Living Labs for Smart Innovation: a User-centric Approach

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ABSTRACT

The paper aims to describe the notion of Living Labs, then to frame it in a particular kind of innovation, namely smart cities. These metropolitan and urban contexts are redefined as it regards the way in which they have to be managed and due to the services provision. When stakeholders take part to this context, they carry different resources, favoring the emergence of innovation as a product of resource integration. Due to this, managers have to create the conditions to enable the mixing of resources towards smart projects. In line with this choice we depicted the city managers decisional process favoring user intervention through a two-step investigation: firstly we had an overall examination of Living Labs in Europe; secondly we analyzed two of the empirical evidences different one another because of the kind of area they are referred to through reports published by the actor acting as key player in the process towards smart city, and direct interviews performed with city managers to better investigate some issues. The investigation led us to the definition of a series of activities to leverage user's involvement achieving resource integration to support smart cities projects through an innovation process mainly based on users contributions.

Keywords: Living Lab, User-centered Innovation, Smart City, Resource Integration

INTRODUCTION

Our research is addressed to investigate the usefulness of Living Labs in urban contexts and, more in detail, in cities approaching to *smartization*. These labs represent a particular inclusive methodology in defining innovative initiatives and particularly social innovation (UE-URBACT, 2011). Following the definition of the congruity of this perspective with smart cities finalities we want to depict the effects on innovation to be pursued by city managers through Living Labs. In the innovating process, Living Labs (LLs) are one of the paths to involve people, and in particular users (Almirall and Wareham, 2008); all actors are considered in the same way as contributors of this process, as they carry their experience, the resources they own and their personal beliefs in a set built to share towards a common aim. This kind of approach recalls the notion of resource integration, as a process designed and planned by managers (Badinelli, 2012) to achieve a goal. In this way a wider set of resources can be built, reaching the *density* as suggested by Normann and Ramirez (1993), viz. the best combination achievable thanks to the resources mobilized. The two authors highlighted the relevance of integration as a challenge for the new economy and to enlarge the knowledge base with continuity. A wider knowledge foundation can be embedded into an organization's offerings to improve them. The mix of resources deriving from several sources is tied to the idea of uniqueness too; this thought is taken into account as the knowledge arising from resource integration can be totally new (Hoyer et al., 2010) and useful in creating innovative goods or services. The results emerging from resource integration are relevant for organizations (Dholakia et al., 2009), no matter if they produce something already existing or they aim to get innovative outcomes. The usefulness of this mix of resources emerging is even linked to common benefits deriving for all actors involved, as they can use resources they can access to, instead of using resources they own (Badinelli, 2012). An organization's capability to become a collector of resources is itself a critical resource, especially when it is referred to already existing sets of relationships (Möller, 2007). The resource collection is just the starting point towards the achievement of some results, as the resources put together need to be integrated to-

wards the established and the emerging goals. Managing a resource integration process is a complex issue due to the difficulties in setting a context composed by dispersed actors (Möller, 2007). In managerial literature there are several – and even different one another – attempts to classify resources (Normann and Ramirez, 1993; Day, 1994; McColl-Kennedy et al., 2009) to be integrated and then used, but the links among resources, tools, and contextual conditions is what emerges. The usefulness of these linkages is expressed when taking into account the success attained by an actor, as it depends on quantity and quality of resources controlled (Anand and Khanna, 2000). In this domain the role of knowledge resources is highlighted as relevant, because learning aims are achieved thanks to the mixing of knowledge arising from joint ventures and alliances (Kogut, 2000). Such a combination can hardly be achieved in different ways, due to the mutual usefulness of different contributions. Hence the coordinating activity is pivotal and it can be performed by a single organization or by a set of organizations, acting as integrating actors; by the way the approach has to be *open* to avoid a strong centralization, as it usually leads to a great reduction in generating learning (March, 1991).

