Group Decis Negot (2017) 26:857–874
DOI 10.1007/s10726-017-9524-z

Managing Open Innovation in Urban Labs

Barbara Scozzi[1] · **Nicola Bellantuono**[1] · **Pierpaolo Pontrandolfo**[1]

Published online: 31 January 2017

Abstract Urban labs are open innovation ecosystems, i.e. places, either promoted by companies or local institutions or spontaneously established by active citizens, wherein the current problems and challenges associated with a city are discussed and possibly innovative solutions are designed and implemented. Urban labs usually face complexity in managing the contributions of several heterogeneous actors. The paper presents the Urban Lab Methodology (ULM), which supports the management of urban labs by integrating Soft System Methodology with an open innovation framework previously developed by the authors. The former is a methodology to facilitate the structuration and solution of complex problems involving different stakeholders, whereas the latter aims at suggesting an association between the innovation context and the open innovation practices to be adopted. ULM is used to analyze the case study of Manifesto della Città Vecchia e del Mare ("The Old Town and Sea Manifesto"), a urban lab created in Taranto (Italy) in 2014. The analysis shows that theoretical prescriptions are to a great extent coherent with the real course of action and ULM is relatively easy to be adopted.

Keywords Urban lab · Management · Open innovation · Soft system methodology · Case study

✉ Barbara Scozzi
barbara.scozzi@poliba.it

Nicola Bellantuono
nicola.bellantuono@poliba.it

Pierpaolo Pontrandolfo
pierpaolo.pontrandolfo@poliba.it

[1] Dipartimento di Meccanica, Matematica e Management, Politecnico di Bari, Viale Japigia 182, 70126 Bari, Italy

1 Introduction

In the last decades the number of studies that investigate innovation at urban scale has significantly augmented (Shearmur 2012). Cities indeed are a research setting of increasing importance: according to recent estimations, about 80% of the European population by 2020 and over 70% of the global population by 2050 is expected to live in urban areas (McCormick et al. 2013; Voytenko et al. 2015). On one side, cities pose (and will increasingly pose in the future) serious environmental, social, and economic challenges. On the other side, they represent (and will increasingly represent in the future) a place wherein enormous potential and opportunities can arise.

Extant literature analyzes different aspects of the nexus between city and innovation, e.g. creativity and cities, or innovation and city growth (Shearmur 2012). Some studies explore innovation processes that occur in cities at different scales, from neighborhoods to metropolitan areas. Such processes, which very often entail an active participation of citizens, take place in different environments, such as online contests and competitions (e.g. hackathons), innovation jams, and urban labs (Almirall et al. 2014; Nambisan and Nambisan 2013).

Urban labs, which are the focus of this paper, are discussed in the literature according to different typologies, which include civic labs, transient labs, urban living labs (e.g. Hirvonen-Kantola et al. 2015; Nevens et al. 2013). Most of the proposed definitions describe urban labs as the *loci*, in a given city, wherein a group of persons develop proposals, and possibly experiment and implement actions, to address problems and challenges associated with that city. Urban labs can be established by local public administrations, which try to find new, more effective, and less resource-intensive modes of problem solving at the city level (Nambisan and Nambisan 2013). They may be founded by companies as well, which may be interested in developing and testing new products and services. Finally, many of them are directly established and managed by citizens interested in improving urban life and conditions. The motivations are manifold: reducing costs, bringing better services to the public, improving opportunities for citizens, strengthening citizens' involvement in making complex decisions (Almirall et al. 2014). Actually, the confluence of these forces has set the context for redefining the citizens' role in public services: what is emerging is a gradual shift from passive service beneficiaries to active, informed partners or co-creator in public service innovation and problem-solving. Nambisan and Nambisan (2013) identify four distinct roles for citizens in public service co-creation and problem-solving: namely explorers, i.e. citizens who identify/discover and define emerging and existing problems; ideators, i.e. citizens who conceptualize novel solutions to well-defined problems; designers, i.e. citizens who design and develop implementable solutions to well-defined problems; diffusers, i.e. citizens who directly support or facilitate the adoption and diffusion of public service innovations and solutions among well-defined target populations.

Based on the goal of the urban lab, other actors may be involved and may contribute to develop innovations. They include city managers, developers, consultants, policy makers, venture capitalists, and intermediaries (Almirall et al. 2014; Juujärvi and Pesso 2013).

Whatever the urban lab typology, the founder, and the involved actors, a critical capability is to effectively organize and manage the contribution of all the external knowledge sources (Almirall et al. 2014). The problem of managing the contribution of several external knowledge sources so as to produce an innovation is currently investigated in the research field of open innovation, usually with reference to the business context. Urban labs are indeed open innovation ecosystems (Hirvonen-Kantola et al. 2015), i.e. places wherein "civic open innovation" (Almirall et al. 2014) takes place. The latter expression underlines the embracement of open innovation principles and practices by cities. It is noteworthy that the management of external knowledge sources in a urban lab may be even more complex than in a company. In most cases, urban labs involve external knowledge sources that correspond to highly heterogeneous stakeholders, whose needs and visions could be dissimilar, if not conflicting, even within the same category (e.g. the stakeholder category "residents" may be further decomposed into: families with babies, singles, elderly people, teenagers).

The paper deals with the development of a methodology to support the management of a urban lab in particular with regard to external knowledge sources. To do so, we review the literature on open innovation and soft operational methods usually adopted to manage multi-stakeholder decision-making processes. Based on that, we identify two promising methodologies, i.e. the framework proposed in Bellantuono et al. (2013b) and Soft System Methodology (SSM) (e.g. Checkland 1981, 1985). By integrating the former into SSM, we develop the Urban Lab Methodology (ULM) which supports the management of a urban lab. We analyze the case study of *Manifesto della Città Vecchia e del Mare* ("The Old Town and Sea Manifesto"), a urban lab created in Taranto (Italy) in 2014, though the lens of ULM. The analysis shows that theoretical prescriptions are to a great extent coherent with the real course of action and ULM is relatively easy to be adopted.

