sensing process, finally, provides a powerful opportunity to better understand -and hence improve- the day-to-day lives of individuals and communities. A full review of the projects using PS air pollution measures is outside of the scope of this document. The analysis of a number of them, however, has allowed the identification of certain key elements that these projects typically include (e.g. see: Dutta et al. 2009; Devarakonda et al. 2013; Sivaraman et al. 2013; Massung et al. 2013; Dekoninck, Botteldooren, and Int Panis 2012; Hasenfratz et al. 2012; Zheng, Liu, and Hsieh 2013).

Participants. Air quality participatory sensing depends on the availability of volunteers (citizen scientists) to carry a sensor, and take and share measurements as they go about their daily lives. A key challenge, which is common to most crowdsourced data collection, is to ensure sustained volunteer participation over the time of the measurement. Typical elements that can boost volunteers' participation include personal motivation and stakes in the project outcome, gamification of the task, monetary gain, information (and/or a combination of them). Depending on the objectives of the research, it is possible to choose volunteers that all use the same mode of transport while taking the measurement (i.e. to produce measures of air pollution), or to choose volunteers using a representative mode of transport (i.e. to produce measures of exposure to air pollution).

Infrastructure. All projects that were reviewed include a number of different components to the data architecture. These include: i) portable sensors; ii) mobile phones equipped with an application that harvests the data from the sensor, tags it with time-space information, and uploads to the server; iii) a server that stores and automatically analyses the data; iv) and visualisation tools that map. It is necessary to carefully consider the available options for each of these components, and choose the best fit, given the objectives and the conditions of the project (e.g. a few of highly precise and expensive sensors vs. numerous sensors providing lower level of detail; real-time vs. differed data visualisation; existing systems vs. ad hoc).

Data collection, analysis and visualisation. Crowdsourcing and participatory sensing projects should include efforts to ensure that the measurement protocol is standardised as much as possible. It is likely that the spatial-temporal coverage of measurements will be biased toward the busiest areas at the busiest time, and thus should be taken into account. Even in the best case scenario, moreover, it is impossible to have a measure of all points in space and time and it might be necessary to estimate pollutants' concentration throughout the urban area. There are different techniques at different levels of complexity, including interpolation, statistical regression, land use regression, and neural networks, atmospheric chemistry and dispersion… Finally, it is necessary to analyse and visualise the data, which is most typically done through a web application that automatically generates reports and maps based on the submissions.

The SmarterLabs challenges for the Brussels Living Lab

As mentioned above, SmarterLabs aims to test a Living Lab methodology for smart mobility, against its capacity to mitigate the risks of social exclusion, and those stemming from unforeseen barriers to large-scale change in socio-technical systems. A preliminary review of the literature has identified venues of inquiry both at the level of the research results (i.e. does the LL -as a scientific inquiry- reveal any patterns of exclusion or any barrier to upscaling?), as well as at the level of the methodological approach (i.e. is the LL - as a methodology- vulnerable to risks of exclusion and upscaling?). It ought to be noted, however, that the focus of the project is the latter, which is why time will be dedicated towards this below.

Exclusion

The SmarterLabs project shares with other participatory sensing projects – and more in general with many participatory approaches to knowledge production and policy co-design – the risk of excluding certain groups. In fact, while one of the principles of these practices is the democratisation of science through broader inclusion of groups and stakeholders, this does not always happen. Exclusion can be the result of certain barriers preventing the actor to fully participate, or of an explicit choice at the project design level. On one hand, it has been highlighted that citizens who volunteer to participate in C.S projects often come from an educated middle class, possibly because of issues of motivation, available time, access to technology (e.g. smart phones), and more in general intellectual and financial resources (Haklay 2013). Given that personal motivations play a key role in people's participation to a project, it can also happen that due to mismatching motivations between a participant, other participants and the project organisers constitute a barrier to broad inclusion. On the other hand, a project design and implementation does not happen in the vacuum; the choice of participants and groups of participants might depend on existing networks (e.g. project designers might prioritise groups which they already know), and/or on the presumed feasibility of working with certain groups or with others. It was noted, for instance, that researchers tend to prefer to work with university-educated individuals, since they are more likely to provide accurate data (Connors, Lei, and Kelly 2012). Another potential barrier concerns the political and ideological bias that are implicit in the project objectives, which might result in (self)exclusion of non-likeminded individuals and groups. In this context, adequate coping strategies will be designed and while it might be impossible to completely avoid exclusion, it will be necessary to be reflexive while making choices that potentially have exclusionary impacts.

Upscaling

Whilst conceptions of scaling often differ, this ULL approaches the Brussels Living Lab with a broad understanding of spatial and institutional scaling. The ideal scenario of the Living Lab in the context of upscaling would involve one where participatory sensing of air quality is adopted at a city-wide scale, engaging virtually all urban residents or a representative subset thereof, and where the knowledge produced in this way becomes a collective resource for the governance of the city's mobility system. In particular, the project case aims to build upon existing non-state actors and networks in the context of Brussels, as well as maintaining a relationship with municipal actors in the city.

Therefore, upscaling is envisioned as a process; one through which new practices, in this case participatory sensing and knowledge co-production, move beyond an initial geographical domain and into an institutional context. Drawing insights from transition studies, this interplay between resistant institutions and mobilizing practices/actor sets becomes an important site of attention. Although often regarded as reciprocal in nature rather than a unilateral dynamic, the Brussels Living Lab focuses on co-producing knowledge and mobilizing actors, in a distinctly urban context that can lead to a re-orientation of current structures related to mobility. When compounded with a unique governance structure in Brussels, we envision institutional complexity as a particularly latent quality in the Brussels Case Study. Therefore, we will conduct a thorough enquiry into the context of previous smart mobility projects in the city (WP3), paying attention to lessons learned, co-creation, openness, reflexivity and public value creation. In addition, this enquiry will explore attempts to overcome resistance to innovation, as well as innovation achieved.

With these premises, the analysis of the barriers to upscaling could be done at two different levels, namely at the level of the generation of knowledge, focusing on the spread of the SmarterLabs approach to air quality measurement, and/or at the level of the policy process, i.e. on how the projects feeds it. Considering the priorities of the project consortium, oriented towards contributing to improve urban mobility rather than testing and spreading a certain air quality measurement approach, it was agreed to focus on the latter level. In particular, the analysis will focus on the barriers that prevent the widespread appropriation and "use" of the knowledge produced within the Living Lab by individual and institutional actors who were not directly involved in it, a question relating to the broader debate on the role of knowledge in urban governance and on the perceived and actual value of citizen science for decision makers. Rather than casting aside the role of the non-expert, the Brussels case study aims to empower citizens and recognize their influence on science and policy. By recognizing notions of trust as a barrier in citizen science, this projects adopts a rigorous and systematic research design for participatory sensing using a Living Lab methodology. This is done in three ways. First, and on a broader level, by maintaining a three phase trajectory for the attainment of the project. Secondly, participatory tools are co-tested and evaluated before use, and calibrated by trusted air quality sensors with high degrees of accuracy and precision. Therefore, citizen science aims to anticipate a common limitation, as the reliability of participatory measurements are often challenged. Thirdly, the methodology is underpinned by principles of transparency, reflexivity and co-creation, all of which are prominent concepts in the democratisation of both science and information.

