Exploring the Living Lab approach for improving the interoperability between local, regional and transnational transport networks

Florian Kressler[a]*, Tamara Vlk[a], Gabriele Grea[b], Anja Seyfert[c], Doris Wiederwald[a]

[a]AustriaTech Ltd., Raimundgasse 1/6, Vienna 1020, Austria
[b]CERTeT – Bocconi University, via Roentgen 1, Milano 20136, Italy
[c]Redmint s.c.r.l., via Fra Cristoforo 14/D, Milano 20142, Italy

Abstract

Transport systems in Central Europe often show a lack of integration between different transport networks and modes. Linking the Trans-European Network to the regional passenger transport system is a challenge, linking both to flexible mobility services such as sharing services, on demand transport etc. on a local level, is an even bigger one. However, the potential of a successful integration with regard to improved service quality, increased accessibility and sustainability is high. The paper will outline the basic concept of Living Labs and its usability for the improvement of local, regional and transnational transport systems. The Living Lab approach will help take into account the mobility needs of different user groups when developing new services or adapting existing ones and will support these services to become more competitive and financially viable. In the Interreg-project SHAREPLACE six Living Lab sites in Austria, Croatia, Germany, Italy and Hungary will be implemented.

Keywords: Living Lab, user involvement, sustainable mobility, interoperability, transport network

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* Corresponding author. Tel.: +43 1 26 33 444-25; fax: +43 1 26 33 444-10.
  E-mail address: florian.kressler@austriatech.at

1. Introduction

The quality of transport networks in hinterland regions in Central Europe varies in terms of provided public transport services, infrastructure for environmental friendly transport modes and moreover, of interoperability between existing services (from different operators). The Interreg co-funded project 'SHAREPLACE' ("**Sha**red mobility and **Re**gional transport integrated **Pla**nning for a better connected **C**entral **E**urope") tackles mobility needs and existing transport options in six pilot regions, located in Austria, Croatia, Germany, Hungary and Italy by developing and implementing new tools and services for better connected local, regional and transnational transport networks. Currently, the participating pilot regions vary in terms of provided services and the service quality. Some regions already have developed concrete mobility plans or strategies; others have certain services or vague plans for soon-to-be-done implementations or not even well functioning or affordable transport services. Besides lack of quality at local and regional level, the connectivity to the Trans-European Transport Networks (TEN) – in this case the Rhine-Alpine and Mediterranean corridor – is not sufficiently provided.

In order to tackle these issues the SHAREPLACE project was set up. For the purposes of the project the methodology of Living Labs was identified to be most suitable. The approach provides various stages of user involvement and enables user-driven innovation on local and regional levels. Furthermore, experiences and insights can be transferred among six different Living Labs and scientific support is provided throughout the project. In specific, tools and services will be designed and co-created by its potential future users and operators for enhancing the transport situation. However, the functionalities and areas of use of the tools and services depend on the corresponding regions and its previous developments and efforts in terms of mobility planning. This means, the project's output will not be a standardised tool respectively service, but rather a flexible and adaptable/scalable solution to be customized for each pilot region. Each Living Lab will be supervised by mobility planners and transport providers aiming at matching the users' requirements. The solutions identified by the living lab activities with the contribution of engaged stakeholders will be accompanied by a business modelling exercise; the aim is to establish solutions that will be self-sustaining in a long-term perspective.

As the participating regions differ from one another in terms of available transport services, cultural patterns, demographic characteristics and attitude towards mobility and transport mode choice, the Living Lab concept helps to develop and implement suitable services accordingly. Moreover, each of the regions can benefit from one another as knowledge and experiences can be exchanged across Europe.

This paper outlines the basic concept of the Living Lab approach, its use in transport research and concrete potentials as well as challenges when it comes to the target achievement of the SHAREPLACE project. Since the project recently started, the aspiration of this paper is not presenting actual Living Lab findings, but thoughts on the suitability of the Living Lab methodology in an applied mobility-research-related context.

2. Living Lab approach and applied transport-related research

Living Labs are real-world test environments that address certain areas (thematic as well as spatial) and target groups for enabling joint developments of tools and services. Besides development processes, also awareness towards certain topics can be raised among different participant groups. Living Labs aim at pooling knowledge from as many (willing) participants as possible for generating best possible solutions respectively innovations.