The paper is organized as follows. Section 2 presents the concept of urban lab, as this is the place in which we study the innovation process. In Sects. 3 and 4 we briefly present the two approaches based on which we develop ULM, the methodology to support the management of a urban lab. In Sect. 5, after discussing urban labs as special innovation ecosystems, we present ULM. Section 6 reports a description of the case study, *Manifesto della Città Vecchia e del Mare*. The adoption of ULM to analyze the case study is discussed in Sect. 7. Finally, Sect. 8 presents some conclusions and discusses the theoretical and practical implications of the paper.

2 Urban Labs

The literature refers to urban labs through different expressions and definitions. As utilized by Almirall et al. (2014), the term refers to "the use of public city space—streets, buildings, or a designated neighborhood—as an active laboratory where companies can evaluate and pilot pre-market products and services". Hirvonen-Kantola et al. (2015) define the urban lab as a "living laboratory as a user-centered, open innovation ecosystem that strives to facilitate research, development and innovation processes related to different public–private-people partnerships in physical, real-life contexts".

Nevens et al. (2013) prefer the expression urban transition lab UTL) by which they refer to the "locus within a city where (global) persistent problems are translated to the specific characteristics of the city and where multiple transitions interact across domains, shift scales of operation and impact multiple domains simultaneously (e.g. energy, mobility, built environment, food, ecosystems). It is a hybrid, flexible and transdisciplinary platform that provides space and time for learning, reflection and development of alternative solutions that are not self-evident in a regime context. The platform brings together innovative 'regime' actors and frontrunners from 'niche' contexts. In UTLs, transition knowledge is tailored to the local urban setting: different future visions or already ongoing transition initiatives across domains or sectors are brought together for consideration, integration and re-scaling; learning points on how multiple visions and experiments reinforce (synergies) or counteract (trade-offs) their ambitions are identified and captured; windows of opportunity for complementation and synergies are explored; potential barriers and tensions and how to overcome them are investigated. Because of the various problems that cities deal with, they need to find smarter and more sustainable ways to navigate their future development […]. The main task of the transition team is to facilitate the interaction, to unveil lock-ins, to discover innovation opportunities, to assure transparency, and to nurture the social learning environment".

In the literature, though not always defined as urban labs, several cases are proposed and the reasons of success often examined (e.g. Sagaris 2014; Wittmayer et al. 2014).

According to Hirvonen-Kantola et al. (2015), a proactive urban planning laboratory comprises "four parallel processes sustained by the city", called as visioning, strategizing, performing, and assessing. Visioning relates to the exploration of the opportunities and advantages of the city, and it is concerned with the long-term intentions of that city. Strategizing consists in the selection of opportunities and shaping into real spatial planning descriptions. Performing means exploiting the opportunities with the advantages at hand. Finally, assessing requires the observation of effects and consequences of action. When something new is created as final output of the lab, the processes might start from visioning and continue through strategizing and performing to assessing. When something existing is transformed, the processes usually begin from performing and then go through assessing, visioning, strategizing and finally performing again. As a whole, the four processes cover and frame all the ongoing urban activities. They allow the exploration and exploitation of the opportunities and advantages for the city.

3 Open Innovation

Studying open innovation within a urban context requires some preliminary notes on the broader concept of innovation. The utilization of this term in the domain of urban studies is consistent with the multi-disciplinary tradition of research on this topic, which spans the business field as well as several other fields. According to the pivotal studies by Zaltman et al. (1973), at least three different means of innovation can be identified, namely: (i) a new item, in form of product, service, or process, (ii) the process of developing that item, and (iii) the process of adopting it in a new context.

More recently, Baregheh et al. (2009) build on 60 definitions retrieved in the extant literature and define innovation as "the multi-stage process whereby organizations transform ideas into new/improved products, service or processes". In this paper, we focus on the innovation development process in a urban context and use the term innovation in the meaning depicted by Baregheh et al. (2009).

In the rest of the section, we first discuss the concept of openness, then provide an overview on open innovation literature, finally describe the framework proposed in (Bellantuono et al. 2013b) to identify the open innovation practices most suitable to a given innovation context.

3.1 Evolution of the Concept of Openness

In the last decades the concept of openness has been adopted in several research fields, often with different meanings. In the nineties, the Open Source Initiative coined the expression Open Source Software (OSS) to refer to software (e.g., Linux) innovatively developed by several thousands of independent developers, geographically dispersed and often operating voluntarily (Raymond 1999). Such a development model, also called commons-based peer production (Benkler 2002; Benkler and Nissenbaum 2006), represents a kind of private-collective innovation (Alexy and Reitzig 2013; von Hippel and Krogh 2003): developers, indeed, receive a personal (private) reward by sharing a code often written for personal use and collectively contribute to its development and improvement. Furthermore, the model has been adopted in fields which go beyond the software development, for instance to design or develop different kinds of products such as encyclopedias (e.g. Wikipedia: Halfaker et al. 2013), cellular phones (Stuermer et al. 2009), or automobiles (e.g. the Oscar project: Zhang et al. 2013).

As it integrates the contributions of a community of innovators, who simultaneously are producers and users of the output, the innovation developed according to the model initially adopted in OSS development teams is able to address genuine needs, i.e. needs which really originate from the customers as opposed to purposively induced by companies (Crowston and Scozzi 2003). It can thus be classified as a user innovation, as meant by von Hippel (2013), and as a social innovation, given that it is aimed at addressing the genuine needs expressed by a community of actors who are often involved in the development of the solution itself (Phills et al. 2008; Pol and Ville 2009).

Since 2006, the concept of openness was also used to refer to open innovation, a set of practices that firms adopt to access to expertise and technologies not available in house, as well as to reduce the costs of innovation by sharing the risks with others (Chesbrough et al. 2006; Dahlander and Gann 2010; West et al. 2014).

