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Living Lab as knowledge system: an actual approach for managing urban service projects?

Valerie Lehmann, Marina Frangioni and Patrick Dubé

Abstract

Purpose – *This paper aims to explore Living Labs (LL) as knowledge systems for urban service projects. This empirical study aims to identify and characterize knowledge in LL dedicated to urban service projects. It also aims to understand how through knowledge path, LL redefine the management of projects. First, the praxeologic and academic context underlining the main challenges associated to urban service projects is presented. It mainly concerns the growth of the cities (Haouès-Jouve, 2013), the problematic of social acceptability (Savard, 2013) as well as the normative approaches to manage projects (Kerzner, 2010). Second, a literature review on co-innovation and Livings Labs is presented. (Chesbrough, 2004; Gaglio, 2011). This paper also presents the concept of knowledge applied in an LL system (Sanders and Stappers, 2008). Here, knowledge refers to dynamic knowledge, as suggested by Argyris (1995).*

Design/methodology/approach – *In the third part, the goals of this study as well as the abductive and "partnership" qualitative methodology that was used are explained (Fontan and René, 2014). The constitutive and the operational definitions on knowledge that have been mobilized are detailed (Piaget, 1974; Gadille, 2012). A special focus is made, here, on distributed knowledge (Nowotny et al., 2002; Trepos, 1996), on "users" as "experts of uses" (Chen et al., 2010). Then, the sample and the four cases of LL that were explored are described.*

Findings – *Finally, the findings are presented. This paper exposed how knowledge lying in the loops of the LL system was characterized and how knowledge is mobilized in an LL. This paper also draws a theoretical model of project management referring to knowledge, LL and co-innovation approach.*

Research limitations/implications – *To conclude, several implications in project management research and urban studies are presented.*

Practical implications – *Several implications concern the current practices of project management. Due to some new societal challenges, it is considered that a new professional posture is required.*

Social implications – *Several implications concern citizens as users and stakeholders of urban projects.*

Originality/value – *The originality of the study lies in its content and its format. A specific participative approach was used to explore LL. This paper investigated knowledge in LL, which are new entities dedicated to very actual projects, where users are co-managers.*

Keywords *Project management, Innovation, Systemic thinking, Knowledge, Stakeholders, Collection management*

Paper type *Research paper*

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Praxeologic and academic context of the research

New societal dynamics and new practices for urban projects

By 2050, two-thirds of the world population will live in urban zones (Baron, 2013; Bouton *et al.*, 2003). Cities are growing exponentially, so is the willingness of citizens to contribute to the future of their cities, (Haouès-Jouve, 2013) through the use of open data (Manyika *et al.*, 2013) and other participative modalities. Knowledge management is becoming a significant challenge, as numerous, cities such as Barcelona (Spain), Amsterdam (The Netherlands), Montréal (Canada) or Lyon (France), recognize the importance of innovating collectively to ensure holistic value creation and alignment with the needs and desires of

"**From an academic standpoint, researchers from various disciplines often question the social dimension of urban projects, especially through the notion of citizen appropriation.**"

stakeholders across the territory. Consequently, an increasing number of project actors, both from private and public sectors, are beginning to adapt their practices accordingly and to define new approaches to knowledge sharing and collective creativity, thus attempting to maximize "social acceptance" or "social acceptability" of urban projects (Gendron, 2014).

The concept of social acceptance/acceptability refers to the premise that a project which is not accepted by stakeholders has fewer chances of being successfully achieved (Wolsink, 2010).

As Gendron (2014) suggests, social acceptability can be viewed at least as the agreement given to a project by people, even if, for Caron-Malenfant and Conraud (2009), it means rather "the result of a process through stakeholders build together the mininal conditions to implement for a good integration of a project [. . .] in its natural and human environment".

In Quebec, early 2000s, several large-scale projects were left uncompleted, due to their non-acceptance by stakeholders, including citizens (Fontan et al., 2012). Still today, some public organizations do not fully understand the factors behind such failures (Savard, 2013), which reveals the complex nature of urban projects, as described by Declerck et al. (1997) and as suggested more recently by Remington and Pollack (2010). Among the solutions proposed to gain in performance and to increase project success rates, some underline the need to generate a greater diversity of useful knowledge.