The methodology of Living Labs was firstly recognized by the mid-2000 and has its origins in the industry sector where it was initially applied for accessing users' opinions on product development. Originally the Living Lab concept (in the context of physical developments) was mentioned as such by the Massachusetts Institute of Technology (MIT) with the main aim of identifying and proving the potentials of users' contribution for successful innovations in production-consumption systems (von Geibler et al. 2014). In 2005 Living Labs were mentioned in the context of ICT solution development. Back then, the aim was to bring users and consumers into the system of innovation and benefiting of a larger mass of ideas, knowledge and experiences (Eriksson 2005).

2.1. Methodological approach of Living Labs

Living Labs are used for creating test environments by enriching traditional research methods (e.g. qualitative and quantitative surveys, modelling and observations) with constant user involvement and feedback loops together with other stakeholders. By implementing Living Labs, a platform on which various methods of user integration are put into practise is provided (von Geibler et al. 2014). The core element of every Living Lab is the network formed of public and private stakeholders who jointly develop and test new technological developments within the framework of an open innovation process (Wiederwald et al. 2017). The Living Lab approach and its variations (e.g. urban mobility lab) are based on the quadruple helix model of (innovation) partnership, where government, industry, the public and academia work together and produce innovative solutions (Voytenko et al. 2015).

The Living Lab concept is integrated in EU and national open innovation strategies as well as in research funding programmes (e.g. "Mobility of the Future" in Austria). By doing so, the EU as well as for example Austria aim at strengthen their global competitiveness in economic developments. Therefore, the aim of Living Labs is to involve as many stakeholders as possible for generating disruptive innovations. A crucial characteristic of Living Labs is the win-win pairing for participating actors, whereas every participant ideally benefits of the Living Labs' outputs as much as effort was performed (Wiederwald et al. 2017). A core value of Living Labs is high transparency for promoting the cooperation between various involved or affected stakeholders.

When applying the methodology of Living Labs, insights on the preferences and behaviour of users and consumers are generated (Liedke et al. 2012). Aspects such as user friendliness, acceptance, accessibility and usability of tools or services can be examined and customized accordingly. At the same time, user awareness about certain tools or services can be generated at an early stage of development. By doing so, the chances for success and user acceptance as well as (long-term) exploitation can be increased. According to Liedke et al. (2012) user-centred approaches are appropriate for minimizing the risk of rejection by future users. Hence, chances of long- or at least mid-term success are enhanced.

2.2. Living Lab research practices

On EU as well as on Austrian scale, open innovation activities such as Living Labs are integrated in strategies and policies that aim at forming future developments. By following the principles of open innovation, joint knowledge and innovation processes should involve actors from economy, science, politics, public authorities as well as the public for enabling a broader view on future product and service developments.

In 2006 the 'ENoLL' (**E**uropean **N**etwork **o**f **Living Lab**s) was founded as an international federation of benchmarked Living Labs in Europe (and worldwide). ENoLL includes around 400 (active and inactive) Living Labs in its database, whereas mobility- and transport-related Living Labs are represented. Involved Living Labs try to enable a bottom-up dialogue between affected stakeholders by empowering citizens and motivating them to participate in innovation processes. Different mobility solutions and more sustainable commercial tools or services should be achieved. Focus areas of the ENoLL mobility labs are the (1) development of physical infrastructure and services, (2) the validation of shared mobility solutions, (3) cross-border applications and (4) the integration and interoperability of different mobility related services (ENoLL 2017).
Another institution that promotes Living Labs respectively Urban Living Labs is the Joint Programming Initiative (JPI) Urban Europe.[†] The initiative is the main funding agency for Living Lab related projects in European cities (Voytenko et al. 2015). By 2017 twenty Living Lab projects were funded by the initiative (JPI Urban Europe 2017).

When speaking of open innovation, also open data is subject to the operation of Living Labs. Open data means generating, processing, providing and using (publicly) generated data among a certain user group (e.g. users of a transport application). Especially when it comes to research methodologies and findings that are of general interest and would generate an added value for a society or economy, open data and its joint use is promoted. This is especially due to the provision of an open and transparent innovation process (Wiederwald et al. 2017).