3.2 Overview of the Literature on Open Innovation

In their seminal paper, Chesbrough et al. (2006) define open innovation as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively", so putting emphasis on both knowledge acquisition and knowledge spread. The former has been labelled

by Enkel et al. (2009) as inbound open innovation, i.e. the process of enriching the organization's own knowledge through the integration of external knowledge. In other terms, inbound activities are related to acquiring and sourcing knowledge, whereas outbound activities deal with selling and revealing knowledge (Dahlander and Gann 2010). The articulated nature of the concept has been stressed by other scholars as well. Most of them, while highlighting the lack of clarity on how it has been used so far (Acha 2008; Dahlander and Gann 2010; Saebi and Foss 2015), stress that ambiguity lies in the way the term openness is adopted.

In general, what emerges from the literature is that open innovation includes many kinds of practices and categories. Chesbrough (2006) used the expression to indicate "a set of practices for profiting from innovation" as well as a "cognitive mode for creating, interpreting, and researching those practices". According to von Hippel (2010), it may relate to either (i) the absence of intellectual property constraints, which makes anyone free to use the resulting information commons, or (ii) the organization permeability, namely its propensity to overcome the traditional model of closed innovation and acquire ideas, patents, and products from outside. Building on previous studies, Chesbrough and Bogers (2014) have recently defined open innovation as "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model".

The several available definitions are heterogeneous also due to the fact that studies on open innovation adopt different units of analysis, i.e. the innovating organization as a whole, a single innovation project, a single problem managed by the innovating organization (Felin and Zenger 2014; Knudsen and Mortensen 2011; Pisano and Verganti 2008), or a single knowledge acquisition which the innovating organization recurs on within a given innovation project. In the rest of the paper we will call such a knowledge acquisition as knowledge supply (Bellantuono et al. 2013a, b). At this level of analysis (knowledge supply), the way open innovation is managed may differ innovation by innovation and, within a given innovation, collaboration by collaboration.

In accordance with the recent stream of the literature that emphasizes the existence of a continuum between open and closed innovation (Knudsen and Mortensen 2011; Trott and Hartmann 2009), the concept of openness degree has been introduced to assess the extent to which an innovation is open. For instance, adopting the company as unit of analysis, Lazzarotti and Manzini (2009) measure the degree of openness based on (i) the partner variety, i.e. the number/type of partners with whom the company collaborates, and (ii) the innovation funnel openness, i.e. the number/type of phases of the innovation process that the company opens to external contributions. Similarly, Drechsler and Natter (2012) define the openness degree of an organization based on the number and the perceived importance of collaboration partners. When the focus is on single innovation projects, the openness degree is calculated based on the reliance to external and internal resources within a specific project (e.g. Du et al. 2014; Knudsen and Mortensen 2011). Finally, Bellantuono et al. (2013a), adopting the knowledge supply as unit of analysis, propose a methodology based on the criticality of knowledge supplies. The same authors (Bellantuono et al. 2013b) identify different open innovation practices which, differently from other studies (e.g. Pisano and Verganti 2008; Boudreau and Lakhani 2009), analytically help describe the continuum

between closed and open innovation. Based on that, Bellantuono et al. (2013b) propose a framework that suggests the fit between the innovation context and the practices.

3.3 Innovation Practices and Context: A Framework

An organization needs knowledge and expertise to develop any innovation. The term organization here identifies any socio-technical system—not necessarily endowed of a formal recognition (e.g. company, association, public institution)—whose members make the initial decision to start the innovation process and, finally, deliver the outcome of that process.

Open innovation can be considered the peculiar kind of innovation where knowledge and expertise needed to innovate do not entirely belong to the organization wherein innovation is developed. Rather, open innovation occurs when the so-called knowledge recipient (i.e. the individual or team, belonging to the innovating organization, who is directly involved in the innovation process) acquires knowledge from one or more external sources, such as customers, suppliers, or consultants (Doan et al. 2011; Tether and Tajir 2008; Verona et al. 2006). Any collaboration or interaction between the knowledge recipient and a knowledge source, aiming at acquiring knowledge useful to develop that innovation, is called knowledge supply. Beside recipient and source, knowledge supplies can be characterized in terms of knowledge kind, knowledge transfer medium, and supply type. The knowledge kind characterizes the nature of the provided knowledge, which can be certain, stable, usable, proficient, applicable, original, and onerous (Holsapple and Joshi 2001). The knowledge transfer medium is the mean of communication between the knowledge source and recipient. Finally, the supply type describes the knowledge supply in terms of performance impact (i.e. profitability, competence and image benefits that the organization gets from the open innovation) and supply risk (i.e. extent to which the organization can be affected by exogenous factors such as changes in regulations).

To effectively manage a knowledge supply, the innovating organization should make several decisions. Based on Bellantuono et al. (2013b), they relate to the following dimensions:

- *Access mode* The knowledge recipient has to choose whether or not to limit the search of the knowledge source among pre-qualified knowledge sources. The access mode is defined closed if the knowledge supply is provided by ad-hoc selected sources (e.g. acknowledged experts and consultants) and open if any possible knowledge source can access to the knowledge recipient's request.
- *Degree of formality* The communication between the knowledge source and the knowledge recipient can be ruled by standards, protocols, and procedures. A high degree of formality occurs if the knowledge supply is provided in a formalized mode (e.g. by written reports), whereas such a degree is low if the knowledge flow is less formal (e.g. based on unstructured conversations).
- *Incentives* They are the drivers that allow the knowledge recipient to have access to (or establish a collaboration with) the knowledge source, and can be pecuniary or non-pecuniary.

- *Interaction mode* It refers to the way of interaction between knowledge recipient and knowledge source: a static interaction mode is associated with a mere knowledge transfer, whereas a dynamic one activates a mutual learning process.
- *Information flow* It relates to the direction of the information transferred: a mono-directional information flow occurs if the knowledge source does not receive any information from the knowledge recipient (e.g. a scientific article examined by the knowledge recipient), whereas a bi-directional information flow occurs if both parties exchange information.
- *Locus of control* It describes the actor who makes decisions regarding the knowledge supply: control can be in the hands of the knowledge recipient, in the hands of the knowledge source, or shared.
- *Coordination mode* It relates to the way the interdependences between knowledge recipient and source are managed: coordination by programming requires to preliminarily detail tasks, deliverables, and time schedule, whereas coordination by feedback entails continuous adjustments according to what emerges during the knowledge supply.
- *Output accessibility* It is associated with the existence of possible limitations to access or adopt the content of the knowledge supply. It is open if deliverables of the knowledge supply can be used by anyone, and closed if some form of protection (e.g. copyright, patents, or licenses) exists.
- *Coordination form* It describes the kind of relationship between the innovating company and the knowledge source. Unlike other dimensions, coordination form may assume values ranging in a continuum, from pure market relationships to hierarchical relationships.