LITERATURE REVIEW ON LIVING LABS

Living Labs as contexts of innovation through integration

After summing up the characteristics of resource integration it is necessary to highlight some differences with LLs; in this latter, the context to collect resources is specifically defined and the procedures to combine are the basis to sustain actors' involvement (Muñiz and Schau, 2011) and to keep their engagement alive during the time, thanks to the "enthusiastic assistance" in helping other actors besides themselves (Dholakia et al., 2009). In a more general way the users' participation is enabled thanks to a kind of governance and a well defined structure (Almirall and Wareham, 2008). The linkages to the notions of governance and structure do not have to be considered as a limiting factor in the implementation of LLs in different contexts; the *open* approach and the enabling of interactions towards innovation are applicable in different fields. The support provided by ICT is crucial in enhancing the potential results achievable through LLs. More in detail the new technologies can prop up the collection of data (Cosgrave et al., 2013) and ideas, improve their mixing and optimize the results (Niitamo et al., 2006). The relevance of a LL emerges when considering its outcomes as a long-term resource for a set of actors, instead of just taking into account the results for a specific project. It has to become a way of thinking when approaching innovation, especially if contexts require the involvement of different actors. This logic is not enough spread in complex systems, as the coordinating actors usually define boundaries, aimed outcomes, and actors (Cosgrave et al., 2013). In this way the *openness* of the emerging system is not exploited since they do not use all the potential contributions emerging from unexpected actors or resources and from the resulting combinations. The role of coordinators is usually performed by an organization, a research centre, an institutional actor like a government body, or one or more organizations, but it is important to begin by combining the right resources to establish the lab and carry it on. As it regards this issue, central institutions like European Union often offer grants to favor the arrangement of this kind of milieu aiming to innovation. When the issues regarding funding are solved it is necessary to focus on the necessity to enhance the *openness* of the context, especially by applying the notion of cross-border innovation (Schaffers and Turkama, 2012). This typology of innovation set usually takes place when small actors perceive business opportunities from wide or international context they cannot reach as a stand-alone. The difficulties emerging from these contexts have been analyzed by Schaffers and Turkama (2012); these barriers are connected to market settings, language, culture, regulatory settings or other features calling for a support emerging from collaborations. These connections can emerge from the closer networks, leading to the definition of cross-border networks. This approach leads to collaboration among different LLs too, enabling the creation of innovation and new markets. The two literati above cited attained the definition of four major phases to establish relationships overcoming the existing borders; namely they are three: connecting, planning, and supporting, followed by the closing one linked to the outcomes. The first phase is necessary to identify the opportunities emerging from the business context, leading to the definition of the opportunities for innovation and to the subsequent identification of partners to collaborate with. The second part of the process goes deeper into relationships as roles and responsibilities are defined; in the same time the contracts about activities to be performed are signed to allow the beginning of activities. The third phase of this process is named *support* as the activities are performed to sustain the innovating process towards the aims. Finally the process is completed with the assessment of the achieved benefits and the emerging impacts from the activities performed in the network.

The settlement of the network is a relevant prerequisite to allow partners acting together towards common aims. The interaction environment can be shaped thanks to some elements linked to the actors and to their participation, as defined by Bergvall-Kareborn and Stahlbröst (2009), as they underlined the role played by *openness*, *realism*, and *empowerment*; the *openness* is connected to the opportunity of including new users, and this is strictly linked to von

Hippel thought (2005) on interdependent innovation development, as it depends on the contributions arising from several users. The *realism* means a focus on reality, both when considering users and when paying attention to life situations. Finally the *empowerment* is relevant as a way to get people motivated and so to lead to their engagement. This latter is usually a hard job to be performed (Ramaswamy and Gouillart, 2010) as organizations have to manage an intricate web of interactions linked one another towards the same aim and this often leads to generate conflicts. The cooperation performed by several actors in contributing to resources collection and combination can be better analyzed with reference to open innovation. More in detail the common actions to interact in combining resources lead to innovation communities (von Hippel, 2005), as these are contexts enabling a faster sharing process with a higher effectiveness. LLs are totally aligned with the described logic as they involve users in the innovation processes in a context shaped by different actors (Almirall and Wareham, 2008). These actors can be companies, research centers, public entities, and so on, and they all aim to create a platform allowing actors' involvement in an innovation process. Almirall and Wareham described these labs as the better place for open innovation, because the mutual agreement among actors lets all of them moving towards a common aim thanks to transversal activities. The carrying out of these activities is relevant to describe governance as the main difference between LLs and other open innovation arenas; this key feature appears as differently set in LLs as they depends on public private partnerships. When acting in this way, the potential actors from both private and public domains (Rothaermal and Thursby, 2005) can all be involved together with users (Almirall and Wareham, 2008).

Living Labs and smart cities

The description introduced above and built on some literati contributions shows the chance to create LLs to favor interventions in metropolitan areas and urban contexts, as the actors shaping these two kinds of contexts are so similar to the ones taking part to innovation. Private actors, public entities, and individuals are all influencing and influenced by this typology of cooperation. This consideration emerges as stakeholders participate with a relevant role in urban contexts, no matter of the characteristics of the space to be analysed, as urban areas are defined as "system of systems, (...) system of stakeholders" (Bélissent, 2010, p. 16). The reciprocal overlapping between innovation process and cities led to the definition of a LL as an "open research and innovation ecosystem" (FIREBALL, 2012) involving different actors, viz. stakeholders, to define ideas and scenarios, to assist a deeper analysis of local areas needs and to support policy makers. The so-called socio-emotional intelligence (Goleman, 2006) can be activated through this way of collaboration, leading to the chance of driving innovations (Cosgrave et al., 2013). As it regards LLs in urban areas we observed lots of literati contributions framing innovation in smart cities. The smart cities' notion emerged in about a decade by evolving from some previous and partial perspectives; thus in 2000 Hall focused on the digital city, as a context monitoring and integrating conditions of all of its critical infrastructures. A similar approach by Ishida (2002) added a specific reference to hardware components, and the evolution towards the notion of smart city went on by supplementing the software features to attain "social and human development (...) in a participative governance model" (Caragliu et al., 2009, p. 50). Thus hardware and software elements have been combined in a definition linked to the quality of life and the sustainability (Caragliu et al., 2009) by integrating three fundamental dimensions (technology, people, institutions) (Nam and Pardo, 2011).