[†] http://jpi-urbaneurope.eu/ (retrieved on 12.09.2017, Vienna)

2.3. Embedding of the Living Lab approach in transport-related research activities

von Geibler et al. (2014) found that the field of 'region and mobility' are particularly relevant for the investigation in Living Lab (research) practices especially tackling natural resource consumption and improvement when it comes to greenhouse gas emissions. Since activities in this field are strongly influenced by user behavior, innovations have high potential to benefit from user involvement (von Geibler et al. 2014).
In 2011, the European Commission published a roadmap for establishing a low-carbon economy in 2050 with the goal of cutting domestic greenhouse gas emissions by at least 80% by 2050 compared to 1990 (European Commission 2011). Part of achieving these goals (on national and European level) are e.g. research projects or implementation measures or legal guidelines that regulate the decarbonisation processes in the transport sector such as Interreg CENTRAL EUROPE projects.

Every single activity related to transport developments in Europe has to be carried out in accordance with global, European, national or regional goals. Mostly, sustainability, decarbonisation, affordability and social inclusion rank first. In this context, three goals of the Transport White Paper were chosen to be addressed by the upcoming developments on local level. According to the Transport White Paper there is a global aim of halving "the use of 'conventionally-fuelled' cars in urban transport by 2030, phase them out in cities by 2050 and achieve essentially CO2-free city logistics in major urban centres by 2030". Furthermore, "A fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high quality and capacity network by 2050 and a corresponding set of information services" is approached. Also, by 2020, a framework "for a European multimodal transport information, management and payment system" should be established (European Commission 2011).

The government of Austria, in concrete the Federal Ministry of Transport, Innovation and Technology hosts the funding initiative "Urban mobility labs" which enables the implementation of urban mobility labs and co-creation processes for making transport more sustainable in a long-term perspective. In the current funding period five urban mobility labs are implemented in four different cities in Austria, considering both passengers' transport and freight transport. The common aim of all these Urban Mobility Labs is to establish and provide certain environments (defined areas and involved actors) for identifying potentials and strengths on a small scale (e.g. municipalities), testing certain innovations and furthermore transferring it to larger scales (e.g. regions).

Considering the effects of the transport sector on climate change developments (in Austria 28.5% of the national greenhouse gas emissions are produced by the transport sector (Anderl et al. 2016) new forms of mobility, alternative propulsions technologies (e.g. electricity, hydrogen, liquid gas) and a modal shift from private transport to e.g. public transport or shared mobility options require a change of attitude in the first place. This change of attitude can be achieved by addressing customers and users in an early development stage by confronting them with their own behavior e.g. within the framework of Living Labs.

3. Use of the Living Lab approach in SHAREPLACE

For accordingly addressing Europe's transport goals and achieving a contribution for a more sustainable and inclusive mobility, the Interreg project 'SHAREPLACE' was drafted. The core elements of the project are the Living Labs that will be implemented in six different regions. Test environments will be implemented, stakeholders will be trained and knowledge for developing new mobility-related tools and services will be pooled.

3.1. General introduction to the SHAREPLACE project

The overall goal of SHAREPLACE is to develop an innovative approach to improve the connectivity of local, regional and transnational transport systems. SHAREPLACE will be open to all types of passenger transport and target groups. By implementing Living Labs and actively engaging stakeholders, transferable solutions for a more integrated, accessible and harmonized mobility system in six central European regions will be created, tested and change of behaviour will be monitored. These solutions will be supported by innovative business models and strategic guidelines for policymakers and planners. The Living Labs will be set up on municipality level whereas concrete implementation areas will be found together with local and regional stakeholders during the course of the project.

The Living Lab activities in SHAREPLACE focus on the reduction of the amount of traffic generated by fossil fuelled vehicles (powered by fossil fuels) and energy efficiency respectively fossil energy savings in passenger transport. Therefore activities for increasing the occupancy rate of individual cars (e.g. by implementing ride-sharing initiatives), promoting (existing) public transport or environmental-friendly transport modes (e.g. biking) are planned to be tackled within the Living Labs.

Within the framework of four thematic work packages, Living Labs and pilot projects will be set up, new tools and services will be tested, improved (according to the stakeholders' needs) and mobility strategies for respective regions will be designed. The whole process will be accompanied by various communication methods in order to properly address corresponding stakeholders. The main goal of the communication approach is to raise awareness among providers, authorities and political actors and engage users for co-creating their future mobility.