Any combination of values for the dimensions above defines an open innovation practice. Not all practices are appropriate to every innovation context. The innovation context defines the features of the environment wherein the innovation takes place, and can be expressed in terms of context variables. In their framework,[1] Bellantuono et al. (2013b) take into account three context variables, i.e. the interest and easiness of external subjects in taking part to the innovation (IEP), the knowledge owned by the knowledge recipient for defining the innovation problem and evaluating the solutions proposed (KDE), and the knowledge owned by the knowledge recipient to address the innovation problem (KA). Every innovation context can be thus positioned within a three-dimensional matrix, whose dimensions are associated with the context variables. Assuming that such variables may assume two values (high vs. low), after observing that certain combinations of values are unfeasible and others relate to closed innovation, it emerges that open innovation may occur in four innovation contexts. Table 1 shows the values that characterize each innovation context and the attendant open innovation practices.

It is noteworthy that, although the variables are assessed as high or low, the framework does not pretend to give an absolute measurement of knowledge. Rather it requires the innovating organization to make a (relative) self-assessment so as to understand whether the knowledge owned is "sufficient" to address the specific issue,

[1] The framework is discussed in Bellantuono et al. (2013b), The reader is referred to the paper for a detailed description of the framework.

Table 1 Open innovation variables and (set of) practices

		A	B	C	D
Context variables	IEP	Low	High	Low	High
	KDE	Low	Low	High	High
	KA	Low	Low	Low	Low
Decision variables	Access mode	Any	Open	Any	Open
	Degree of formality	High	High	High	High
	Incentives	Pecuniary	Non pecuniary	Pecuniary	Non pecuniary
	Interaction mode	Any	Any	Static	Static
	Information flow	Any	Any	Any	Bi-directional
	Locus of control	Knowledge source or both	Knowledge source or both	Knowledge recipient	Knowledge recipient
	Coordination mode	Feedback	Feedback	Programming	Programming
	Output	Any	Open	Any	Any
	Coordination form	Market or partnership	Market or partnership	Any	Market or partnership

i.e. to define the innovation problem and evaluate solutions in the case of KDE and to address the innovation problem in the case of KA.

4 Soft System Methodology

Soft System Methodology (SSM) is an action research methodology developed in the 1970 s by Peter Checkland and his colleagues at Lancaster University (Lane and Oliva 1998). The methodology was developed to overcome the inadequacy of system engineering in coping with the complexity of management problems. In the view of Checkland (1985), such inadequacy depends on the misleading assumption that the way a specific system works is always obvious and does not depend on the perspective adopted by the involved actors.

SSM is one of the best-known soft operational research methods (Lane and Oliva 1998; Munro and Mingers 2002; Paucar-Caceres 2010; Reisman and Oral 2005), i.e. methods and techniques aimed at interpreting, defining, and exploring problems, based on the worldviews, interests, and motivations of the people who face those problems. Such analyses are conducted by means of qualitative, rational, and interpretative techniques, so as to generate debate, learning, and understanding that can be used to address complex problems. SSM, as other soft operational research methods, help key

stakeholders understand the problems they face and the views held by others. It also facilitates negotiation on the actions needed to address the problems.

SSM has been used in the practice of operational research and management science since the early 1970s (e.g. Checkland 1985; Georgiou 2008; Jackson 2001; Mehregan et al. 2012; Mingers and White 2010; Mingers 2011; Mingers and White 2009; Reisman and Oral 2005). Applications of SSM can be found in multiple different settings (e.g. Brown et al. 2006; Crawford et al. 2003; Doloi 2011; Liu et al. 2012; Macadam et al. 1990; Kasimin and Yusoff 1996; Novani et al. 2014; Small and Wainwright 2014; Teles and Sousa 2014; Venters et al. 2002). However, to the best of the authors' knowledge, it has not been adopted to support problem analysis and innovation development in urban labs.

SSM draws a clear distinction between the real world, wherein a problematic situation occurs, and the conceptual world of the systems thinking, where the problematic situation can be studied and modeled. To analyze and address a problem seven steps are proposed (Checkland 1985), two of which concerning the system thinking world:

Steps 1&2. Enter unstructured problem situation & express the problem situation. The first two steps (real world) deal with the characterization of the problem to be addressed. They require the development of a detailed description of the problem situation, expressed as a "rich picture". The rich picture depicts the situation (including the organizational entities of interest, relationships among them, roles and issues of apparent significance) and the eventual areas of conflict (Wilson 2001). There is no formal technique to present the rich picture, even though it is often represented as a mind map.

Step 3. Formulate root definitions of relevant human activity systems. This step requires succinct descriptions of the system to be studied. The descriptions can be multiple, because the different actors (stakeholders) involved in the problematic situation may interpret it differently. Each description, defined as root definition, include the following elements (CATWOE):

- Customer, i.e. the person or organization to whom the output is delivered;
- Actors, i.e. the persons that, within the problematic situation, carry out some activities to deliver the output;
- Transformation, i.e. description of inputs and outputs (e.g. a physical entity, a service, or information);
- Worldview, i.e. reasons why the transformation makes sense to the actors;
- Owner, i.e. the person that has the power to terminate the transformation;
- Environment, i.e. the elements that characterize the transformation but are not under the owner's control.

Step 4. Build conceptual models from the root definitions. This step requires an in depth analysis of the root definitions identified. For this purpose, SSM does not prescribes a specific method. This is one of the main critique associated with SSM.

Step 5. Compare models with real world. This step requires the comparison between the conceptual models developed in step 4 and the real world wherein the problem situation occurs.

Step 6. Define desirable and feasible changes. This step requires the identification of feasible desirable changes/solutions, which are supposed to be facilitated by the iterative implementation of the previous steps.