Moving beyond the legitimisation of citizen science for empirical evidence, the importance of backing policy with scientific knowledge has widely been acknowledged; there does however seem to be a number of barriers when translating research results for decision-making. First of all, these barriers might be linked to issues of communication of the results. These concern, for instance, the level of detail that is used when communicating results, where a balance needs to be found between ease of access for a non-academic public and the adequate depth of the analysis. Another communication issue concerns the time gap between the time certain knowledge is produced and the time this is actually needed (i.e. research could take too long to produce useful results, or, conversely, could precede the policy agenda), and this problem becomes even more complex because of the non-linearity of the policy process. Another kind of barrier to the effective translation of knowledge into policy making concerns the fact that expert knowledge about the city is only one of the determinants of policy making, together with other political processes, which might be hidden or explicit (See Owens, Petts, and Bulkeley 2006, and van Stigt, Driessen, and Spit 2015 for a review of the barriers from the point of view of researchers and policy makers). A collaborative approach to research such as the one we are using in the SmarterLabs, can help to bridge the gap, in as much as the co-creation of knowledge increases understanding of each other priorities and methods and helps to align research, the policy agenda and citizens priorities (see for instance Yearley 2006, on two attempts to encourage public participation in local air-quality management). At the same time, this approach citizen science is not immune to critique, due to the perceived and actual quality of the data (see for instance Underwood and Chapman 2002; Riesch and Potter 2014; Kanhere 2013).

Table 4.6 - Brussels approach to upscaling

Barriers to upscaling	Anticipation
Institutional complexity	Thorough understanding of institutional dynamics of previous mobility projects in Brussels (WP3).
Trust in citizen science as a mode of enquiry	Systematic approach, thorough methodology, calibration using trusted sensor technology, thorough communication of co-creation process, transparency of data and results, collaborative approach
Balance between scientific rigour and accessible results	Co-creation with citizens, focus on digital literacy, co-production of knowledge. Designed learning scenarios.
Translating knowledge into policy concerns	Accessible communication, clear relationship with state actors in Brussels

4.2.2 Methods and operations

Overview

The Living Lab is proposed as a new approach to urban mobility where awareness driven public engagement plays a key role in the policy process. Public engagement, in particular, includes for instance direct involvement in decision making, or more coherent and ambitious political demand. As an urban experiment, the Living Lab will be designed as a controlled inducement of change and an analysis and measurement thereof, involving a constant shuttling between local and non-local dimensions of concepts and theories, specificity and generalisation (see Karvonen and van Heur 2014).

Research questions

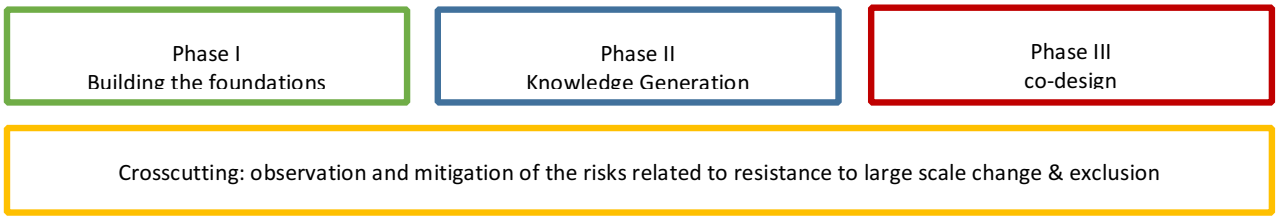
Does self-produced knowledge (e.g. Citizens Science/Participatory Sensing) imply greater participation in the policy process?

Do increased awareness and greater participation imply a better performance in dealing with risks of social exclusion and upscaling?

WP4 - Living Lab - Methods and operations

After a joint effort to establish the foundations of the experiments (Phase I), the Living Lab progresses along two distinct and complementary phases, namely Phase II where partners convene to generate knowledge on their own mobility trajectories (Knowledge Generation); and Phase III where they use that knowledge to co-design urban mobility policy (Co-design). Throughout the project, BRAL will lead the efforts to minimise the risks of exclusion and resistance to large-scale change, while VUB will lead the inquire to identify opportunities and weaknesses of the approach in relation to these two risks (the distinction among the different phases is rather a conceptual one: in practical terms, there different phases unroll under continuous feedback loops).

Figure 4.3 - Brussels Living Lab



Phase 1 Building the foundations

Engage communities of interest

BRAL engages with people "on the move" in the core of the City of Brussels (i.e. the portion of Municipality of Brussels referred to as the "Pentagon") through well-established practices of citizens engagement. Building on BRAL past projects, three different recruitment approaches will allow to establish three groups of volunteers/citizens scientists, different from one another on the basis of different (presumed) socio-economic trajectories and everyday mobility behaviour. The initial composition of each of the groups depends thus on the recruitment approach and on individuals' self-declared interest in participating in the project. The three recruitment approaches are below. While the three groups are pre-selected and fixed throughout the project, the composition of each of them might change throughout the different phases of the project.

- **Call #1.** Call for volunteers in centres for underprivileged residents of Brussels city centre (neighbourhood houses, medical centres and other social projects). The call was done through the centres' existing structure, meeting different groups separately first, and convening a single group after.
- **Call #2.** Call for volunteers through Brussels cycling organisations GRACQ and Fietserbond
- **Call #3.** Call for volunteers through the European Union Cyclists' Group (employees of European institutions interested in urban cycling)

These different recruitment strategies were used to reach out potentially diversified groups, all of which have a different relation to the city centre. In particular, it is presumed that Call #1 will mobilise residents that live within, but rarely leave, the city centre. Air quality in the city centre has potentially a direct impact on the lives of these residents. Call #2 will possibly mobilise participants entering and leaving the city centre in rush hours, for working purposes. These participants are likely to be confronted with air pollution peaks, yet only for a limited amount of time. During working hours, they are presumably, in offices with a relative good air quality, whereas for the rest of the time they are in neighbourhoods less affected by air pollution. Call #3 will possibly mobilise individuals who do frequent the city centre, but mostly in their free time and for leisure purposes.

Develop the research infrastructure

Project actors will jointly identify and develop the research infrastructure, including the tools for the measurement campaign (measuring device/app/server/web platform/log template); the questionnaire; and the webpage for the project.

Expected results

- Engagement of three groups of volunteers interested and motivated to jointly work on the project
- Research infrastructure developed and tested

Phase 2 Knowledge generation

Kick off meeting

The three groups of volunteers are invited for the kick-off of the measurement trials (three separate meetings). During the meeting they will receive an overview of: i) the SmarterLabs Project and ii) air quality and accessibility in Brussels. The meeting is also the opportunity to distribute questionnaires and sensor devices and to give instructions.

Questionnaires

The questionnaire will be designed to i) collect information on the users and assess correlation between personal profile and exposure to air quality; and to ii) start engaging with volunteers to shape up the Living Lab. Participants will be able to complete the questionnaire either on their own, or with the support of the project team. The questionnaire will seek answers regarding the demographic and socio-economic profile of users (e.g. level of income, level of education, family size, age, mobility patterns), their view on the issues at stake, their willingness to change/learn/mobilise.