Stakeholders-centered approaches that value the input of users in project design (Girard, 2013) are now rising as an answer to this need. Within the context of urban projects, these now common approaches mostly take the form of synchronic management tools, dialogue, meetings, round tables, future search exchange, serious games simulations and collaborative conversations. They are usually applied during feasibility project phases, while diachronic approaches, on the other side, take place from the inception phase to the implementation phase (Prahalad and Ramaswamy, 2013). In Quebec, the latter emerged in the 90s and are often referred to as *consultation methods* (Gariepy, 2012). Today, most of them now belong to a vast range of statutory public mechanisms (OPCM, BAPE, two consultation offices for Montréal and Québec, etc.).

From consultation to dialogue

Dialog-based approaches (Beaudet et al., 2012) are now used as "new forms of consultation", although the definition of dialogue itself often differs from one technique to another. Open innovation principles (Chesbrough, 2003) such as co-creation, co-design and co-development practices also represent promising approaches to go beyond traditional consultation frameworks. While they still remain marginal at the "upperground level" (Simon, 2009), their adoption is growing quickly over large territories thanks to underground initiatives. More visible since the 2000s, the request to experiment with them from upperground organizations gets stronger every year.

These new approaches enable a deeper participation of relevant stakeholders, especially users (citizen, employees, storekeepers, etc.), regarding the development of urban services and infrastructures that will directly affect them. Users occupy a place of choice among stakeholders on the premise that they can give unique "usage insights" of a given

infrastructure/service experience and that this knowledge can be of significant value in terms of service adoption/appropriation. Therefore, they now become contributors in the same way experts were traditionally involved in the development of urban infrastructures and services.

The European Union was a pioneer on the subject by supporting the development of Living Labs (LL) over its territory this past decade, especially in the context of smart cities. It is only in 2010 that the phenomenon appeared in Quebec, where the model was quickly adopted and tailored to local dynamics.

### Normative approaches to manage projects and current urban studies

From an academic standpoint, researchers from various disciplines often question the social dimension of urban projects, especially through the notion of citizen appropriation. This has been an important topic in political sciences (Lamizet, 2013) and in architecture (Beaudet et al., 2012) for several decades. Recently, transdisciplinary research works have been conducted to deal with the concepts of social acceptance and open democracy (Breux, 2012). In strategic management studies, new research topics such as social responsibility and stakeholder's commitment are also emerging (Gendron, 2014). In communication studies, several researchers emphasize the societal role of stakeholders in complex urban projects (Yates et al., 2013).

In project management studies, however, only a few researchers have investigated projects in relation to their social aspects (Lehmann, 2010). Even if urban projects are studied since several decades (Revedin, 2014), only few research efforts target social acceptability and stakeholder management (Bourne, 2009) in the field of project management.
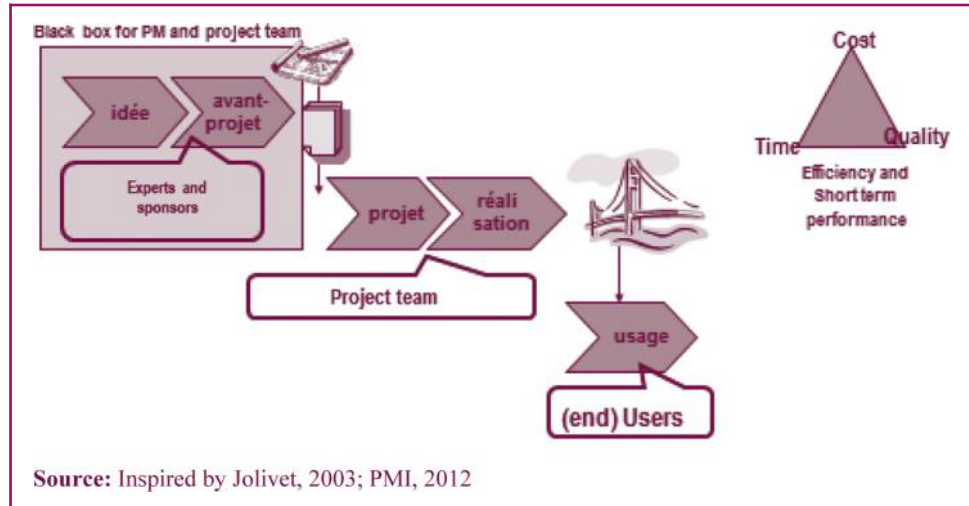
Researchers in project management only begin to study the conception and the management of projects through inclusive modern approaches (Figure 1), which consider users as contributors, unlike normative traditional approaches (Figure 2), which consider them as end-users (Kerzner, 2010). And, while "agile" IT methodologies (Messager Rota, 2007) which take into account "users stories" at the early stage of a project are now used for all types of projects, including urban service ones, current scientific research scarcely explores the management of non-IT projects (Boivert and Trudel, 2011).