Step 7. Take action in problem situations. The last step requires the implementation of the identified changes/solutions.

The seven steps should be iteratively implemented, each iteration representing a learning cycle.

5 The Urban Lab Methodology

The definitions provided in Sect. 2, although different, share the focus on two aspects of urban labs, namely the presence of several different stakeholders and the adoption of open innovation practices to achieve the goal of the lab. Such features recall the idea of open innovation ecosystems, an expression which combines the concepts of business ecology and open innovation. According to West and Wood (2008) and Chesbrough et al. (2014), an open innovation ecosystem comprises communities of different stakeholders who, linked by competitive as well as cooperative relationships, co-create value by adopting an open approach. Based on that and building on Hirvonen-Kantola et al. (2015) and Nevens et al. (2013), we consider a urban lab as an open innovation ecosystem wherein open innovation practices are adopted to identify and address urban problems. Such problems are complex as they usually impact multiple domains simultaneously.

The presence of different stakeholders and different relationships makes the management of urban labs particularly hard (Almirall et al. 2014). The goal of the paper is indeed to develop a prescriptive methodology to support urban labs' management, whose criticality is particularly high when the lab is managed by public administrations (which is more and more common), and citizens have no or limited experience on both the open innovation practices to be adopted to involve the identified stakeholders, and the method to support them so as to develop feasible and desirable innovations. In this paper we name "solution" any innovation that gives a feasible and desirable answer to a problem as pointed out by stakeholders.

As mentioned in Sect. 4, the goal of SSM is to support the identification and implementation of feasible and desirable solutions to specific problematic situations wherein multiple stakeholders are involved. However, SSM does not support the identification of open innovation practices to be adopted to involve those stakeholders. Therefore, we decided to couple SSM with the framework developed by Bellantuono et al. (2013b) and illustrated in Sect. 3.3. In particular, the characterization of the innovation context and the identification of the attendant innovation practices have been considered as a further element of step 2 of SSM to complement the description of the problematic situation. To characterize the context, a value (high *vs.* low) should be associated with each context variable. Thus, every combination of values identifies the appropriate open innovation practices. Possible combinations and attendant open innovation practices are reported in Table 1. Once identified and implemented the open innovation practices for the different categories of stakeholders, the urban lab together with all stakeholders should iteratively adopt the five following steps of the original SSM.

Steps1&2.	Enter unstructured problem situation, express the problem situation, describe the innovation context & identify the most suitable open innovation practice
Step 3	Implement the identified open innovation practice and formulate the root definitions (CATWOE) of relevant human activity systems
Step 4	Build conceptual models from the root definitions
Step 5	Compare models with real world
Step 6	Define desirable and feasible changes
Step 7	Take action in problem situations

Fig. 1 Urban Lab Methodology: main steps

The main steps of the proposed methodology, named Urban Lab Methodology, are reported in Fig. 1.

6 *Manifesto Della Città Vecchia e del Mare*: A Case Study

In this section we present the case of *Manifesto della Città Vecchia e del Mare*, a urban lab recently created in the town of Taranto (Italy). The final goal of *Manifesto della Città Vecchia e del Mare* is to contribute to the revitalization of Taranto Old Town to develop a continuous and welcoming web of human liveability within the urban experience (Roseland 1997). This encompasses the creation of healthy environments and the stimulation of social interactions and economic activities. Such activities, which fall under the umbrella of urban development planning (McCormick et al. 2013), are necessary to foster sustainable urban transformation and deserve more attention (Radywyl and Biggs 2013). Out of the four parallel processes carried out in a urban living lab, namely visioning, strategizing, performing, and assessing (Hirvonen-Kantola et al. 2015), only the first two processes are of interest to *Manifesto*.

6.1 The Case Study

Taranto, a city of about 200,000 inhabitants, is located along the coast of Apulia, in Southern Italy. Born in the VII century as a Greek colony, it was among the most important cities of Magna Graecia. Today, Taranto is a primary port and one of the principal military bases of the Italian navy. It is also one of the main industrial cities in Italy: its vast industrial area includes a dockyard, an oil refinery, and one of the largest steel plants in Europe. Such heavy industries have made Taranto one of the most polluted towns in Europe,[2] severely undermining traditional economic sectors, including fishing, agriculture, and farming (which is currently forbidden in an area of 20 Km around the plant), and jeopardized its touristic development. Despite of this, the Old Town of Taranto—-located on an island—is extremely fascinating even though seriously affected by urban blight.

[2] In 1997 the Italian Ministry of Environment declared the area of Taranto at *high risk of environmental crisis*. Two recent Italian laws, Law n. 171 (4 October 2012) and Law n. 20 (4 March 2015), have defined the initial resources (336 million euros) and the procedures to adopt so as to start urgent measures for the land reclamation drainage and industrial reconversion of the area.

In the last decades Taranto was animated by an intense debate on how to preserve the heritage of the Old Town. Although in the past many important actions were taken, partly thanks to some European Union funding, the architectural, urban, environmental, social, and economic problems of the area have not been properly addressed and are more and more urgent. Among the citizens it has been growing a diffuse awareness that it is imperative to define a project to preserve the Old Town heritage, as it can strongly contribute to the re-launch of the entire city.