Measurement trials

The volunteers will produce data on certain aspects of their mobility trajectories in the Pentagon. The measurement trials will include the following elements:

Measuring device: Volunteers will use the selected measuring devices to measure certain information regarding their daily mobility. This includes measures of the quality of the air, the time, and the location (it might include either a standalone device, or a device + smartphone)

Measurement log: Volunteers will also complete a measurement log for each of their trips. This includes synthetic information on how they are moving, why they are moving, their perception on air quality.

In collaboration with the volunteers, the project team will identify a common measurement protocol, including the length (possibly 8 days per measurement) and the object of the study (e.g. measure *all* daily commutes vs. only some measures, give a fair space to personal and project/collective objectives…).

Analysis and dissemination of results

While certain preliminary results (e.g. individual measurements) will be immediately elaborated and made available through the web platform, a more detailed analysis of the results will be carried out in-house, and disseminated among participants through different channels (to be defined, this might include short documents, infographic, videos…).

Expected Results

- A dataset of quantitative information on:
  - Volunteers socio-economic profile
  - Volunteers priorities and motivations on issues of mobility and air quality and participatory gov.
  - Selected information (perceived and actual pollution, time, mode of transport,) on the mobility trajectories of the volunteers in relation to selected origin-destination combinations (e.g. home-work, home-leisure, mixed, experiment…)
- Information material on the research results (e.g. videos, infographic, leaflets…)

Research Questions

Consider analysis of data both among groups and among individuals

Socio economic analysis

Do mobility trajectories depend on personal profile (e.g. relation between accessibility measure and income). If so, how?

Is there correlation between perceived and actual air quality?

Is there correlation between mode of transport and exposure to air quality? Is there correlation between mode of transport and time spent on the trips?

Spatial and geographic analysis

Are mobility trajectories related to characteristics of the urban form? (and if so, how?)

Are mobility trajectories to proximity to certain mobility infrastructures (urban highway? public transport? pedestrian area?)

Phase 3 Co-design

The co-design phase consists of an ongoing dialogue among the project partners (i.e. VUB, BRAL, and Brussels's residents). While conceptually this comes after the mobilisation and the knowledge generation phase, elements of this phase are present throughout the process and range from discussing the objectives of participants and their motivations and values, jointly designing strategies for action, and working on the concrete follow-up. This dialogue will inform the operationalisation of the Living Lab, and the specific steps that will be taken throughout the project.

- Discussion on the results. After measuring air quality (and possibly already during measuring, if the devices allow for real time feedback), we engage in an open discussion on what the results mean to the participants, and in particular on whether these coincide with their expectations and whether there are lessons to be emphasised. This discussion, will also set the basis for follow-up actions.
- From information to action (1) - communication: Among the most likely follow-up there is the question on the communication if the results to a wider audience. This includes a discussion on whether and how to inform other citizens about the quality of the air measured through the SL project. Examples of different options include public debates, informal communication to relatives and friends, presentation in participants' groups and associations, communication to the press.
- From information to action (2) - behavioural change & prescription: At another levels, participants will discuss potential solutions to the problems identified. These range from changing their own behaviour, to identifying strategies to induce other people changing their behaviour too (e.g. conducting awareness raising campaigns, demand for regulations through public hearing and demonstration…)
- Implementation of the action: a final stage concerns the concrete implementation of the strategy jointly elaborated. This is potentially also the first stage of the next cycle.

Expected Results

- An overview of the meaning and the value participants attach to the measurement strategy
- Action agenda (includes communication strategy, and other solutions)

Cross-cutting: minimising and observing risks of social exclusion and barriers to large scale change

Project meetings

VUB and BRAL will hold regular meetings (at least once a month) both to agree on the operationalisation of the different phases of the projects, and to exchange views on the ongoing activities. The meetings will offer a platform to constantly reflect on the risks of social exclusion and resistance to large scale change, and to identify *ad hoc* solutions to minimise these risks.

Qualitative research (i.e. interviews with project participants and other stakeholders, participative observation, Survey of the press)

Throughout the project, VUB will conduct qualitative research to collect information on the perception and motivation of people and stakeholders in relation to the Living Lab. Particular attention will be paid on question related to the opportunities and the limits of the Living Lab to address issues of social exclusion and resistance to large scale change.

Expected results

- Detailed report on project specific issues related to social exclusion and resistance to large scale change

Research questions

Did the SmarterLabs methodology exclude individual users, groups of users or other stakeholders? If so, how?

Did the project change the mobility trajectories of the project participants? Did it change the mobility trajectories of other people and stakeholders?

Did the project produce an impact beyond the preselected project objectives? Why did it? Why did it not? Did the co-design phase reached an urban and metropolitan level? Did participatory air measurement processes become mainstream? why did it and why did it not

4.3 Graz

Project Partners: University of Graz – RCE Graz-Styria; City of Graz

4.3.1 Introduction and theoretical approach

The Griesplatz is an important 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. While over the last decade the Griesplatz has been an important subject of district development and urban renewal, it still suffers from low quality of the living environment for pedestrians and cyclists due to the high levels of motorized traffic. The City of Graz has recently decided to redesign the area implementing a Living Lab to involve local residents in the multicultural district of Gries.

The City of Graz follows a long-term "Smart City Strategy" which includes mobility measures prioritizing public transport, investments in e-mobility and city logistics. For the redesign of the Griesplatz interrelations with other city projects close-by need to be anticipated, such as the renovation of the "Rösselmühlpark", traffic calming measures for the area of the "Griesgasse" and plans for redevelopment of the adjacent "Griesviertel".

In the context of social inclusion and upscaling, the Living Lab Griesplatz will support the implementation of this redesign project by organising a participatory planning process that focuses on the inclusion of technology, people and institutions. This process is based on the city-internal guidelines for participation, which have been developed and applied in a couple of projects over the recent years and will be evaluated in the Griesplatz Living Lab with regards to institutional upscaling.

The participatory approach should reduce the risk of a socio-technical 'misfit' of the new square (i.e. technical solutions that do not fit the demand and concerns of stakeholders), as well as the risk of excluding certain social groups (especially marginalised groups, by approaching them 'on street' and inviting them in the participatory activities), and it will also increase the legitimacy of the final design. To facilitate the Living Lab, a "city district office" was installed at Griesplatz, which hosts the project coordinators from the city's Executive Directorate for Urban Planning. The office serves as venue for diverse activities and as a public space in general for people to get informed or bring in their opinions and desires.