However, several researches in urban studies questioning the social dimension of urban projects suggest that a new era has come: besides the fact that citizens are becoming active contributors (Fontan et al., 2012), civil society and intermediation organizations now play a new role as regulators or intermediaries, anchored locally (Gadille, 2012); the notion of urban projects itself now has a new meaning for the citizens (Lamizet, 2013); the

Figure 1 Modern project management: agile approaches in the 2000s (Lehmann, 2013)

Source: Inspired by Midler, 1996; Messager-Rota, 2009
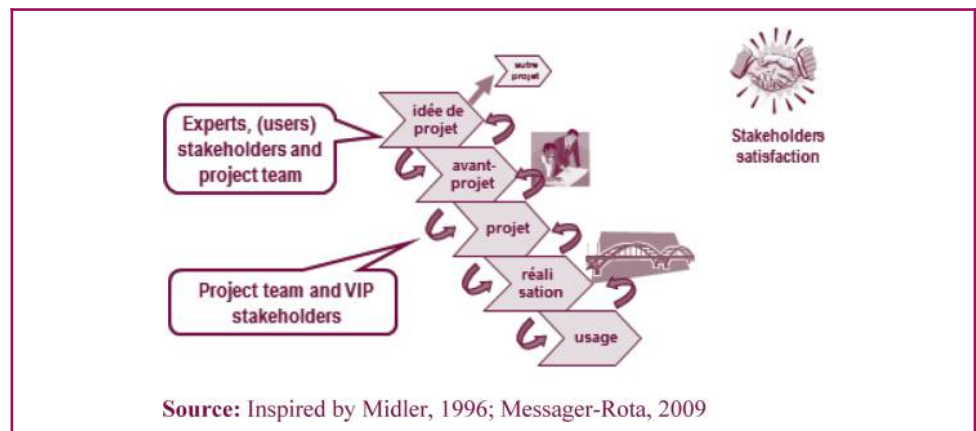
Figure 2 Traditional project management: approaches coming from the 70s (Lehmann, 2013)

Source: Inspired by Jolivet, 2003; PMI, 2012

experimental practices of dialogue between citizens and government increase (Bousquet, 2013; Terrin, 2014); and the private developers of urban projects endorse sustainable development to avoid being "blacklisted" by major investors (Savard, 2013).

For us, this means it is relevant and in time to understand properly how "traditional" urban project designers, namely, private and public organizations, deal with this new social reality from a project management perspective. It is also interesting to understand which knowledge emerges from new collaborative systems and how this knowledge supports the development of urban projects.

Below, is presented a literature review defined for that purpose, and a conceptual guide as well as the methodology used for doing the research.

Innovation, co-innovation and knowledge

Innovation is traditionally considered as the motor of the economy (Schumpeter, 1911). However, numerous researchers from social sciences underline that innovation is rather a socio-cultural phenomenon which arises from the interaction between individuals and communities and which can be directed toward the creation of common goods or services by means of original knowledge production.

Doloreux (2004) underlines that innovation is a complex process embedded in a social and cultural territory, occurring by the numerous interactions of a various individuals.

Innovation has long been made through contributions and collaborations between organizations, such as research centers and small and medium enterprises (SMEs), stressing the importance of networks to help develop, finance and sell innovation. While traditionally such networks were mostly composed of experts and investors, new technologies have allowed private companies to develop collaborative works, integrating customers and suppliers, as in the automotive and aerospace sectors, through a set of precise rules and specifications.