One more focus on smart cities can be useful to underline how it is linked in literature to innovation, as Schaffers et al. (2011) underlined how the open innovation can support the provision of internet-enabled services to test interventions and to validate activities. Internet acts as the way to make involvement easier (Roy, 2005) and to activate interactions among all stakeholders. This way of thinking has been carried on even by literati working on the so-called helix models. Etzkowitz (2008) began this modelling about interactions when proposing the Triple helix describing the contemporary contributions by university, industry and government to favor innovation. Some years later the model was analyzed again in the revised triple-helix (Lombardi et al., 2011), with a deeper focus on innovation, defining the path towards the Quintuple helix (Carayannis et al., 2012) shaped by 5 systems named as: education system, economic system, natural system, media-based and culture-based public, political system. In line with previous considerations on resources collection and combination, the main advantage of an innovation approach in smart cities can be described as the mixing of digital skills, creativity and innovative models to facilitate the creation of linkages between technologies and the related applications (FIREBALL, 2012). Moreover this solution is helpful to support local administrators in relation to the shortage of public finances. As the implementation of the LLs was becoming relevant, some literati (Concilio et al., 2011) asked for a specific observatory, by underlining their importance in smart cities contexts. The approach proposed through these collaborative ecosystems is defined as a "user-centric approach" (Copenhagen Cleantech Cluster, 2012) as citizens are considered as the most relevant actors.

LLs have been implemented in different ways in smart cities, leading to some slightly different approaches, defined

by European Union in its reports as *Citylabs* (Enemark and Kneeshaw, 2013) or *Social Living Labs* (UE-URBACT, 2011). The two definitions are useful to stress the contexts in which the innovation can perform effects and to underline the high relevance of social contributions and the results achievable for the social stakeholders. *Citylabs* are LLs contextualized in cities to support some kinds of investment, to enable local actors' participation and to favor the implementation of best practices arising from previous interventions in comparable areas. More in detail these labs emerge when interventions on mobility have to be performed, with particular reference to two concurrent aims. Firstly the necessity to support the development of smart logics connected to infrastructure building or their refurbishment, transport services, integration tolls, and multimodal transport. Stakeholders' contributions are connected to local plans to be defined, especially as it concerns the screening of mobility needs, the design of sustainable urban mobility plans, their subsequent implementation and the evaluation of process to feed the future improvement of plans. Secondly mobility acts like a set of interventions leading to improvement in other services and in other aspects in a city context, like energy consumption, environmental conditions, safety, and support to local businesses. *Social Living Labs* are different from the *Citylabs* because of their wider and more general approach to cities improvement. The idea of a *Social Living Lab* comes out from several needs, like the decrease of public finances, the demographic shrinking, and so on; due to these issues it would be hard to choose one of them to be challenged and forget about the other ones, thus a democratic and participative approach to them can be useful to integrate the problems and solve them with a more integrated approach. Public interests are first of all defined thanks to the intervention of citizens and stakeholders, then the features of the lab emerge: first of all a co-creation approach is required to build interactions addressed towards a mutual and contemporary involvement of citizens, local institutions and organizations. These interactions have to mobilize resources to be levered on for solutions; the proposals have to be framed into the existing vision of smart interventions and then implemented with a contemporary monitoring activity. The participation of a wide range of actors is needed to explore the context, as the knowledge hold by each subject has to be merged with other available data to map the areas asking for interventions. The solutions emerging thanks to a co-creation mindset and defined in the contexts highlighted through the exploration have to be tested before being launched; thus the experimentation is necessary to have a basic evaluation of the effects. This activity is a "trapdoor" for useless or low-effective projects or it acts like a "starting flag" for hopeful programs. Finally the evaluation of the interventions is done thanks to stakeholders' satisfaction and it allows higher level of attention on unsolved issues, even suggesting the areas asking for a new activation of the lab activities.

Living Labs towards a wider perspective

One wider perspective on LLs can be observed in connection to the concept of ecosystem, a notion widespread in various fields of study but recently it became more and more interesting even in management literature, with particular reference to innovation. Moore in the 90s coupled the issues of innovation and ecosystem to describe the set of actors, technologies, knowledge, skills, and context in which the cooperation aimed to innovation took place. Time by time more literati deepened this topic to depict innovation contexts in which the set of relationships is fruitful to innovate outside an organization's boundaries (Ketchen et al., 2007). More recently even in smart cities' research the idea of innovation ecosystem was applied, as the whole range of subjects involved in smart cities management shape an ecosystem, considered as an urban laboratory, and in a more detailed way an urban innovation ecosystem (FIREBALL, 2012). The idea of ecosystem connected to cities was already in some researches a few years ago thanks to Komninos (2002), but only after smart city notion had appeared the two topics were merged. Nowadays the same author (Komninos, 2011) defined a series of chances for smart city innovations to be achieved thanks to an ecosystem-based collaboration, in order to take into account all actors shaping the network of relationships in urban and metropolitan areas. In this way internet keeps its central role, but it becomes an instrument instead of being the main source of innovation; this role is now acquired by subjects of the open innovation context.