Table 4.7 -Limitations and barriers to Living Lab process at Griesplatz

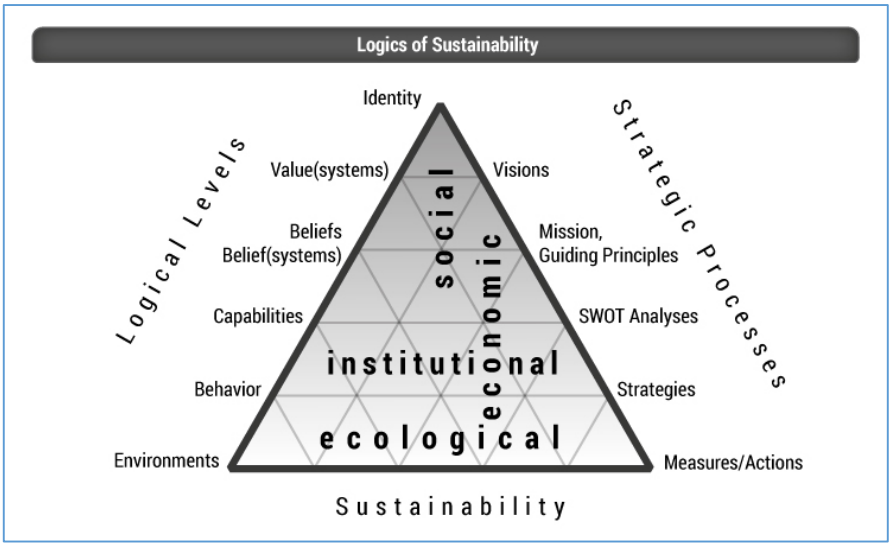
Limitations and barriers	Strategies/Measures
Not all groups of local residents are represented in the project	Stakeholder analysis at the beginning to get an overview of all relevant stakeholders. Use of different methods/tools for participation.
Little participation	Organize various (smaller) activities for different stakeholder groups over a longer period of time
Limited co-creation possibilities	Communicate clearly what is dedicated to creative freedom the and keep expectations realistic
Outcomes are contrary to people's desires	Create a shared vision with common objectives
Unstructured participation process	Define project steps. Stick to city's guidelines for participation.
Rigid administrational structures	Training and educational opportunities for civil servants on participation guidelines
Experiences from various participation projects do not lead to institutional upscaling on city level	Assure involvement and continuous commitment of city decision makers in the Griesplatz Living Lab. Critically evaluate the process, also from external institutions.

4.3.2 Methods and operations

Methodological background

To support and evaluate the process of the Griesplatz Living Lab the Logics of Sustainability Model will be applied. It was developed by Janschitz and Zimmermann (2010) in the context of inter- and transdisciplinary research by combining the two social theory approaches of logical levels and regional modelling. It describes how to practice regional or urban development based on a common set of values and beliefs, which is developed through participatory actions.

Figure 4.4 - The logics of sustainability (Janschitz and Zimmermann 2010)



The left side of the triangle in Figure 4.4 represents the concept of logical levels adapted from Neuro-Linguistic-Programming (NLP) which can be used as natural classification hierarchy for processes of thinking and learning in communication and change, but they are also necessary to integrate social, economic, ecological and institutional sustainability along these levels, leading to value-led logics of sustainability. Described in more detail, (1) the basis is built by our natural and societal environments, they are forming our external frameworks; (2) these environments are the basis for our behaviour; (3) our behaviour is organized by our capabilities (our perceptions, our knowledge, our personal strategies); (4) these capabilities are determined – quasi top-down – by our beliefs and belief systems; (5) our belief systems finally are shaped and coined by our value systems and our identity.

On the other side of the triangle are the elements of a strategic development process, which in connection with the logical levels enable a structured and appropriate process. This means to consequently follow the order from vision to mission (as guiding development principles) followed by a problem-based SWOT analysis, leading to strategies and consequently to concrete measures (Janschitz and Zimmermann 2010).

The hierarchical structure of the model is crucial. The higher levels organize and control processes at the lower levels, which means that higher level changes are more important and sustainable because the modulation effect of the system is working downwards. Janschitz and Zimmermann (2010) emphasize the creation of a shared mind set among stakeholders through innovative participatory communication methodologies. In this respect the authors refer to a “top-down meets bottom-up” approach, which results in a common vision and identity of the people in a region, city or district. Once a clear vision is set and values are defined, change processes are more likely to happen since the identity on top of the triangle influences all actions below.

Retrospective analysis (WP3)

The retrospective analysis (WP3) will investigate three past projects in the city of Graz. They were selected considering their value regarding the SmarterLabs project’s objectives and their potential for comparison to the new case study. Each project can be analysed towards aspects of either deepening, broadening or scaling-

up as well as social inclusion. A special focus lies on institutional upscaling by investigating how the city-internal participation guidelines were applied and improved over time.

- Griesplatz. The focus area of the Living Lab as described in the introduction was already re-designed some years ago. This provides the possibility to compare methods and outcomes used at that time (2001) with the new participatory approach.
- Sonnenfelsplatz. At this square in the university area a problematic, highly frequented roundabout was converted into a "shared space" by involving citizens, which led to a reduction of accidents.
- Neutorgasse. In this street the city government planned to adapt the existing traffic infrastructure. The final decision was made after applying a two-step participatory process with randomly chosen citizens.

From a methodological perspective, these three projects will be analysed mainly through project reports and interviews with stakeholders that should address the following **research questions**:

- Who was the initiator of these projects (bottom-up, top-down) and how was the design of the participation process?
- Were there any scientific models applied in the setup of the projects (e.g. logics of sustainability, participation models)?
- Has there been any learning process among city actors and citizens throughout the projects? How was knowledge and experience gained from one project used for following ones and how has it been documented?

Living Lab experiment (WP4)

The Living Lab experiment tests a new approach to urban development projects by focusing on a broader involvement of key stakeholders into the co-design process for the Griesplatz redesign. At the same time the whole process permits to evaluate the city's guidelines for participation and assess them with regards to institutional upscaling. The process consists of five phases described in the following:

In **Phase 1** stakeholders are identified in a systematic stakeholder analysis. This method is broadly used in diverse organisations, institutions and scientific fields (Friedman and Miles, 2006). During the last years, approaches to stakeholder analysis changed as methods gradually developed from business management and project management to tools used in policy, urban and regional development and natural resource management (Donaldson and Preston 1995; Healey; Jepsen and Eskerod 2009). There is a great variety of specific methods that can be applied for a stakeholder analysis. Drawing on ideas from business management, natural resource management and development studies, Reed et al. (2009), classified these as tools used for (1) identifying stakeholders; (2) differentiating between and categorizing stakeholders; and (3) investigating relationships between stakeholders. Table 4.8 summarizes some of the methods that can be used for the different categories, including details of the resources required, level of stakeholder participation, and their strengths and weaknesses. Whereas some methods can be applied to several reasons (e.g. Social Network Analysis), most are used for one of these three categories (Reed et al. 2009).