The work of Von Hippel (1986), dating from 1986, included a new category of contributors to innovation networks: *users.* Initially, the term referred to "lead-users" who could make a significant contribution in the development of a product/service. Consequently, a new perspective was explicitly introduced in project management, the point of view of users, on the premise that it would help build products/services better aligned with user needs and desires. This shift led to the so-called "user-centered" innovation paradigm, which

prevailed for more than 20 years within innovation and design communities. Lead-users usually work on existing products designed and developed internally by an organization. In most cases, they do not intervene as contributors in the phase of ideation or pre-feasibility. They are rather involved as testers before implementation.

Through the work of Prahalad and Ramaswamy (2004), user-driven innovation has been defined as an innovation empowered by users in the very first stages of a new product or service development. While user-centered innovation acceptability by stakeholders remains hazardous (Rogers, 2003), user-driven models seems to generate promising outcomes (Chen et al., 2010).

Recent constructivist studies address the differential contributions of "experts" and "layperson" regarding innovation projects. Boder (2006) suggests that the production of knowledge cannot be separated from the notion of informal network and only exists in a setting, through solutions seeking. According to this author, it is essential to structure innovation processes around the production of experiential knowledge by "uninitiated" contributors, as the structuration of knowledge, within a network, enables direct production of data relevant to an innovative solution.

On the other hand, works of Sawhney and Prandelli (2003) insist rather on the fact that the structure of knowledge in the context of solution seeking needs to be intermediated. According to these authors, some intermediate entities such as LL can foster the emergence, the capture and the use of a new knowledge through the construction of semantic spaces, giving meaning to the individual and collective knowledge created.

As innovation and knowledge creation are accelerating in our societies (De Jong et al., 2010; McKinney, 2008), scientific and technological knowledge become more diffused and distributed (Von Hippel, 1988). Networks get bigger and deeper and contribution to the innovation process now naturally occurs from various stakeholders. It is acknowledged that ICT helps multi-levels networks gain in efficiency, but most of these virtual networks are still limited in their ability to define meaningful innovations. Innovation networks are now getting back to face-to-face experimentation aiming to get the most value from experiential knowledge in the context of innovation projects. This phenomenon stresses the need to manage different types of knowledge (as tacit, explicit and in action through network) to foster innovation by kindling collaboration between network members, leading to the co-innovation area. One of the deep roots of co-innovation is also "open innovation", as defined by Chesbrough (2003). In the context of co-innovation, however, knowledge production does not only take place between experts, but also within informal networks of actors and between members of those networks (Granovetter, 1973). Besides, the work of Westerlund and Rajala (2010) suggests that different learnings are done during the co-innovation process and that they complement each other in creating of new knowledge.

LL: a unique co-innovation model

Consistent with the principle of distributed knowledge management (Trépos, 1996) – LL can be seen as centers of co-creation and open innovation of products and services, "where users citizens are at the heart of the creation of societal knowledge in a context of global development" (Roy, 2011).

> "Living Labs do not only mobilize acquired (explicit and implicit) stakeholders knowledge and knowing, they also generate new ones consistent with the knowledge creation spiral proposed by Nonaka and Takeuchi."

"**Urban projects as well as healthcare projects could benefit from open design processes as well as knowledge exploration.**"

Initiated in the late 1990s at the MIT Media Lab and developed in 2006 in Europe, with the creation of the European Network of Living Labs and the launch of the project IST CoreLabs granted from the European Commission, there are now hundreds of LL in over 40 countries worldwide.

LL are open innovation models or "systems" focused on value creation in social, economic and knowledge field. The involvement of SMEs in close relation with user communities, public organizations and research institutions in an LL aims to address different issues of economic, legal and ethical matters from various perspectives, compared to more traditional methods (consultation), to maximize the benefits of innovation in a particular territory. In addition, the LL as intermediation entities can address otherwise the concepts of connectivity, trust and reciprocity that are fundamental elements of co-creation. Therefore, the LL model brings new perspectives on technological and social innovation, viewing them as two sides of the same coin (Dubé et al., 2010).

For Schumacher and Niitano (2008), they are "collaborations of public-private-civic partnerships in which stakeholders co-create new products, services, businesses and technologies in real-life environments and virtual networks in multi-contextual spheres". For Bergvall-Kåreborn et al. (2009), an LL is "an innovation platform which brings together and engages all stakeholders in the early stages of an innovation process to experiment breakthrough concepts and the potential value to all concerned and this leads to breakthrough innovations".