3.2. SHAREPLACE regions in detail

The SHAREPLACE regions vary in terms of their geographical, socio-demographical, economical and structural characteristics. Two Living Labs will be installed in Italy - one in Bergamo and one in Crema -, another one in Zalaegerszeg, Hungary, a fourth one in Osijek, Croatia, and two more in the Ulm region in Germany and the Fuschlsee-Mondseeland (FUMO) region in Austria. Participating regions show different stages of advancement when it comes to their transport supply and the level of achievement of European transport goals.

The municipality of Bergamo, Italy, is in charge of a pilot activity focusing on the integration of sharing options into local and regional transport networks, through the active participation of citizens and the collaboration of mobility service providers and other stakeholders. The living lab will be set up at municipality level and the concrete pilot area will be defined by the co-creation process and according to the innovation potential and feasibility. The results of the experimentation will be scaled up at municipality level to improve the connectivity of peripheral areas to the regional transport system.

In Crema, Italy, a pilot activity focusing on developing and optimizing flexible transport options through collaboration will be implemented. The Living Lab will be set up at municipality level with the support of the endorsed Municipality of Crema, as well as the pilot area which might be extended to the extra-urban territory. Test results will be scaled up within the Miobus[‡] offer which is provided by the regional transport provider Autoguidovie, enabling the basis for the development of innovative and integrated services in other urban and extra-urban contexts in Lombardy region.

Osijek, Croatia, will implement a pilot activity focusing on planning and governance for seamless mobility-based systems. The target area for the living lab and pilot action is the City of Osijek (regional transport node), while the scaling of the solution will cover the area of Osijek urban agglomeration (ca. 195,253 inhabitants). By participating in the SHAREPLACE project local transport and development strategies will be enhanced. Indirectly it will also have an impact on Transport Masterplan for Osijek Baranja County, Development strategy of the County and the future Transport Masterplan of the Eastern Croatia Functional Region. The expected benefits are enhanced mobility offers within the municipality region and the concrete pilot area. It will allow further integration of City operated bus and tram services, with other mobility providers (e.g. ride, car and bike sharing services).

Zalaegerszeg, Hungary, is in charge for the implementation of a pilot activity focusing on developing and optimizing flexible options through collaboration. The City has developed its Integrated Settlement Development Strategy for the 2014-2020 programming period as well as the Integrated Territorial Program to support its implementation, identifying several projects which were planned for later realization with specific budgets and timelines. City of Zalaegerszeg has elaborated its Sustainable Urban Mobility Plan (SUMP), and SHAREPLACE approach will represent a complementary enhancing element of the strategy and support the implementation of the plan. The target area for living lab and pilot action is the commuting, suburban area of the city consisting of 111 settlements, summing up relevant commuting flows (ca. 3,400 students and ca. 14,600 workers), and highlighting public transport unserved areas and poor connections to main transport hubs within the city (main railway and bus station, other stops).

[‡] Miobus is the flexible bus transport services operating in Crema since 2006

The City of Ulm, Germany, is in charge of a pilot activity aiming at integrating sharing options into regional and local transport networks. The target area for living lab and pilot action is the Stadtkreis Ulm, Landkreise Neu-Ulm and others, the range of interest will be broadened to wide area of responsibility in Baden-Württemberg and Bavaria. The pilot action will focus on sharing solutions for enterprises in Ulm or Neu-Ulm, connected to the growing commuter flows along the Rhine-Danube corridor between Stuttgart and Ulm, and will involve the employees of several companies and include the City of Ulm (ca. 2,500 employees).

The FUMO region originally is a LEADER project of 11 municipalities together with the countries of Salzburg and Upper Austria, working on regional improvements when it comes to spatial development and transport. It represents a typical "Hinterland" region in the catchment of the Alps, characterized by rural and hilly areas, disperse settlements and a concentration of employment in supra-regional centres. Thus, the public transport network is not as dense and private cars are the most common mode of transport (mainly with single person occupation) especially when it comes to leisure travels. The FUMO region aims at implementing a so-called service hub that provides integrated mobility services for citizens and visitors. The expected benefits include strengthening of the economic situation within the region and to lower greenhouse gas emissions produced by transport. Based on previous experiences, the pilot will contribute to the fine-tuning of precisely analysed and planned measures for the FUMO Region.