Table 4.8 - Resources required, level of stakeholder participation, strengths and weaknesses of each of the methods identified in the typology. (source: Reed at al. 2009 1937)

Method	Description	Resources	Strengths	Weaknesses
Focus groups	A small group brainstorm stakeholders, their interests, influence and other attributes, and categorise them	High quality facilitation; room hire; food and drink; facilitation materials e.g. flip-chart paper and post-its	Rapid and hence cost-effective; adaptable; possible to reach group consensus over stakeholder categories; particularly useful for generating data on complex issues that require discussion to develop understanding.	Less structured than some alternatives so requires effective facilitation for good results
Semi-structured interviews	Interviews with a cross-section of stakeholders to check/ supplement focus group data	Interview time; transport between interviews; voice recorder	Useful for in-depth insights to stakeholder relationships and to triangulate data collected in focus groups	Time-consuming and hence costly; difficult to reach consensus over stakeholder categories
Snow-ball sampling	Individuals from initial stakeholder categories are interviewed, identifying new stakeholder categories and contacts	As above: successive respondents in each stakeholder category are identified during interviews	Easy to secure interviews without data protection issues; fewer interviews declined	Sample may be biased by the social networks of the first individual in the snow-ball sample
Interest–Influence matrices	Stakeholders are placed on a matrix according to their relative interest and influence	Can be done within focus group setting (see above), or individually by stakeholder during interviews (see above) or by researcher / practitioner	Possible to prioritise stakeholders for inclusion; makes power dynamics explicit	Prioritisation may marginalise certain groups; assumes stakeholder categories based on interest–influence are relevant
Stakeholder-led stakeholder categorisation	Stakeholders themselves categorise stakeholders into categories which they have	Same as semi-structured interviews	Stakeholder categories are based on perceptions of stakeholders	Different stakeholders may be placed in the same categories by different respondents,

	created			making categories meaningless
Q methodology	Stakeholders sort statements drawn from a concourse according to how much they agree with them, analysis allows social discourses to be identified	Materials for statement sorting; interview time; transport between interviews	Different social discourses surrounding an issue can be identified and individuals can be categorised according to their 'fit' within these discourses	Does not identify all possible discourses, only the ones exhibited by the interviewed stakeholders
Actor-linkage matrices	Stakeholders are tabulated in a two-dimensional matrix and their relationships described using codes	Can be done within focus group setting (see above), or individually by stakeholders during interviews (see above) or by researcher/ practitioner	Relatively easy, requiring few resources	Can become confusing and difficult to use if many linkages are described
Social Network Analysis	Used to identify the network of stakeholders and measuring relational ties between stakeholders through use of structured interview/ questionnaire.	Interviewer, questionnaire, training in the approach and analyses, time, software	Gain insight into the boundary of stakeholder network; the structure of the network; identifies influential stakeholders and peripheral stakeholders	Time-consuming; questionnaire is a bit tedious for respondents; need specialist in the method.
Knowledge mapping	Used in conjunction with SNA; involves semi-structured interviews to identify interactions and knowledges	Same as semi-structured interviews	Identifies stakeholders that would work well together as well as those with power balances	Knowledge needs may still not be met due to differences in the types of knowledge held and needed by different stakeholders.
Radical transactiveness	Snow-ball sampling to identify fringe stakeholders; development of strategies to address their concerns	Training in the approach, time	Identifies stakeholders and issues that might otherwise be missed and minimizes risks to future of project	Time-consuming and hence costly

The stakeholder analysis helps to avoid some common pitfalls of participatory processes, such as neglecting historically marginalised stakeholder groups from the co-design process; overlooking pre-existing conflicts between different actors; and a lack of representativeness because of a narrow focus on small groups for in-depth deliberation and mutual learning process (Prell et al. 2009). It is especially crucial for the Griesplatz area that is characterized by a high percentage of foreign residents with income and education levels below city average. In fact, a mixture of the methods presented above is applied in order to identify interests and characteristics of relevant stakeholders.

Following the Logics of Sustainability Model, in **Phase 2** a diverse set of stakeholder assumptions, interests and expectations regarding Griesplatz is collected in order to create a shared vision. This is a long-time process (two years) of several activities that complement each other: stakeholder oriented events with workshop character, events in public space, online platforms, and being locally present with the "city district office" (temporary office during the participative process). This office serves as a contact and information point for the Living Lab Griesplatz and hosts the project coordinators from the city's Executive Directorate for Urban Planning who are also responsible for keeping track of all activities and facilitate the process. The goal of the workshops with different stakeholders is to understand their expectations, needs and the functions required on the Griesplatz and its environment. The participatory activities, both 'on street' and 'online', focus on exchange and joint engagement of the stakeholders. Through internet and digital media, information is provided to the wider public, emails and letters support the information campaign. Special attention is dedicated to local actors, groups as well as individuals frequenting the Griesplatz. One example for an interactive activity open to everybody are "Social Safaris" that during two to three days focus on one subject (e.g. traffic, safety etc.). Another activity are "Mental Maps" which are created directly with people in the street, thus also including target groups that are usually underrepresented such as children or old people.

In **Phase 3**, an idea competition for the Griesplatz area is organised, which is based on the learnings from the envisioning process as described in Phase 2. Citizens and civil society organisations are challenged to propose a design. The smartest design receives a prize, although there is no promise that it will be implemented integrally, but useful elements will be applied. This step is based on the methodological background of an idea competition and represents a subtype of architectural design competitions. It focuses on exploring significant design issues and thus stimulates interest in unconventional possibilities in city planning projects. Thereby, the specific frame conditions of the competition should be defined carefully because designers are likely to be sceptical of participating in idea competitions that do not have benefits either for the public or the profession, or whose benefits are limited because the ideas cannot be implemented (AIA 2010).

In **Phase 4**, the results of the idea competition (Phase 3) and the stakeholder perspectives and suggestions for the renovation plan (Phase 2) feed into the final architectural (re)design of Griesplatz. This is done by considering the collected inputs in the development of a clear, complete and well prepared program for an open architectural design competition. This method is commonly used for identifying design proposals of high quality to a wide range of solution to different planning challenges. They are supposed to foster innovative building opportunities accordingly to the requirements of the client. Therefore, format, rules and details must be tailored specified for each competition. The selected design solution for the project will directly lead to the construction of specific projects on the Griesplatz. The architect whose submission is judged the best of the competition will be commissioned to develop and realize the project on site (AIA 2010).

In **Phase 5**, the effects of the Living Lab activities are evaluated through a survey and a joint reflection workshop. This step is based on the methodological framework of participatory evaluation. According to Cousins et al. (1998), the basic assumption of this approach is that stakeholder participation in evaluation processes increases the evaluation relevance, ownership, and thus utilisation. The outcomes of participatory evaluation processes can be instrumental (support for discrete decisions), conceptual (educative or learning function), or symbolic (persuasive or political use of evaluation to reaffirm decisions already made or to further a particular agenda). Burke (1998) describes a collection of key principles for the process of engagement in collaborative evaluation activities, which are summarized in the following: (1) the evaluation should include and be useful to the key stakeholders, (2) the evaluation should be context-specific, based on the concerns, interests, and challenges of the key stakeholders, (3) the evaluation methodologies should respect and use

the knowledge and experience of the key stakeholders, (4) the evaluation must be impartial and should aim to empower stakeholders with the least power in the context of the evaluation, (5) the evaluation favours collective methods of knowledge generation, (6) the facilitators of the participatory evaluation process share power with the stakeholders, and (7) the participatory evaluators continuously and critically examine their own attitudes, ideas, and behaviour.

Based on the normative framework of the logics of sustainability model the following **research questions** are addressed through the Living Lab experiment in Graz:

Identity/Values: How does the process design of the Griesplatz project facilitate the vision-making of the area? What factors support the vision-making process to change the present urban mobility system? To what extent does the re-design process change the perception of the area's identity?