In 2014, a group of citizens, active in different sectors of the civil society (e.g. consultants, actors, students, researchers, freelancers), voluntarily and for free decided to create a urban lab to carry out an in depth analysis of the problems affecting the Old Town and develop proposals to address them in the short, medium, and long term. The lab was named after the document the group intended to develop, namely *Manifesto della Città Vecchia e del Mare* (literally, "The Old Town and Sea Manifesto"). The initial idea of *Manifesto* was sketched by a charismatic citizen, who concurs to animate the life of the Old Town. He invited citizens with different backgrounds to take part to his project. One of the first participants was another charismatic citizen, born in the Old Town, expert of the history, traditions, and life of that part of the town, who actively concurs to animate the cultural life of the entire town. Other citizens have been joining the initial group. That can be considered as an example of what Nevens et al. (2013) define as a transition team. As mentioned, the innovation which *Manifesto* is interested to develop is a proposal for urban recovery. Even though it is not the first urban recovery proposal ever developed, it is innovative for two reasons: (i) the group members were not used to the development of such proposals and (ii) the way adopted to develop it was innovative (at least within that group). The first questions the group had to address were about which knowledge to adopt to understand the Old Town problems and genuine needs, and how to access such knowledge. It was decided that the knowledge sources would have been citizens, local associations, businesses, and the institutions located in the Old Town. Seven thematic groups were established: urban requalification and architectural interventions; business activities; resources of the sea; tourism and territory; culture, associations, and relationships with the Church; fishing and mussel farming; residents; institutions; innovation and technology. Each group collected knowledge on the problems and potential solutions by means of meetings and calls for statements. People living or working in the Old Town were invited, through the media (e.g. local press, social networks) or directly by means of personal invitations, to take part to the meetings and/or freely contribute to the document.

All the contributions were collected in a document that the lab presented to the community to get further feedbacks. These contributions highlighted a serious decrease of the quality of life in the Old Town (e.g. scarce cleanliness or street lightning) and also provided some recommendation to improve the as-is condition. It was also stressed that the traditional ways to cope with the urban blight in the Old Town usually adopted a short term vision and tended to focus on emergencies rather than on their causes, which would involve the search for solutions under a long-term perspective. The lack of systemic answers to the issues of the Old Town led many people to move out of it, which in turn caused the suppression of numerous services, so determining a vicious circle. Finally, many contributions stressed that no real action was carried out (or

even planned) to nurture the great cultural, traditional, as well as economic heritage associated with the Old Town.

7 The Case of *Manifesto* Analyzed Through The lens of Urban Lab Methodology

In this section the case of *Manifesto* is discussed through the lens of ULM. Even though we claim that our methodology is prescriptive, we ex-post applied it to a real case to verify whether theoretical prescriptions are coherent with the real course of action.

As mentioned, SSM supports the identification of solutions to address a given problem by leveraging the key involved stakeholders. They are those who better know the problem because they experiment it daily (e.g. residents or shop owners in the case of *Manifesto*) and will also be affected by the solutions. Their involvement increases the chances that the identified solutions are desirable and feasible. Even though the methodology was not known by the *Manifesto*'s members, as shown in the analysis reported below, they made decisions that were consistent with what our methodology would have suggested.

Below we discuss the steps that have been carried out in the case study. Where appropriate, we briefly recall what should have been done compared to what was actually done.

1&2. Enter unstructured problem situation, express the problem situation, describe the innovation context & identify the most suitable open innovation practice. During this step it is important to identify the actors potentially involved in the problem as well as those that could implement the solutions. It is also necessary to describe the problem situation, and characterize the innovative context and the attendant innovation practice. In the case of *Manifesto*, the innovation context wherein the practice is carried out is characterized by high IEP, high KDE, and low KA. As suggested by the framework by Bellantuono et al. (2013b), such a context would require the adoption of practice D in Table 1.

In the case of *Manifesto*, the problem situation refers to the urban blight existing in the Old Town of Taranto. Given that most of the members of *Manifesto* were aware of the problem situation, they did not explicitly express it. They substantially adopted practice D (with the only exception concerning the degree of formality). In fact, the *access mode* to the lab is open, as anyone can contribute on a voluntary basis, and *incentives* are non-pecuniary, as any support is given for free. The *degree of formality* of collaborations is low (any kind of contribution is accepted) rather than high as in practice D. The *interaction mode* between the knowledge recipient (i.e. the *Manifesto* group) and its knowledge sources is static, as learning almost exclusively involves the recipient, and the *coordination mode* is based on programming (knowledge sources' tasks, deliverables and time schedule are detailed in advance), whereas the *information flow* is bi-directional, as contributions are collected and then re-discussed with people. The *locus of control* is in the knowledge recipient's hands, as decisions regarding the knowledge supply are made by the *Manifesto* group. The *coordination form* is partnership, in the sense that the relationship is neither based on hierarchy nor formally

Table 2 Step 3: root definition for the Manifesto della Città Vecchia e del Mare

Customers	All the citizens of Taranto, in particular those living or working in the Old Town
Actors	Citizens involved in the thematic groups, Manifesto della Città Vecchia e del Mare, Public Administration (at regional and local level), Local Universities, Businesses, Church representatives, Important Institutions working in Taranto
Transformation	Citizens (living in the Old Town) ⟶ Satisfied citizen (living in the Old Town)
Vision of the world	Need to improve the human liveability within the urban experience
Owner	*Manifesto della Città Vecchia e del Mare*
Environment	Traditions, physical characteristics of the Old Town

ruled by contractual agreements. Finally, the *output* is open, as the documents produced by the thematic group are publicly disseminated.

3. Implement the identified open innovation practice and formulate the root definitions (CATWOE) of relevant human activity systems. The solution comprises an in-depth analysis of the problems at the foundation of the urban blight and a set of proposals to address them in the short, medium, and long term, so as to improve the human liveability within the Old Town. The root definition was not formulated as required by the methodology, given that the urban lab was not aware of it. However we report in Table 2 the root definition as emerged based on an ad-hoc interview with the *Manifesto*'s members.

4. Build conceptual models from the root definitions. Step 4 was conducted by means of meetings organized within each thematic group, collection of documents, and interviews with citizens. During the meetings and interviews the discussions were recorded and successively analyzed and summarized into a document.

5. Compare models with real world. The final document was presented and discussed with all the participants to the thematic groups.

6&7. Define desirable and feasible changes and take action. The validated document was published and discussed with the city government.

The definition of an in-depth analysis of the problems of the Old Town and a set of recommendations to improve the current condition were the first step carried out by *Manifesto* to pursue the transformation reported in Table 2. *Manifesto* is currently working in view of the final goal, namely the revitalization of Taranto Old Town.

8 Conclusions

In the last years urban labs are proliferating as places, either promoted by local institutions or companies, or spontaneously established by active citizens, wherein the current problems and challenges associated with a city are assessed and innovative solutions designed and possibly implemented (Voytenko et al. 2015).