3.3. Description of Living Lab activities within SHAREPLACE

Overall goals of the project are the improvement of connectivity between urban centres and peripheral areas, the enhancement of interoperability and intermodality between existing services as well as the promotion new forms and options of transport. Considering a long-term perspective, changed attitudes and habits as well as new and more sustainable mobility patterns are desired. Furthermore, urban approaches such as the adaption and enrichment of Sustainable Urban Mobility Plans (SUMP) and the integration of sharing-mobility options in regional and local transport networks are to be considered.

Different services and improvements are currently being discussed. The City of Ulm is with around 120,000 inhabitants the most populous municipality engaged in the project. It wants to raise the share of people using bikes, Crema, Osijek and Zalaegerszeg want better integrated intermodal transport services and Bergamo seeks to pool rides in order to increase vehicle occupancy. One specific activity envisaged within the Living Lab framework is represented by the co-design- development and fine tuning of a technological "service hub", developed within the FUMO region. The FUMO region wants to integrate existing and new services/tools in a digital, intermodal service hub. At a later stage, this service hub will be transferred to the other participating regions and further developed in accordance with their needs and expectations. It will be part of the tasks of the Living Labs to define further details and decide on which services to establish in each region.

For achieving these goals set for the SHAREPLACE Living Labs, stakeholders such as prospective and existing customers, authorities, local and regional transport providers and operators (e.g. of railway, busses, light rails), agencies for local public transport planning, transport associations and private companies offering transport services will be involved. The pilot projects within the Living Lab activities follow the goals of the Paris climate agreement from 2015 and aim at reducing greenhouse gas emissions from transport. Every country hosting a Living Lab in SHAREPLACE signed, accepted and approved the ratification of the Paris agreement on national level and entered it into force by now (United Nations Framework Convention on Climate Change 2017). Therefor funding programs such as the Interreg CENTRAL EUROPE program enable the development of technical and social innovations that contribute to a greenhouse gas reduction in certain target areas.

By developing and installing a digital service hub for people commuting and travelling on leisure purpose, more mobility options will be made available and also visible for (potential) users. Since it must be ensured that the services are used efficiently, test users will be consulted from the very beginning – this is where the Living Lab activities are going to start. As it is obvious that the SHAREPLACE pilot regions strongly vary from each other, especially when it comes to the quality of the transport systems, it has to be ensured that the system architecture of the service hub is designed flexible and scalable as possible. Inputs for the beta development phase are also generated within the Living Labs outside the FUMO region. This ensures the feasibility of adapting the service hub for the other regions in a second stage. As soon as the beta version of the service hub is available, the transfer to the other pilot regions, respectively Living Labs can be commenced.

The concrete Living Lab areas will be defined in accordance with the needs and requirements of the participating stakeholders before the actual set-up of the Living Labs. This procedure will be coordinated by each pilot area on local respectively regional level. The overall common approach of all SHAREPLACE Living Labs is to improve the connectivity of the participating regions to the TEN-T networks. Therefore it has to be ensured that the overall perspective is communicated within each Living Lab and its importance transferred to each participating stakeholder. Thereby also information on needs, expectations but also threads towards a transnational connectivity from the stakeholder's point of view can be collected and tackled within the Living Labs. Solution plans and strategies for future developments can be adapted towards these valuable insights.

4. Potentials, challenges and recommendations when using Living Labs in SHAREPLACE

In order to adequately design and implement the SHAREPLACE Living Labs, potentials and challenges of the methodology are prepared and recommendations for the start-up phase can be derived. The following chapters highlight specific potentials and challenges and their meaning for the different SHAREPLACE Living Labs. Recommendations arise from the utilization of potentials in order to mitigate challenges from the very beginning.

4.1. Potentials

High potentials for using the Living Lab methodology in SHAREPLACE can be identified when considering the involvement of different target groups respectively stakeholders for generating innovative ideas in real-world test environments. Different needs and expectations can be considered and the chances of product and service success can be raised before an actual market launch. Involved actors are animated for improving the current situation in the pilot areas by implementing new technologies or business models without having the risk of worsening their own conditions of competition by e.g. taking (financial) risks when developing new services. At the same time awareness for environmental and transport-related issues can be raised, also among authorities and the government. Since the SHAREPLACE consortium also provides assistance for business model developments within the Living Labs, economical weaker regions and areas with low mobility standards benefit from this approach. This is also due to the fact that one core element of Living Labs is that all stakeholders of a certain environment participate and share their knowledge and experiences which should enhance the success factors of innovative solutions (in theory).