After more than a decade of experimentations, the definition of an LL still varies, not only according to theorists and practitioners but also according to its scale of application. For instance, government institutions generally perceive LL as a regional innovation platform (Roux Alezais and Fellman, 2010; Lafontaine et al., 2013), while SMEs mostly consider them as methods of innovation, often without any special infrastructure.

Nonetheless, LL share a set of characteristics allowing setting them apart from other open innovation approaches as specified hereafter (Figure 3, Dubé et al., 2014).

First, LL represent mixed entities and typically operate through public–private–citizens partnerships. They aim to develop new products, services, government and community systems or relevant new business models, to create value for all stakeholders.

Second, LL go beyond "user-centered" models, which are still applied actually in most of public consultation mechanisms. Users are considered as "usages experts", and become fully acknowledged as LL co-researchers throughout the entire innovation process. Users are involved in all stages, including design, planning, prototyping, development and implementation. They become co-creators, sharing their discoveries, impressions and experiences with professionals (designers, developers, engineers, managers, etc.).

Third, this "user-driven" process is supported by different categories of stakeholders – no matter they have divergent opinions – in a given project, allowing collective knowledge to grow iteratively.

LL typically mobilize a combination of co-creative and field experimentation methods dedicated to understand long-term product/services uses in realistic environments, whether real or virtual. Thus, LL recognize tacit knowledge provided from "uninitiated" users as fundamental source of unique value, which can be harnessed in the field through

Figure 3 The Living Lab among the main modalities of open innovation or co-innovation (Dubé *et al.*, 2014)

Source: Adapted from Sanders and Stappers, 2008
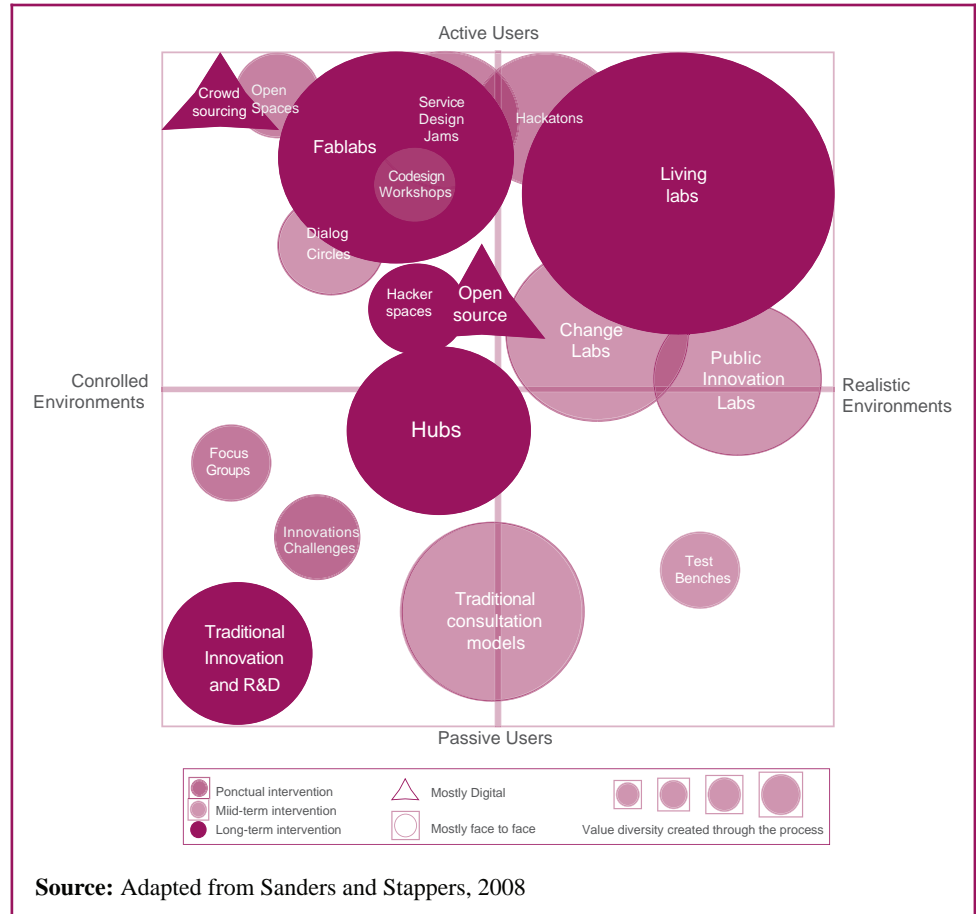
experimentation and throughout the whole innovation process, thus promoting alignment between supply and demand of whether commercial or social projects.