When considering such a wide range of stakeholders (Bifulco et al., 2014), it is necessary to understand which are the mechanism sustaining their willingness to participate or favoring their participation; the improvements aimed in smart city projects act as enablers of the engagement for citizens (Lee et al., 2013). The authors make even a connection between *openness* and engagement, by defining actions useful to assess services designed thanks to open platforms; in this approach citizens and communities act together with mutual influence in cooperating. A similar point of view is presented by Anttiroiko et al. (2013) as they confirmed the opportunities offered by cooperation to design smart city initiatives, but they even highlighted the existence of some activities to be performed by central actors of the ecosystem, due to the impact of some activities on local agencies costs. The ecosystem approach is sometimes linked to bigger territories too, as it happens when talking about regional interventions (Levén and Holmström, 2012) through technologies. Stakeholders in this larger perspective are interested in taking part to this context as they become part of an innovation ecosystem and they can acquire different resources. When considering organizations, the two authors stated knowledge is what they expect the most from this kind of context, so they offer services to get a position in the ecosystem and the subsequent benefits in terms of knowledge. Finally there is one more

version of LLs, known as *Territorial Living Labs*, aiming to get innovations in territories in a social perspective (Concilio et al., 2011). Territories acquired a new role, as they are considered as collector of social relationships and interactions. The key concept to describe *Territorial Living Labs* is the "strategic piloting", as a process to drive the whole setting towards innovation and on a larger area, in a system acting as a loop, because the activities can support the improvement of a territory, but it can increase social cohesion towards common aims related to innovation.

The emerging gap

As our literature review showed, the LLs approach is quite spread in innovation paths, and particularly in cities management, especially when referring to smart cities. All stakeholders play a fundamental role as they are carriers of different kind of resources, knowledge and experience, useful to fill the complex set of resources needed to move towards a smart innovation in cities and in their management. Hence, stakeholders have to be managed in a suitable way in order to favor their contribution to the so-called *smartization* process. The literati contributions we took into account in our review deeply described the contributions emerging from LLs and from the wide range of stakeholders shaping it, but research on the way to manage actors' involvement in LLs is far from being in-depth investigated. The necessity to make people involved in contexts like LLs is underlined in some contributions (West and Gallagher, 2006; Almirall and Wareham, 2008; Levén and Holmström, 2012) stating how an actor can decide to take part to these set of relationships when perceiving value from it. We aim to move from this gap to propose guidelines to deal with stakeholders taking part to LLs driving them towards a relevant and useful support. This intervention is helpful to provide an innovative way in managing cities during their approach to smart logic. Some similar approach took place just with reference to some specific field, like smart health services (Almirall and Wareham, 2009), ICT tools (Levén and Holmström, 2012) or in a more general way when describing the process to set up a LL (Levén and Holmström, 2012). A specific call for research on how to involve people in all potential usages of a LLs is presented in literature (Almirall and Wareham, 2008).

SMART INNOVATION IN CITIES MANAGEMENT

Research proposal

Starting from the above cited gap emerging from the literature review we want to depict in detail how actors' are involved in LLs aimed to support smart cities. In order to define this issue we firstly describe the innovation ecosystem shaped around LLs and the mechanisms shaping their workability. These characteristics will lead us towards a proposition of guidelines for city managers to involve people in smart cities' projects to make their participation fruitful due to uniqueness (Prahalad and Ramaswamy, 2004) of the resources they own and to the set of resources resulting from all actors sharing resources. In order to make our proposal we deeply analyzed the empirical evidences related to LLs all around Europe, to focus on the most important elements to get people engaged in the innovation contexts and to understand how the activities are performed when such a wide range of actors are combined in LLs. Moreover we investigated which the outcomes are emerging from each LLs, to facilitate the identification of the usefulness of this approach. After this first overview on empirical evidences from Europe to screen the phenomenon in a general way, we in-depth investigated two areas moving towards *smartization* through LLs, to understand the definition of cities to be involved and the deployment of this activity with the resulting achievable aims. The choice of the empirical contexts to perform our investigation is illustrated through the methodology approach we are about to describe in the next lines.

Methodology

We selected smart cities in which this way of creating an innovation ecosystem had been implemented in order to investigate and define the usefulness of this intervention and the way in which it performed its effects. The sources we used to make this selection were different and can be connected either to reports from European central institutions (Enemark and Kneeshaw, 2013), local agencies (ANCI, 2013), and to literati researches (Komninos, 2011, Schaffers and Turkama, 2012). First of all we depicted a list and a short description of LLs in Europe, and then we selected cities to be analyzed in depth on the basis of their territorial dimension and on their geographical position, in order to achieve a wider perspective from different evidences.

After listing the cases we developed an approach based on excellence (Yin, 2003) and we chose the LLs achieving the best results and the ones more enforced in the time. We based our research both on reports and on interviews with actors directly involved in the implementation of LLs, in line with Denzin suggestions (1978) on triangulation.

Living Labs empirical evidences: a general overview in Europe

Many European cities have been involved in smart cities projects (European Parliament, 2014) and we have selected those one involved in LLs initiatives for the creation of an urban open innovation environment. In detail we have focused our attention on cities or territories in the EU member states that are broadly accepted as being the most committed in innovation policies and we have chosen 11 examples spread across Europe, from the North Sea to the Mediterranean Sea, each one as a member of the European Network of Living Labs (ENoLL): Amsterdam, Apulia, Barcelona, Copenhagen, Ghent, Helsinki, Lisbon, Manchester, Oulu, Santander and Thessaloniki.