Capabilities: What institutional settings are appropriate for stimulating mutual learning to overcome barriers to changes towards more sustainable solutions? How does the process design of the Griesplatz project support mutual learning processes? How are existing experiences and knowledge embedded/considered in the setup of participatory processes?

Behaviour: How to overcome uneven power relations and existing conflicts between different actors? How to avoid a lack of representativeness in the participatory planning process and include marginalised stakeholder groups in the co-design process? What are suitable tools and processes for adequately involving diverse stakeholders in urban development projects?

Environments: What factors determine the successful implementation of collaboratively elaborated design solutions? How does the re-design of the Griesplatz consider the access of marginalised stakeholders?

4.4 Maastricht

Project Partners: Maastricht University – ICIS; City of Maastricht; Maastricht Bereikbaar; ANTEA.

4.4.1 Theoretical approach

Introduction and theoretical approach

The Living Lab experiment in Maastricht consists of a series of initiatives (most notably a series of focus group meetings and a web-based design tool) that engage relevant stakeholders in co-designing the renovation of the central station area. The Living Lab experiment in Maastricht takes place in the context of the Maastricht2030 vision that foresees a redesign of the Maastricht Central Station area (overground and underground) including the main square in front of the train station. Based on this the city government has set up a programme 'City and Railway'. This multi-year programme aims to address multiple urban planning challenges (e.g. new residential area, mobility, quality of the urban environment, etc.) by making optimal use of innovative, smart solutions. The city council decides on a project basis whether the various stages of the program will receive funding. Current, only the underground bicycle garage has received formal approval and is being built.

The Living Lab experiment invites stakeholders and citizens to become co-creators of the renewed station area for the period after the bicycle garage is finished (early 2017) towards 2025/2030. Future projects may involve a bicycle tunnel under the station, connecting the two sides of station area. This tunnel may involve new shops. Other possible projects include a connection to a tramline to Belgium, car-free zone, electric bus station, bicycle and car sharing stations. The re-design seeks to re-join the two sides of the city, opening to both sides equally and offering multi-functional services in the Central Station area that go far beyond transportation alone (e.g. shopping, eating and drinking, flexible workplaces, etc.).

Beyond the Living Lab experiment, we envisage an upscaling process towards (1) the expansion of inter-modal travel practices (i.e. trips that combines modes like train, bus, car, bikes etc.) at the urban level and (2) towards broader application of co-creative process in urban policymaking and more permanent public-private structures for urban governance. So it is on the one hand about an expanding modal share of intermodal trips at the city level, related to a 'smarter' infrastructure for transfers in the city (for example the development of 'mobility-as-a-service', including new payment systems, better measurements and data about travel times, capacity and connections between train, Park-and-Ride, bus, etc.), and better physical transfer infrastructures such as bicycle and car sharing systems, and possibly car restraining measures. These mobility innovations go hand-in-hand with smarter governance, because such a mobility system cannot be designed from scratch, but needs to unfold gradually in an iterative process in which the knowledge and views of the various stakeholders (including transport operators, travellers, etc.) have an important role. Therefore, it entails the upscaling of the temporary group of Living Lab participants into a more permanent (i.e. periodically meeting) urban mobility 'arena': for instance a public-private platform in which the diverse group of stakeholders become a key advisory and sounding board for the alderman mobility.

Main issues on upscaling & exclusion

Vreugdenhil et al. (2010) discuss five constraints on the effectiveness of pilot projects and ditto on the chances of upscaling (see Section 3.4). Here we describe to what extent these are a particular threat in the case of the renovation of the station area in Maastricht:

- limited representativeness: this barrier is less applicable to the Maastricht case, because there is only one station area, one main public transport hub. Upscaling is less a matter applying it on other station areas, but more a matter of increasing the share of inter-modal trips.
- limited learning: this barrier is very applicable to the Maastricht case, because there is a threat that current car users will be hardly involved in the project, resulting in limited learning how and when current car users would start to shift to PT / multi-modal travelling. Nevertheless, for future upscaling, current car users are the main target group.

- lack of institutionalisation: this barrier is applicable to the Maastricht case in two ways. Regarding travellers, new travel modes such as car sharing (and to lesser extent bicycle sharing) and smart travel services and information may be too unfamiliar for them to be seen as an option, especially for current car users and elderly respectively. Regarding the city government, there is the threat that a co-creation process is too far off their usual procedures to become a more permanent governance structure.
- Poor timing: this barrier is less applicable to the Maastricht case, because issues regarding sustainable mobility and problems with (too much) car use in the city are likely to remain a matter of importance.
- a wait-and-see attitude: this barrier is very applicable to the Maastricht case, because it is most likely that both within and outside the city government people tend to see the renovation as a project for a few streets. They tend to wait-and-see what the broader impacts are.

Regarding exclusion, the key threat is that citizens that do not match the smart citizen profile will be excluded from both the (smart) innovation process and the envisioned result of a (smart) station area.

Theoretical background

In terms of knowledge, this Living Lab experiment delivers 'target knowledge' (as opposed to system and transformation knowledge (see Pohl and Hadorn 2008): knowledge about what the desirable state (of the mobility system) can or ought to be. We view the Living Lab's co-creation process as a (temporary) *boundary organisation* (Cash et al. 2003), spanning the boundaries between council/alderman ('decision-makers') and various types of knowledges distributed across civil servants, urban planners/architects, technology consultants, citizens-travellers, local businesses, other urban organisations. The boundary management that we as process leaders undertake should seek to promote salient, credible and legitimate results and information (ibid.). Three features in our work deserve most attention:

- **Communication.** Active, iterative, and inclusive communication between (the various types of) experts and decision makers proves crucial to systems that mobilize knowledge that is seen as salient, credible, and legitimate in the world of action.
- **Translation.** Linking knowledge to action requires open channels of communication between experts and decision makers but also requires that participants in the resulting conversation understand each other. Mutual understanding between experts and decision makers is often hindered by jargon, language, experiences, and presumptions about what constitutes persuasive argument. Systems mobilize knowledge for action by translations that facilitate mutual comprehension in the face of such differences.
- **Mediation.** Translation can facilitate information flow between experts and decision makers when, as is often the case, they are divided primarily by different languages, usages, and histories. But the trade-offs among salience, credibility, and legitimacy are fundamental. Conflicts among efforts to attain them cannot always, or even often, be resolved merely by improving understanding. Mobilizing S&T for sustainability often requires active mediation of those conflicts.

In our SmarterLabs case, all participants start to develop a station area design for the year 2030, but in an iterative way, because participant comment and make suggestion on each other's design. In this way, the range of designs that are co-created (in the focus groups and 'online') are *boundary objects*. They are collaborative efforts/ outputs that ''are both adaptable to different viewpoints and robust enough to maintain identity across them'' (Star and Griesemer 1989, p. 387). Such collaboration creates a process more likely to produce salient information because it engages end-users early in defining data needs. It can increase credibility by bringing multiple types of expertise to the table, and it can enhance legitimacy by providing multiple stakeholders with more, and more transparent, access to the information production process (Cash et al. 2003).

The co-creation process is NOT a decision-making process. It (just) maps out a range of possible, co-created designs embedded in a multi-stakeholder discussion about pro's and con's. There is no need to find consensus, but there is the art of collaboration.