Such parameters help understand how LL represent a profound shift in the rules of innovation, even compared with other co-innovation approaches. Figure 3 below provides a map positioning the LL by comparison with other innovation approaches, depending on the degree of user involvement (passive vs active) and the type of environment offered as exploratory framework (realistic vs controlled).

LL differ from other co-innovation modalities such as design jams or unconferences by the degree of realism in the conditions under which users and other stakeholders are placed, offering the most realistic environment possible to allow "sense making" processes to take place through experiential learning leading to better understanding of product/service adoption behaviors by users. Figure 3 also shows that the LL is a particular system due to the active involvement of users throughout a project's life cycle. LL is also "unique" with respect to the general protocol used to generate new knowledge, to the diversity of value created and how such value is managed throughout the innovation process.

Compared to design thinking approaches referring to the Scandinavian tradition of participatory design, as LL produce artifacts (here projects) and are based on specific demand emerging – in a specific context – from different types of public–private–civic stakeholders who participate all the way long to the whole process, we can consider them as a research-based design process, as described by Leinonen and Durall (2014) and shown in Figure 4.

Figure 4 Research-based design process
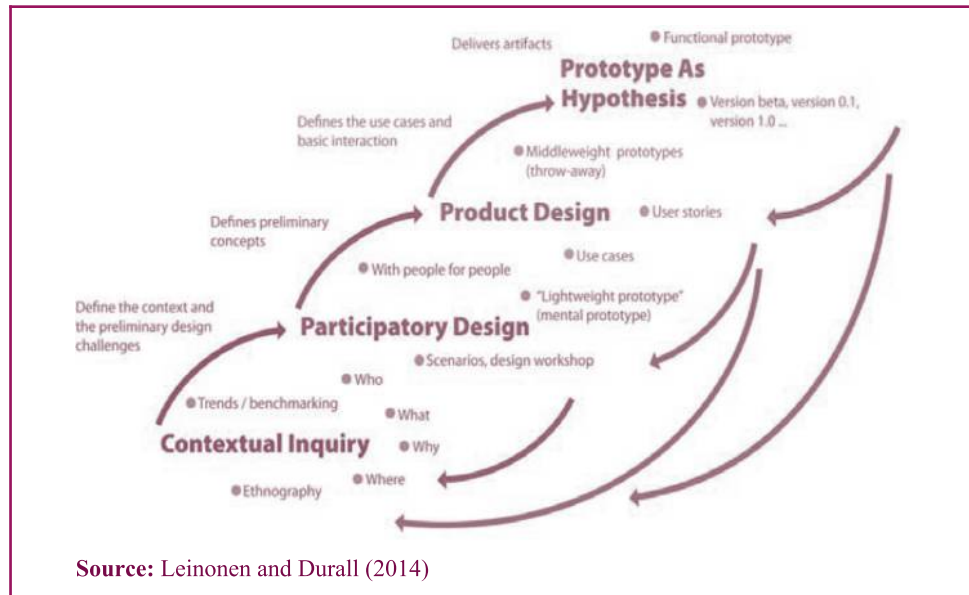
Source: Leinonen and Durall (2014)

So, although common definitions of LL differ, as presented before, LL can be understood and explored as integrated and systemic design processes.

Knowledge in LL

As far as we know, no specific research has been yet conducted on LL and knowledge. But the work of Stählbröst and Holst (2012) suggests that knowledge is involved at each moment of an LL.

Stahlbrost and Holst (2012) proposed that a typical LL process includes several loops or iteration cycle (Figure 5).