Besides achieving real-world testing results by having financial programme support, also scientific support is usually granted. This means the Living Lab implementations in SHAREPLACE enable the development of scalable and flexible solutions by minimizing financial risks at the same time. Living Labs are supposed to function transparent and non-discriminating, which also enhances the chances of success and improves the communication and innovation processes among stakeholders in every region.

Thus cooperate social identities and responsibilities for future work and mobility planning can be evolved during the development and implementation processes of the Living Labs. Since the Living Lab approach focuses strongly on the end-users who will be gathered together in several meetings and events, present and future responsibilities can be discussed and actions for the resilience of the developed mobility solutions beyond the project duration can be defined.

Within the SHAREPLACE test environments, not just services and tools can be developed, also a basis for strong and resilient community-building can be created. It is also a chance to directly transfer the intention and goals of Europe's transport policies to the citizens and transport users in order to raise awareness towards more sustainable mobility behaviour on local level. From another point of view, also citizens can benefit from the Living Lab approach. If carried out properly, the needs and expectations of transport users are collected and directly transferred to corresponding providers and authorities in order to design the transport system accordingly. For the providers and authorities it is a chance to retrieve feedback in a transparent and constructive way. Providers furthermore can benefit of the data to be collected within the Living Labs and get a more clear/proper view on requested future developments in order to match the needs of the citizens with the approached overall climate, energy and transport goals.

There is also a chance of establishing a strong community that is dedicated to low-emission transport. Experiences with user groups of different cultural backgrounds can be collected and passed back in the design and organisation of Living Labs.

4.2. Challenges

Challenges within Living Lab organizations are usually due to the availability of financial and human resources as well as organization-/management-related aspects. This applies for stability of the Living Lab itself as well as the equal participation of every affected stakeholder group. When establishing innovation processes and new solutions, the challenge is to engage all affected stakeholders in the same manner. Otherwise some stakeholders would take advantage of innovation projects without being part of the solution-finding process during the Living Lab (Wiederwald et al. 2017). Another challenge is to define clear responsibilities for certain activities and structures as well as the effective management of the Living Lab (Wiederwald et al. 2017). These challenges will have to be considered with high priority because of complex Living Lab structures and wide-spread activities within SHAREPLACE.

Another challenge that may be faced within Living Labs is that participants and potential users (of future tools and services) are perceived as cheap and unpaid contributors and financial resources are not calculated well. In fact Living Lab developments are characterized by higher costs in terms of time and human capital (Dutilleul et al. 2010; Mulder et al. 2009). However, this challenge is mitigated by providing expertise and financial contributions through the SHAREPLACE project. Another main question is whether to keep users engaged and cooperation alive though there is an absence of incentives (Dutilleul et al., 2017) and steady engagement by Living Lab organizers and supporters. Dynamics to keep the Living Labs alive will have to be generated together with the stakeholders.

Further challenges that may weaken the success of Living Lab are missing flexibility by the involved stakeholders, lack of trust, psychological barriers, entrenched structures, missing attitude towards environmental protection and seek for change among communities and institutional organizations. In addition to these societal-driven factors, also the acceptance of the Living Lab approach may differ between cultures. Organizational culture forms the personality of an organization and includes shared values (e.g. norms, attitudes, traditions) and behaviours of people toward each other and in terms of external relationships (Balsano 2007). In SHAREPLACE Living Labs are new approaches for every participating region. However, some regions already worked with similar instruments such as participation processes for developing mobility plans or strategies. Nevertheless, methods for building a sound basis of trust have to be considered when designing the Living Labs.

When thinking of the open innovation approach of Living Labs, values such as collaboration, sharing and co-development are essential (Balsano 2007). In case these values are not yet represented in participating organizations and institutions it will be difficult to achieve organizational change. Another cultural dimension is represented by the society and its historically formed attitudes and behaviours in different regions, respectively countries. The supervisors of Living Labs have to consider local practices and dynamics that may not be transferable to other regions without intervention or adaption. Certain kinds of motivating factors and engagement strategies have to be defined at the very beginning, during the first Living Lab meetings and stakeholder discussions.