Amsterdam. Before the official launch of the Amsterdam Smart City (ASC) project in 2009, the capital of the Netherlands had already presented the Amsterdam Living Lab (ALL) in 2008 with the goal to help companies to test new products in a real user environment. This initiative is supported by the City of Amsterdam, the Province of Noord-Holland, Stadsregio Amsterdam and the Ministry of Economic Affairs and it works in close cooperation with the Amsterdam Economic Board (AEM), University of Amsterdam, citizens, knowledge institutes and companies. The ALL has developed the following main initiatives (AEM, 2009): Amsterdam Smart City, a unique collaboration between inhabitants, businesses, research institutions and government authorities with the ultimate goal to reduce CO_2 emissions; APOLLON, a European LLs network to reinforce partnerships; FabLab, a workspace with modern proto-typing machines that has developed into a global network of standardized open hardware setups; Mocatour (Mobile Cultural Access for Tourists) an app to enable tourists to submit and share personal views.

Apulia. Since 2012 in Italy was created the Apulian ICT Living Lab, an initiative promoted by Apulia Region to test new approaches to innovation activities, with the European funds. The project's aim is to create an "open ecosystem" in which different actors such as researchers, companies and groups of citizens can design new products and services through the use of ICTs (Agrimi et al., 2013). It has been implemented by InnovaPuglia, a company hold by the main local agency, and it has been started with an online procedures to manage regional calls for proposals on innovation in order to realize the creation of a "Requirement Catalogue" with themes, problems and challenges related to the eight domains, and the "Living Labs Partnership Catalogue" with the participation of local associations, public bodies, research laboratories as proposers of user-led needs and at the same time, potential partners of funded projects aiming to provide solutions to the challenges (Di Ciano, 2013). A second phase has concerned the design of appropriate solutions through different calls for proposals in order to select and provide grants to competitive projects: in November 2013 the third call has been closed and the submitted projects are still under evaluation.

Barcelona. In 2008 within 22@Barcelona district started the 22@Urban Lab, a project created by the City Council in order to encourage business innovation and facilitate the use of public space as an urban laboratory to test new products and services in a real environment (http://www.22barcelona.com/). A pilot proposal is presented to the Urban Lab Board which has to confirm the project linkages to an unmet municipal need and people's quality of life. From the start, more than 12 companies participated in testing innovative services in different spheres as urban development, mobility, ecology, ICTs (Ajuntament de Barcelona, 2013). In 2012 another LL in Barcelona was born, the Barcelona Laboratori (BcnLab), a community to make the City of Barcelona as an open laboratory in culture, knowledge, creativity and innovation (http://barcelonalab.cat/ca/). The project was developed by the Directorate of Creativity and Innovation of the City of Barcelona with i2cat Foundation, University of Barcelona, University Pompeu Fabra, between others institutions, together with academia, business associations and to promote a cultural innovation focused on citizens.

Copenhagen. Since 2007 the City of Copenhagen has implemented new and innovative solutions within transport and mobility, waste and water management, green energies and smart grids in order to realize the ambitious vision of becoming the world's first carbon-neutral capital by 2025 (City of Copenhagen, 2012). The strong relationship between the Danish capital and the environmental sustainability (energy, mobility, air) has conducted to a transformation of the city in a LL for new green solutions with the aim of the creation of a greener, more sustainable and liveable city. Copenhagen has recognised the important roles of the different stakeholders in order to reach the sustainability goals and it has identified the following central partners: citizens, business community, investors, knowledge institutions, companies owned by the city and government. People's engagement in the urban life is relevant especially concerning the mobility domain: Copenhagen aims to be the most bicycle-friendly city in the world (City of Copenhagen, 2014) and users are actively involved in the identification of the improving areas, so that all the investments in the cycling infrastructures are based on the needs of citizens and the sense of ownership is enhanced.

Ghent. The City of Ghent has created the Ghent Living Lab (http://www.ghentlivinglab.be/nl) since 2006, linking the ambition of the Local Digital Agenda with citizens' potential and with the aim of connection among SMEs, activists, researchers, students, citizens, and government. The fundamental process at the basis of Ghent LL is the creation of new products and services and it consists of different and subsequent actions such as observe, ideate, co-create, try and launch (Rosseau, 2012). In 2012 the portal data.gent.be was created to assure the availability of open data and this website was presented within a training course for citizens, called Ghent DataTalk. Ghent LL has used the open data as a pillar to develop most of the projects realized, especially the ones related to the creation of apps, such as "Citadel...on the Move", a wide competition for the creation of an app that works across Europe, and "AppsforGhent" that has reached the fourth edition in 2014 (http://appsforghent.be/).

Helsinki. The capital of Finland is the home of the Forum Virium Helsinki, the private limited company owned by the city of Helsinki, which develops new digital services and urban innovations in cooperation with companies, the city, other public sector organizations and residents (https://www.forumvirium.fi/en). Since early 2006 one of its innovation projects focus has been the development of user-driven innovation process, methods and tools within the Helsinki Living Lab network (http://www.helsinkilivinglab.fi/): an ecosystem of the LLs and their partners in the Helsinki Metropolitan Area. Helsinki Living Lab (HLL) is both a communication hub and an open umbrella brand for enabling companies and the public sector to get in touch and co-operate (HLL, 2013). Furthermore it helps these actors in designing new services and products, and reinventing and improving existing ones by using the feedback from authentic user experiences in real urban environments.