Methodological background

The two main methods in the Living Lab experiment are envisioning and co-design.

Envisioning

A vision entails images and a narrative of desirable systems based on shared principles of sustainable development. Coherent visions provide long-term orientation and guidance (Quist 2007; Farley and Costanza 2002), mobilize support and enrol resources for future activities (Helm van der 2009; Smith and Stirling 2008). A vision connects and commits actors with different backgrounds and stakes (Smith et al. 2005). In Maastricht we employ a process of imaginary scenario building (envisioning) to create a vision by engaging community and local change agents (Newman and Jennings 2008, p.4-5; Nevens et al. 2013).

Envisioning is thus defined as the process of creating a strategic vision. The vision can be seen as a lodestar – an image of the future that offers direction yet is never reached (Hines and Bishop, 2006). Visions are important for urban development because strategies and actions of urban planning should ideally be integrated, i.e., they should be developed and implemented based on defined values and beliefs. Inspirational images of the future of the city can also inspire stakeholders to design new and innovative actions and experiments for the city. Or the other way around, in case after some years several actions and experiments for the city have been developed by means of a bottom up process, the envisioning can take place by asking the question: in case these actions and experiments will be scaled up, how will the city look like? Such an exercise can take place in the context of a strategic learning process.

When developing the concept for the Maastricht station area, there is a need to combine top-down and bottom-up approaches: from top-down there is the Maastricht StructureVision 2030 (developed by the city government a few years ago, including a participatory process). This vision already includes some ideas for the station area. By organising co-creation sessions, bottom-up involvement of a wider group of urban actors can complement the discussion. Common principles need to be set up at the interface of "top-down meets bottom-up" to create appropriate room for business and society orientation as well as a strong orientation towards individual values and preferences. This is probably the most crucial point in the participatory envisioning concept: the possible and sometimes inevitable clash between common and individual value systems. At this point mediation procedures play an important role.

Co-design

Participatory design or co-design intent to: develop tangible benefits from closer collaboration, mainly expressed in new methods and models for urban development, and organize the discussion and to evaluate what has been achieved. In the Participatory Design (PD) / co-design community, action research has been one of the approaches that strongly has inspired how participation and collaboration among researchers, users and various stakeholders can be practically organized (e.g. Whyte, 1991). Thus, experiments and interventions generally play a strong role in these collaborations - combined with intentions of 'mutual learning' (Simonsen & Robertsson 2012; Greenbaum & Kyng 1991). Other core approaches in co-design experiments are 'prototyping' (Simonsen & Robertson 2012; Greenbaum & Kyng 1991, Hillgren et al. 2011) and using 'design games' (Ehn 1988/Brandt 2006, 2008; Eriksen 2012). Initially, PD was applied and developed within IT/systems-design research projects, and research-wise the field is still closely related to this, but during the past decade the use of PD has expanded to a diversity of areas and domains, including public and urban development. More recently, overlaps between a co-design approach and Living Labs have been explored as a part of the 'Malmö Living Lab', focussing on processes that support co-creation in Living Labs (Björgvinsson, Ehn, Hillgren 2010, 2012; Ehn et al., forthcoming).

The co-design approach taken in Malmö Living Lab is characterized by:

- explicitly bringing forward Living Labs as an approach to democratize innovation;
- explicitly addressing marginalized actors in the city and continuously trying to connect them to more established actors;
- connecting disparate parts of the city and building bridges between groups and competences;
- viewing innovation as about opening up spaces for questions and possibilities, rather than seeing innovation purely as producing novelty products to be marketed;

- aiming for a platform that can allow controversies to exist side by side (based on political scientist Chantal Mouffe's concept of agonistic space; Mouffe 2005);
- taking the starting point in community interests with a wider notion of what could be innovated, e.g. social innovation, rather than being industry and business driven (with a technology focus).

4.4.2 Methods and operations

The methodological approach is executed through four phases. Where relevant it is indicated how the phase anticipated the main constraints on upscaling & exclusion identified above.

Phase 1: Mobilisation of key actors

In Phase 1, the local SmarterLabs partners (City government, Antea group, Maastricht-Bereikbaar and Maastricht University) will jointly brainstorm on the types of knowledge and viewpoints that are required in the Living Lab, and the results of this will be translated into a list of stakeholders that need to be invited. Additionally, those invited participants will be asked if they believe more stakeholders should be invited as well (i.e. a snowball-method), and these suggestions will be considered by the SmarterLabs partners. This process should bring up the names of most relevant stakeholders, and hence prevent **- exclusion** of relevant groups or individuals (with regard to both the co-creation process and the suitability of the final results). It also should at least include the future 'users' of the station area (current Public Transport –PT- users and car commuters with most potential to shift to PT), in order to anticipate **scaling up** the level of inter-modal travels through the train station area and to and from the rest of the city.

Phase 2: Develop a common understanding of the process

In Phase 2 the stakeholders identified are invited for a first co-creation session in the framework of the process (see Phase 3) is explained. Jointly, the Lab experiment is designed in more detail and learning goals are defined at both experiment level and stakeholder level. The joined activities should support the commitment of stakeholders on the one hand, and on the other hand integrate various types of stakeholder knowledge and expertise to improve the renovation process in the sense of being better tailored to the particular travellers of Maastricht, and hence improve chances of **upscaling** in the future. Derived from the overall aim to enhance the quality of the urban living environment in Maastricht whilst sustaining high accessibility, there are two central questions: (1) how can the services of the station area facilitate a growing modal share of inter-modal trips in Maastricht (at the expense of pure car trips) and (2) how can the monitoring of mobility trends in Maastricht and development of mobility policies in the future also be embedded in a multi-stakeholder structure? In both cases: what are hindering factors?

Phase 3: Co-design

Phase 3 consists of two parallel tracks, relating to two different ways of engaging citizens. The combination of the two ways should minimize **exclusion** of citizens not fitting the 'smart' profile. The first track uses ICT tools to engage citizens, travellers and local entrepreneurs in the redesign of the Station Area (including the area from the A2 to the 'singels'), most notably a web-based design tool for everyone to create and show his/her own favourite city center online regarding mobility services and physical infrastructure[7]. Contributors can comment on each other's design online, use parts of each other's' design and also adapt their own design at a later stage. Experts from the project partners (i.e. policymakers from the City Maastricht, engineers from Antea and travel experts from Maastricht-Bereikbaar) will also comment the designs online from their particular expertise (i.e. effects on accessibility, quality of the living environment and cost). The second track consists of a series of co-creation (i.e. focus-group) meetings that bring together key stakeholders: designers, policymakers, travellers, local businesses, citizens etc., also designing mobility services and physical infrastructure for the city center by 2025/2030, using physical models of the city. This process includes citizens

[7] The precise technology to be used is still to be decided in discussion with the local government, ANTEA and Maastricht Bereikbaar. Apart from a web-based design tool like Minecraft it may involve virtual reality tools (such as 3D glasses), which would open up a range of new possibilities and methodological questions that we will not address now.

that are easily overlooked, especially those that do not match the 'smart' profile, such as citizens that are not able to afford or use ICT tools easily. The designs from track 1 that are posted online can be an input to the focus groups and they can also be shaped by results of it. At the end of this Phase a range of designs are frozen.