As urban labs face complexity in managing the contributions of several heterogeneous actors, this paper presents the Urban Lab Methodology (ULM) that intends to support the management of urban labs, which are viewed as open innovation ecosystems. ULM integrates Soft System Methodology (SSM) with a framework previously

developed by the authors. SSM helps tackling complex problems that involve different stakeholders, whereas the framework aims at suggesting an association between the innovation context and appropriate open innovation practices. The methodology is used to analyze the case of a urban lab working in the city of Taranto (Italy), called *Manifesto della Città Vecchia e del Mare*.

Many steps of the methodology were unconsciously adopted by the *Manifesto*'s members. Though we are aware that further empirical research would be necessary, the analyzed case shows that people are likely to generate knowledge about their city in a way that is consistent with what our methodology proposes. Hence, we believe that the voluntary adoption of ULM could be relatively straightforward.

In terms of theoretical implications, ULM integrates contributions developed in different research fields. It is the result of a multidisciplinary research effort and extends the possibility of application of SSM. Moreover, the paper represents the first attempt to test the framework developed by Bellantuono et al. (2013b) on a real case.

The paper has practical implications as well: the combination of SSM and the framework contributes to increase the awareness of urban labs about the innovation process that they promote. This in turn is expected to enhance the developed solutions, in terms of feasibility and desirability.

References

Acha V (2008) Open by design: the role of design in open innovation. Imperial College London, DIUS Research Report 08:10

Alexy O, Reitzig M (2013) Private-collective innovation, competition, and firms' counterintuitive appropriation strategies. Res Policy 42(4):895–913

Almirall E, Lee M, Majchrzak A (2014) Open innovation requires integrated competition-community ecosystems: lessons learned from civic open innovation. Bus Horiz 57:391–400

Baregheh A, Rowley J, Sambrook S (2009) Towards a multidisciplinary definition of innovation. Manag Decis 47(8):1323–1339

Bellantuono N, Pontrandolfo P, Scozzi B (2013a) Mapping the Knowledge Supply Chain to foster Innovation. Int J Inf Syst Soc Change 4(4):1–17

Bellantuono N, Pontrandolfo P, Scozzi B (2013b) Different practices for open innovation: a context-based approach. J Knowl Manag 17(4):558–568

Benkler Y, Nissenbaum H (2006) Commons-based peer production and virtue. J Polit Philos 14(4):394–419

Benkler Y (2002) Coase's Penguin or Linux and the nature of the firm. Yale Law J 112(3):369–447

Boudreau KJ, Lakhani KR (2009) How to manage outside innovation how to manage outside innovation. MIT Sloan Manag Rev 50(4):69–76

Brown J, Cooper C, Pidd M (2006) A taxing problem: the complementary use of hard and soft OR in the public sector. Eur J Oper Res 172(2):666–679

Checkland P (1981) System thinking system practice. Wiley, Chichester

Checkland P (1985) Achieving feasible desirable changes: an application of soft system methodology. J Oper Res Soc 36(9):821–831

Chesbrough H (2006) Open business models: how to thrive in a new innovation landscape. Harvard Business School Press, Boston

Chesbrough H, Bogers M (2014) Explicating open innovation: clarifying an emerging paradigm for understanding innovation. In: Chesbrough H, Vanhaverbeke W, West J (eds) New frontiers in open innovation. Oxford University Press, Oxford

Chesbrough H, Vanhaverbeck W, West J (2006) Open Innovation: researching a new paradigm. Oxford University Press, Oxford

Chesbrough H, Kim S, Agogino A (2014) Chez panisse building an open innovation ecosystem. Calif Manag Rev 56(4):144–171

Crawford L, Costello K, Pollack J, Bentley L (2003) Managing soft change projects in the public sector. Int J Project Manag 21(6):443–448
Crowston K, Scozzi B (2003) Open source software projects as virtual organizations: competency rallying for software development. IEE Proc Softw 149(1):3–17
Dahlander L, Gann DM (2010) How open is innovation? Res Policy 39:699–709
Doan A, Ramakrishnan R, Halevy AY (2011) Crowdsoucing systems on the world-wide web. Commun ACM 54(4):86–96
Doloi HK (2011) Understanding stakeholders' perspective of cost estimation in project management. Int J Project Manag 29(5):622–636
Drechsler W, Natter M (2012) Understanding a firm's openness decision in innovation. J Bus Res 65:438–445
Du J, Leten B, Vanhaverbeke W (2014) Managing open innovation projects with science-based and marketbased partners. Research Policy 43(5):828–840
Enkel E, Gassmann O, Chesbrough H (2009) Open R&D and open innovation: exploring the phenomenon. R&D Manag 39(4):311–316
Felin T, Zenger TR (2014) Closed or open innovation? Problem solving and the governance choice. Res Policy 43(5):914–925
Georgiou I (2008) Making decisions in the absence of clear facts. Eur J Oper Res 185(1):299–321
Halfaker A, Geiger RS, Morgan JT, Riedl J (2013) The rise and decline of an open collaboration system: how Wikipedia's reaction to popularity is causing its decline. Am Behav Sci 57(5):664–688
Hirvonen-Kantola S, Haokangas P, Iivary M, Heikkila M, Hentila H (2015) Urban development practices as anticipatory action learning: case arctic smart city living laboratory. Proc Econ Finance 21(15):337–345
Holsapple CW, Joshi KD (2001) Organizational knowledge resources. Decis Support Syst 31:39–54
Jackson MC (2001) Critical systems thinking and practice. Eur J Oper Res 128:233–244
Juujärvi S (2013) Pesso K (2013) Actor Roles in an Urban Living Lab: What Can We Learn from Suurpelto, Finland? Technol Innov Manag Rev 3(11):22–27
Kasimin H, Yusoff M (1996) The use of a soft systems approach in developing information systems for development planning: an exploration in regional planning. Comput Environ Urban Syst 20:165–180
Knudsen MP, Mortensen TB (2011) Some immediate–but negative–effects of openness on product development performance. Technovation 31:54–64
Lane DC, Oliva R (1998) The greater whole: towards a synthesis of system dynamics and soft systems methodology. Eur J Oper Res 107:214–235
Lazzarotti V, Manzini R (2009) Different modes of open innovation: a theoretical framework and an empirical study. Int J Innov Manag 13(4):615–636
Liu WB, Meng W, Mingers J, Tang N, Wang W (2012) Developing a performance management system using soft systems methodology: a Chinese case study. Eur J Oper Res 223(2):529–540
Macadam R, Britton I, Russell D, Potts W, Baillie B, Shaw A (1990) The use of soft systems methodology to improve the adoption by Australian cotton growers of the siratac computer-based crop management system. Agric Syst 34:1–14
McCormick K, Anderberg S, Coenen L, Neij L (2013) Advancing sustainable urban transformation. J Clean Prod 50:1–11
Mehregan MR, Hosseinzadeh M, Kazemi A (2012) An application of soft system methodology. Proc Soc Behav Sci 41:426–433
Mingers J (2011) Soft OR comes of age–but not everywhere!. Omega 39(6):729–741
Mingers J, White L (2009) A review of the recent contribution of systems thinking to operational research and management science. In: Working paper 197, Kent business school (ISSN 1748-7595)
Mingers J, White L (2010) A review of the recent contribution of systems thinking to operational research and management science. Eur J Oper Res 207(3):1147–1161
Munro I, Mingers J (2002) The use of multimethodology in practice. Results of a survey of practitioners. J Oper Res Soc 53:369–378
Nambisan S, Nambisan P (2013) Engaging citizens in co-creation in public services—lessons learned and best practices, IBM Center for the Business of Government Report. www.businessofgovernment.org
Nevens F, Frantzeskaki N, Gorissen L, Loorbach D (2013) Urban Transition Labs: co-creating transformative action for sustainable cities. J Clean Prod 50:111–122
Novani S, Sarjono U, Hermawan P (2014) An application of soft system methodology in batik industrial cluster solo by using service system science perspective. Proc Soc Behav Sci 115:324–331