Lisbon. Since 2008 the City of Lisbon has been committed to become a smart city in order to improve its citizens' quality of life. Thus, it has been implementing measures to achieve that goal, including the promotion of programs to enable citizens' participation aiming at a sustainable development of an economic, social and scientific environment (FIREBALL; 2012). It is in this context that the Municipality decided to create the Lisboa Urban Living Lab (LxULL), an environment that nurtures co-creation processes focused on four key areas: smart cities development, e-government and e-participation, digital innovation and Future Internet, entrepreneurship. The different projects realized have been focused on users' involvement that is guaranteed by different methods and tools such as the test of new applications and services using fibre and wireless, the setting up of focus groups, action learning sets, study circles and user-developer interfaces, the use of social networking through online co-creation networks generating and analysing crowdsourced open data, the planning of support and mentoring activities by connecting users with skills and experience to new users.

Manchester. Founded in 2003, the Manchester Digital Development Agency (MDDA) is responsible of the city digital strategy related to the digital inclusion, industries and innovation. The main issue is the generation of investment for innovation and new infrastructures and the development of Manchester smart city in areas such as energy, fibre and wireless networks and services. One of the latest initiatives is the Manchester Living Lab which aims to allow the easily connection and collaboration between people and businesses, supported through a range of European Union programmes (http://www.manchesterdda.com/livinglab/). The projects (Viitanen et al., 2013) include involving citizens in testing energy management systems through smart meters, working with government agencies to open up data, developing a next-generation access fibre based digital infrastructure and working with local residents to equip them with the skills to support the co-production of new community services.

Oulu. The city of Oulu in Finland supported development programmes, especially in the field of innovation and ICTs, from early 90's in order to achieve good living conditions for residents and a stimulating environment for companies, so that it has become a leading wireless R&D hub within the global innovation ecosystem and they have formed an excellent urban LL, with a focus on the real-life user centric innovations. The city's LL approach has been reinforced with the development of OULLabs (Oulu Urban Living Labs - http://www.oullabs.fi/), a network built to bring together LLs, companies, public sector, social user groups and individual users for co-creation of user-centric appliances and services and to expedite growth of businesses, focusing on ICTs, e-health, education and smart cities (Väinämo, 2013). The key resource of OULLabs is the test users' community and discussion forum called PATIO, which connects developers and the active community of more than 600 end-users.

Santander. The city of Santander since 2010 has been involved in the development of an Internet of Things (IoT) platform full of data received from 12.000 sensors (http://www.smartsantander.eu/) and the involvement of developers, citizens, researchers, organizations, and the business sector in the creation of new Apps. This linkage with the participation domain has conducted to the growth of the IoT Santander Living Lab, fully committed to the open data approach (Sanchez, 2012). Some of the most relevant projects within the LL have been: SmartSantanderRA, a free App based on augmented reality technology and real-time information; SEN2SOC, a mobile and web app which bridges SENsor measurements and SOCial networks interactions; a service called

participatory sensing through the app El Pulso de la Ciudad (The Pulse of the City); Santander City Brain (http://santandercitybrain.com/), an open ideas platform to share ideas and projects, comment and vote on suggestions and upcoming initiatives.

Thessaloniki. The City of Thessaloniki is trying to become a smart city via two parallel processes: the first is linked to the development of innovation clusters and technology districts while the other is related to the deployment of broadband networks and web-based services for business, government and citizens (Zaharis, 2009). The bottom-up initiatives created in this city context are related to the web applications and e-services which provide real-time information, especially concerning mobility, and an easier relationship among different actors. The higher results of this stimulating environment has been the setting up of Thessaloniki Living Lab, created in order to develop innovative ICT products and services by providing a testbed for fermentation and cross-fertilisation of ideas, concepts and prototypes (FIREBALL, 2012). At first stage, Thessaloniki LL has been focused on the engagement of a pool of individuals and end-users in a small town within the Metropolitan area of Thessaloniki.

LIVING LABS TO ACHIEVE SMART CITIES

The overview of different experiences in developing LL initiatives has allowed us to underline the common features among them, such as the linkages with the various UE financing instruments, especially those related to the just ended Programme of Competitiveness and Innovation (CIP) and European Regional Development Fund (ERDF) 2007-2013, the importance of a public institution's pivotal role in the earlier phases and the relevance of coordination tools, both technological ones as platform, forum and blog, and face-to-face ones as workshop, round table and laboratory. As our overview implies, we have conducted our study on some examples of LLs characterised by a focus on the development of innovation relevant for citizens, in which the role of organizations, public authorities and universities is, above all, to support citizens in their innovation activities with the provision of tools, information, development forums and skills. Starting from these citizen-centred quadruple helix cases (Arnkil et al., 2010) we have narrowed the field of our investigation on the Apulian and Barcelona LLs as relevant examples of user-driven innovation environments which are different from each other because of their territorial dimensions: the first is related to a wider territory corresponding to the Italian region, while the other pertaining to a metropolitan area.