Phase 4: Evaluation and monitoring

Phase 4 evaluates the effects of the Living Lab on the final plan (i.e. the one that the city council approves) for the (future) renovated station area through interviews and a joint reflection workshop. These interviews and workshop will with have special attention for (1) barriers to **upscaling** the share of intermodal travels in the city (and decreasing car use) and (2) the **in/exclusion** of social groups during the innovation process.

Research question

The Maastricht case study addresses the following research question: Which innovations should be co-created for the renovated Maastricht train station area by 2025/30 in order to trigger (1) growth of inter-modal mobility at the expense of car mobility and (2) broader application of co-creative process in urban policymaking?

5. Conclusion

The SmarterLabs project sets up and investigates four Living Labs on urban mobility in four different cities (Bellinzona, Brussels, Graz, Maastricht). In this first substantive report (WP2), we review the main bodies of literature that are relevant for our research and introduce the four cases from a methodological perspective. Although we explicitly prefer a research setup that relies on a diversity of cases as well as a diversity of theoretical and methodological angles, this review report does allow us to make some broader conclusions concerning the challenges of social inclusion in and upscaling of Living Labs.

As our chapter 2.5 on social exclusion highlights, exclusion refers to a multidimensional, multi-layered and dynamic understanding of deprivation. Exclusion, in other words, is or can be related to poverty, but also goes beyond it: from a risk perspective anybody can be socially excluded, since everybody is exposed to risks. The chapter also points to the importance of the local context, since various local factors – for example the quality of and access to infrastructure – can influence the extent to which individuals are exposed to risks and ultimately socially excluded. In the context of our SmarterLabs projects and identified most explicitly in our discussion of the concept of smart cities (Ch. 2.1), one of the key challenges of social inclusion is to include not only technology savvy and higher educated citizens, but also those without sufficient digital and other cognitive skills. More broadly, SmarterLabs should ensure that a diverse group of actors is involved in setting up and realizing the local experiment, since the development of new partnerships and collaborations allows for the introduction of new and innovative knowledge into local governance arenas (as discussed in Ch. 2.2).

Also discussed in chapter 2.1 and 2.2, the spatial boundedness of our SmarterLabs project is an opportunity and a threat at the same time. It's an opportunity, because it allows for radical innovation in confined settings that would not be possible (or politically achievable) on a larger scale. But it's a threat, because this situated experimentation might lead to an improvement of the situation within the particular locality, but a worsening of conditions in the surrounding areas. Various of these issues are picked up in our discussions of the theoretical perspectives in chapter 3. The literature on behavioural change is by and large a literature focused on individuals and not social structure, but section 3.1 does address various 'structural tools' that have an impact on the relative in- or exclusion of citizens: for example, the changing of physical environments that supports changes in individual's mobility behaviour, or the implementation of fiscal measures and fair pricing systems for the use of various transport modes. The literature on the commons (Ch. 3.2) supports a Living Lab approach as one of the key ways of achieving social inclusion, since these approaches in theory at least enable a shared identification of common goals, the means to achieve these goals, and of the necessary mechanisms to govern these Living Labs. At the same time, the review also points to similar limits to inclusion as already identified: selective in/exclusion at the design stage of the project, and marginalisation in the project process due to a lack of time or a lack of cognitive resources to participate fully. This last point is addressed more fully by the review of the literature on participatory governance and planning (Ch. 3.3). Starting from Arnstein's (1969) remark that participation without the sharing of power is meaningless, the review identifies various intensities and techniques of participation that, each in their own way, have different implications for social inclusion. The literature on participation emphasizes that citizen involvement in planning processes increases urban democracy, but also the legitimacy of government projects. This observation in itself points to the relation and potential tensions between expert-driven and technocratic governance strategies and what we can describe as lay, citizen or 'bottom-up' knowledge and the emergence of counter-expertise. Finally, the literature on socio-technical change is less immediately interested in social inclusion, but in the discussion in chapter 3.4 of the constraints on upscaling, the first mentioned constraint – limited representativeness – immediately points to the close intertwinement of social inclusion and upscaling: by focusing on very confined scales or by including only a very particular set of actors in the development of the Living Lab, its representativeness and potential of using the outcomes of this project in new situations declines.

The challenge of inclusion thus unavoidably raises questions about upscaling. In chapter 2.4 on upscaling, we review the relevant literature that has engaged with this concept and basically reach two main conclusions. First and most clearly discussed by the literature on strategic niche management, upscaling refers to new or innovative practices (material, discursive), learned in the course of practical experiments (the SmarterLabs

projects), that start to shape new meso-level structures. Ultimately, this upscaling dynamic can transform the urban regime and trigger lasting institutional change. Second, we can observe that much of the success of local experiments depends not only on local upscaling, but also on more transversal and translocal types of knowledge transfer. As has been investigated most extensively by geographers, local actors can 'jump scales' and create spaces of engagement that shifts the local power balance in favour of the local experiment at the expense of vested interests. Many of these upscaling challenges return in one way or another in our literature review. Thus, chapter 2.1 on smart cities already hints the limits to upscaling in the discussion of the technological fetish underlying many smart city projects: in depicting smart cities as technocratic utopias and pretending that the technological means of gathering urban data is neutral, these discourses de-politicize city planning and management by ignoring conflicts of interest. Upscaling of SmarterLabs as envisioned in this report will become very difficult in these kinds of settings. Not surprisingly, therefore, the critical literature on smart cities argues that a full-blown cultural change in public institutions is needed. The literature review on behavioural change (Ch. 3.1) importantly remarks that upscaling is not just about local experiments 'being picked up' and supported by local governments, it is also about embedding Living Lab activities in the daily practices of existing communities, such as schools or people working in the same company. Fostering community engagement activates the power of social norms and this can lead in turn to more structural behavioural change. This observation seems complementary to the argument in the literature on transition studies that we need to upscale by developing new meso-level structures. From a different perspective, the literature on the commons (Ch. 3.2), looks at how experiments of collective governance of micro-level commons (e.g. those engaging only few dozens of people) can be nested within higher levels of governance. Scaling up a collective approach to the governance of the urban common, for instance, implies careful design of mechanisms of representation and feedback among the different levels. Finally, we can point to the literature on socio-technical change (Ch. 3.4) and its identification of six different pathways of upscaling as well as its discussion of five constraints to upscaling. As our SmarterLabs project only runs for three years, which is too short to identify clear pathways of upscaling, the identification of the key constraints will be more directly relevant in the empirical analysis of our four cases: next to limited representativeness already discussed above, this includes limited learning, lack of institutionalisation, poor timing, and a wait-and-see attitude.

Chapter 4 of this report discussed in detail the methodological and data collection strategies adopted in the four different SmarterLabs case studies. We will not repeat this discussion here, but this methodological review informs the actual empirical analysis of the cases that is to be conducted as part of WP4. Taken together – the review of the literature and the discussion of the methodological approach – this report will also be used to analytically structure the output for WP3, namely the retrospective analysis of urban mobility governance in the four cities.

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