Challenges can be expected considering to properly reaching the critical mass of users (spread out/sprawled regions) in Living Labs and for the use of new mobility options, especially considering the transnational context. Another challenge is to impart the idea and importance of Living Labs and joint developments to the citizens and to have an appropriate number of (different) participants.

4.3. Recommendations for using potentials and mitigating challenges of Living Labs in SHAREPLACE

An upstream exploratory study on urban mobility labs (derived from the Living Lab approach) conducted in Austria found that these labs are complex processes with specific local challenges, fields of tension between economic and societal objectives and require a long-lasting commitment of the participating stakeholders (Berger et al. 2016).

Other researchers found key conditions for successful sustainability of Living Lab such as long-time horizons for research projects, ensuring open-ended innovation processes, reflexive learning, strong transdisciplinary, and the consideration of socio-cultural factors in user behaviour and acceptance (von Geibler et al. 2014). All these aspects are considered for the SHAREPLACE Living Lab implementations.

In order to ensure sufficient human and financial resources, an early engagement of stakeholders and key personnel is necessary and therefore provided in the SHAREPLACE Living Labs. Project partners and participating stakeholders will be made aware of this issue during methodological trainings and ongoing support by the scientific partners. Especially the financial contribution provided by the Interreg programme mitigates the challenge of ensuring enough participation by corresponding groups of interest in each region. In order to maintain the financial viability of implemented tools and services, business models will be developed together with potential shareholders and future providers. In the end, the implemented tools and services will be self-sustaining.

By involving corresponding stakeholders and defining certain key persons (especially from authorities and providers) weaknesses due to political instability and issues within authorities can be discussed in an early stage. Thereby, also conflicts of interest and thematic focus areas can be examined and considered for Living Lab activities. However, these challenges are already mitigated due to the fact that public authorities and decision makers are partly represented in the SHAREPLACE consortium and pilots are initially implemented on a small scale (which means that communication flows are easier to handle, monitor and steered if needed).

Open dialogs and transparent discussions will ensure the equality of participating stakeholders and take care of the represented values and attitude's in order to properly address them. The risk of not addressing the right issues and problematic areas in the respective pilot regions is mitigated by already considering existing strategy and mobility plans (as well as identified transport-related weaknesses) during the conception of the SHAREPLACE project. This means that it is ensured, that the project's purpose matches with local, regional and European transport strategies and policy papers.

It has to be ensured, that long-term visions for each region are communicated within the Living Labs. Otherwise participating stakeholders might struggle with identifying benefits and added values towards their efforts and to engage users for a long-term perspective.

Conflicts of interest may occur between stakeholders which might weaken the functionality and dynamics of the Living Labs. However, by scientifically accompanying the Living Labs throughout the whole duration, certain measures and problem-solving processes can be initiated. Another advantage of the constant support of the Living Labs is to be aware of potential changing organisational structures. By identifying cultural differences, solutions can be drafted more precisely and adequately for the corresponding pilot regions.

5. Conclusions and outlook

Eventually during the next months the exact structure and operation of the Living Labs in SHAREPLACE will be defined and specific potentials and limitations shown in this paper can be considered. The theoretical elevation of how to use the Living Lab approach in SHAREPLACE and thereby improving the transport-network accessibility and connectivity in different pilot regions gives important indications for the upcoming project progress. The importance of user-generated content and open innovation networks when trying to change entrenched structures is obvious. Therefore the methodology of Living Labs was well chosen.

Before the set-up of the Living Labs societal and cultural dimensions will have to be considered carefully. The supervisors of the single Living Labs will need to be trained when it comes to the assurance of comply with key principles such as transparency and equality among the stakeholder involvement. First trainings will take place during spring 2018 and prepare the local stakeholders for Living Lab and co-creation activities. Concrete implementation projects and service hub implications will be examined together with the stakeholders and scientific partners in all regions.

In theory, the concept of Living Labs seems to be adequate for reducing transport-related greenhouse gas emissions. In practice, indicators and monitoring systems will be established in order to actually derive environmental effects and changed behaviour in the corresponding regions.

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