Actors' involvement

The Apulian ICT Living Lab can be considered an example of *Territorial Living Lab* (Concilio et al., 2011) because it is not referred to a smart city context but it is linked to a wider perspective that include five cities corresponding to the Italian provinces of the Apulian Region. The Apulian LL represents a hopeful initiative thanks to its main characteristics, in particular referring to the mapping of end-users' needs set up as the starting point of the innovation processes and the creation of a web portal as a sharing instrument for the community (http://livinglabs.regione.puglia.it/). The above mentioned eight domains (environment, safety and social protection; cultural heritage and tourism; e-government; social inclusion and active and healthy ageing; energy; education; transport and mobility; creative industry) have been filled with a list of 473 needs and the information about the related 34 projects can be visualized on the official website. People can participate thanks to the online community which allows three main activities: the selection of a topic with the corresponding list of needs submitted to the platform, the players included in the catalogue, ICT research and innovation projects already financed, the active LLs; the opportunity to take part in the blog, the so-called "Living Labs Cafè", activated only in Italian, a virtual place for free discussion, ideas exchange, suggestions and contributions; the chance of using a wide range of social media (Facebook, Twitter, Google plus, Flickr, Youtube, Slideshare) to enhance the interactions. Among the ongoing LLs we have noticed a predominance of projects based on open source platforms, integration instruments, mobile applications and creative tools: these evidences let us underline the fundamental role of end-users as co-creators in the innovation process.

The other example that we have selected differs for its territorial dimension, in fact we focused our analysis on the LLs experiences developed in Barcelona metropolitan area. The 22@Urban Lab is strictly related to the involvement of organizations in innovation processes and it aims to solve two different needs: the one from companies on how to better fit their offerings by engaging users in early experimentation and real-life environments, and the one coming from city halls addressing the need for fostering innovation and creating innovative spaces. This focus on the economic growth and business investments is balanced by a deeper attention to people's involvement in the other LL in Barcelona, the BcnLab. This initiative was born as an ecosystem that encourages civic innovation in arts, science and technology, and it has been developed as a laboratory-city based on the quadruple helix model

(Lombardi et al., 2011) which includes citizens, public administrations, research institutions and Universities, and companies (micro, SME and big companies). The primary activities of BcnLab are related to creative industries, science and research communities, and arts in order to create a stimulating field for development of new concepts, ideas and projects. The most relevant characteristic is the focus on communities among different stakeholders from civil organizations, companies, research centres and public administrations, so that it has been possible to create a so called "Community of Communities" with 150 communities which are subdivided in 6 interest groups: citizens sciences, creativity, digital cultures, entrepreneurship, open infrastructures and social innovation (Serra, 2014). One of these groups has an important role in facilitating the processes of technological, social and cultural innovation, and it acts as a bridge between the social sciences and the world of engineering. It uses qualitative and ethnographic methods to explore the social uses of technology and the interpretation that users make of their experiences with technology in order to collect information on user s' requirements and develop new methods of co-design. BcnLab has adopted an innovative approach changing the perspective from the "community of practice" to the "community of project" and it has ensured citizens' involvement through in-depth interviews and groups' dynamics of Kurt Lewin (1953) up to reach more than 150 users as participants in innovation projects. This engagement has been reached also thanks to the online open platform that allows citizens to create and submit their projects.

Deploying and monitoring activities

Our analysis about Apulia went on thanks to the interview performed with one of the person in charge of Innova-Puglia (this name is a syneresis between Innovation and Apulia), an organization hold by the main local agency to develop solutions addressed to city enhancement. This organization operates thanks to a portal embedding the data emerging from three websites related to travelling and events in Apulia and to a social network for tourists visiting this area. An information system connects data and processes of these online spaces to generate a set of information useful to provide better services to organizations, citizens, and tourists. The portal created by InnovaPuglia can be seen as the platform to develop the services, but the contents are necessary if a city enhancement is the most relevant aim; thus, the managers decided to launch some calls during years to get people involved and to obtain their contributions. The first one was such a big success, in spite of the expectations and more than 400 proposals were sent by several kinds of stakeholders linked to the territory of Apulia. The big quantity of results was under examination by the organization's managers and they synthesized them in three main streams of intervention, namely: creating a territorial information system, favor the creation of smart communities, supporting services like health services, energy provision, and justice thanks to digital systems. The person we interviewed stated the first aim was reached with a wide digitalization process, achieving the expected results in more than 95% of the local area. As it regards the second stream of intervention, the smart communities have been created and they are sustaining the new calls promoted by the company, with both totally new proposals and ideas to improve the existing ones. When describing the creation of the LLs inside the community, the helix-based models (Etzkowitz, 2008; Lombardi et al., 2011; Carayannis et al., 2012) have been taken into account and referred to as relevant by the interviewee, with citizens and organizations acting as co-proposers of initiatives, research centers performing their supporting role in interacting with the other actors, and local agencies coordinating the whole process. The third kind of intervention is related to public services improvement and during the interview the results were considered quite positive, as the cost-efficiency processes achieved a 50% reduction in some cases. Most of the activities usually performed by local agencies through its operators widespread on the territory are managed through the territorial information system. Citizens' engagement in this range of activities is pivotal, as stated by the person in charge we interviewed, because organizations were forced to participate and at the beginning their contribution was not so useful, while citizens represented a relevant source of ideas, needs, and data to allow the development of the platform and its usage in connections with the new way of public services provision.