Paucar-Caceres A (2010) Mapping the changes in management science: a review of 'soft'OR/MS articles published in Omega (1973–2008). Omega 38(1):46–56
Phills JA, Deiglmeier K, Miller DT (2008) Rediscovering social innovation. Stanf Soc Innov Rev 6(4):34–43
Pisano GP, Verganti R (2008) Which kind of collaboration is right for you? Harv Bus Rev 86(12)
Pol E, Ville S (2009) Social innovation: buzz word or enduring term? J Socio Econ 38(6):878–885
Radywyl N, Biggs C (2013) Reclaiming the commons for urban transformation. J Clean Prod 50:159–170
Raymond E (1999) The cathedral and the bazaar. Knowl Technol Policy 12(3):23–49
Reisman A, Oral M (2005) Soft systems methodology: a context within a 50-year retrospective of OR/MS. Interfaces 35(2):164–178
Roseland M (1997) Dimensions of the eco-city. Cities 14(4):197–202
Saebi T, Foss NJ (2015) Business models for open innovation: matching heterogeneous open innovation strategies with business model dimensions. Eur Manag J 33(3):201–213
Sagaris L (2014) Citizen participation for sustainable transport: the case of living city in Santiago, Chile (1997–2012). J Transp geogr 41:74–83
Shearmur R (2012) Are cities the font of innovation? A critical review of the literature on cities and innovation. Cities 29:S9–S18
Small A, Wainwright D (2014) SSM and technology management: developing multimethodology through practice. Eur J Oper Res 233(3):660–673
Stuermer M, Spaeth S, von Krogh G (2009) Extending private-collective innovation: a case study. R&D Manag 39(2):170–191
Teles M, Sousa D (2014) Environmental management and business strategy?: structuring the decision-making support in a public transport company. Transp Res Proc 3:155–164
Tether BS, Tajir A (2008) Beyond industry-university links: sourcing knowledge for innovation from consultants, private research organizations and the public science base. Res Policy 37:1079–1095
Trott P, Hartmann D (2009) Why open innovation is old wine in new bottles. Int J Innov Manag 13(4):715–736
Venters W, Cushman M, Cornford T (2002) Creating knowledge for sustainability?: using SSM for describing knowledge environments and conceptualising technological interventions. LSE Working Papers Series, 107. London School of Economics and Political Science, London, UK
Verona G, Prandelli E, Sawnhey M (2006) Innovation and virtual environments: towards virtual knowledge brokers. Organ Stud 27(6):765–788
von Hippel E, Krogh G (2003) Open Source Software and the private-collective innovation model: issue for organizational science. Organ Sci 14(2):209–223
von Hippel E (2010) Comment on: is open innovation a field of study or a communication barrier to theory development? Technovation 30:555
von Hippel E (2013) Open user innovation. In: The encyclopedia of human-computer interaction, 2nd ed
Voytenko Y, McCormik K, Evans J, Schliwa G (2015) Urban living labs for sustainability and low carbon cities in Europe: towards a research agenda. J Clean Prod 123:1–10
West J, Wood D (2008) Creating and evolving an open innovation ecosystem: lessons from Symbian Ltd. Available at SSRN 1532926
West J, Salter A, Vanhaverbeke W, Chesbrough H (2014) Open innovation: the next decade. Res Policy 43(5):805–811
Wilson B (2001) Soft systems methodology conceptual model building and its contribution. Wiley, ISBN0-471-89489-3
Wittmayer J, Roorda C, Steenbergen F Van (eds) (2014) Governing urban sustainability transitions—inspiring examples. DRIFT, Erasmus Universiteit Rotterdam. http://www.drift.eur.nl/wp-content/uploads/2011/12/Governing-Urban-Sustainability-Transitions_DRIFT.pdf
Zaltman G, Duncan R, Holbek J (1973) Innovations and organizations. Wiley, New York
Zhang S, Hu Y, Zhang X, Li Y (2013) Simulation study on collaborative behaviors in mass collaborative product development. In: Computer supported cooperative work in design (2013 IEEE 17th international conference on), IEEE, pp 375–379