In order to deepen Barcelona logics to promote a *smartization* process we had a face-to-face interview with Vicente Guillart, the Chief Architect of the City. He presented the initiatives in his city to describe the road towards a smart context. He argued the real challenge is doing something new in an already existing city and in a wide and overfull area; because of this, one of the first issues to be taken into account is the mobility, as the bigger and more crowded the city is the bigger congestion problems are, with direct consequences on the quality of life. The quality of life can be improved thanks to the promotion of citizens and city identity and by avoiding the emergence of significant differences in social classes. In order to reach these aims the city management decided to launch a project known as "United States of Barcelona", leading to the creation of city zones with their own identity, just as it happens in the states shaping the USA. Hence, markets are needed to give autonomy to each areas of Barcelona, to satisfy identity and daily needs. Two contests were launched and addressed to citizens, organizations, and all actors related to the city, confirming what we had found in the analysis of the report presented above. This idea arose because in previous years the local university supported the City Council in creating a LL and the high quality of the results they achieved led to the stabilization of this approach when facing challenges related to the urban context. It is

interesting to underline one of Guillart statement about LLs, as he affirmed city management certainty and competences in creating these labs on their own, viz. without the support of the university that had acted just as an initiator of this approach, as it gave the know-how to create labs as model to co-generate solutions. The University still takes part to some LLs (as we described when analyzing the report), but the leading role is kept by city management. The involvement of citizens and their resulting participation allowed the definition of a priorities list to focus on the intervention to be done in the upcoming years. Namely these priorities are: greening the city, decentralizing energy production from the central areas, supporting a new industrial revolution through a specific lab, promoting the sharing logic, investing in a more performing information system, decreasing the number of cars from the city centre, and launching an international contest to re-build transport infrastructures in the heart of the city favoring the increase of the space to be part of the greening actions. As identity was so pivotal in supporting these projects, Guillart stated the relevance of citizens' involvement in a participatory process to define the interventions to be done. The role played by citizens involved in the previous LLs is crucial and the results achieved in this way influence the way in which new aims are set. Indeed the domains already conveying positive results are less focused than in the past, whilst upcoming needs are at the top of the list. The ideas about interventions to be fulfilled need cooperation between governance bodies and organizations with both citizens and citizens' associations to identify together how to solve critical issues, instead of just listening to complaints and acting with no consultation.

A framework LLs-based

The analysis of the reports published to describe what happened in Apulia and Barcelona LLs led us to the depiction of a best practice to achieve users' involvement in the proposal of ideas supporting the innovation process related to smart cities management. First of all needs have to be mapped in order to have an overall perception of the interventions to be performed in a city. In this phase citizens' role is fundamental and because of this the reports show two necessary decisions: where participation has to take place and how. When referring to where, city managers have to define which are the physical or virtual space to favor interaction; when considering the how, suitable tools have to be settled to allow citizens participation. After these choices the two cases shows both a difference and a similarity: the different choice depends on the subjects to be classified as sources of information on needs, because in Apulia the proposals arrive just from citizens, while in Barcelona the suggestions emerge from potential users and city halls; the similarity depends on the criteria to select the proposal as both citizens' needs and local agencies perspective are taken into account. After needs are listed the city managers perform a categorization on them, to define which are the domains to be considered for interventions, in order to be efficient when focusing on the investments to be done, looking for scope economy, especially when referring to instruments, like ICT.

The second step of our investigation gave us some more insights as from direct interviews we had an in-depth focus on the most significant features. In detail we noted the relevance of the platform where citizen's interventions are expected to be addressed. It depends on the choice done in the first stages of this process, namely when the city management has to decide "where" the interactions can take place, namely in a physical or in a virtual context. The interactive platform is useful in two ways: firstly to collect proposals and to favor a debate between citizens and city managers; secondly as it represents the starting point to define the strategies to deploy the interventions in the different domains, in a digitalization perspective. The deployment of the actions leads towards the necessity of monitoring, as city managers have to define a set of indicators to understand the efficiency of this process and to periodically check if the expected results are achieved or the strategies have to be redefined. In this case the definition can take place through citizens' involvement in the interactive platform itself.

CONCLUSIONS

LLs emerged as a useful context to innovate and *smartization* processes benefit from them as it came out from reports. One more demonstration about their usefulness depends on the continuous usage of this approach in several cities among the ones considered. The interviews we performed face-to-face were helpful to confirm the potential contribution to innovation emerging from LLs. The respondents underlined some aspects we had found in our literature review and we had used to depict the effects. In the final part of our research we tried to define the way in which different features of the smart development of cities can be supported through LLs.

Limitations and further research

This research has been performed with a focus on Europe and we can state the focus is complete as the reports have been useful to depict all LLs in this continent. All this evidences are influenced by EU support in setting the LLs, so

the research can be improved in the future by taking into account empirical contexts outside Europe, with the aim of making comparisons as it concerns the different approaches resulting. We took into account two LLs to perform an in-depth investigation, hence with a similar perspective showed above a more detailed focus on the other LLs can be performed by interviewing a higher number of city members. Finally it would be interesting to perform a similar analysis in an ongoing project and in order to do this we have already pinpointed a location. Indeed this city is involved in a smart city project in these months and we are directly involved in the definition of the interventions to be done, so we will investigate on it in-depth.

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