Each iteration cycle is composed of four main activities:

1. co-creation/co-design activities allowing stakeholders to collectively create common grounds, understand contexts, ideate and create solutions together;

2. exploration activities allowing users to deepen their understanding of the context, of the service itself, to document their ideas in the field, to identify new market opportunities, etc.;

3. experimentation activities are set-up to test service provider solutions, at various level of maturity, to the reality of the field in user communities and in real conditions; and

4. finally, evaluation activities designed to validate the potential of products and services in development from a collective perspective and to define orientations for the next iteration.

A loop can be iterated until satisfaction on evaluation is reached. By essence, each iteration cycle or loop involves the contribution of all stakeholders of the LL: investors, as well as designers, users, managers, specialists, consultants, researchers, etc.

So, if we consider that the conceptual proposition of Stählbröst and Holst makes sense, knowledge appears to empower the whole process. Even if those authors do not explore knowledge in itself, it appears that multiple sources of knowledge are present in an LL, that knowledge is mobilized in an LL and that knowledge is generated in LL.

Moreover, in a single loop of an LL, many tools and procedures are used to capture knowledge emerging from co-creation, exploration, experimentation and evaluation

Figure 5 Iteration cycle within a Living Lab

Source: Inspired from Stahlbrost and Holst, 2012
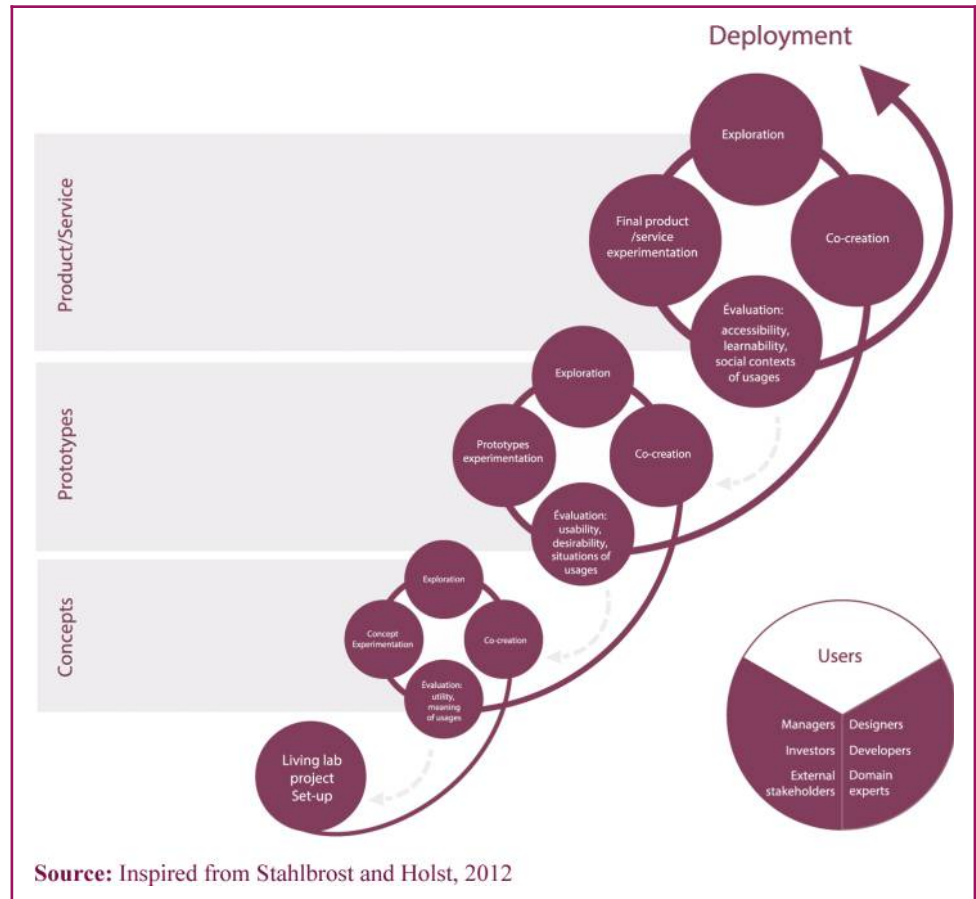
activities of over time. They come from different disciplines such as design science, engineering, marketing, ethnography, etc.

From another perspective, by transposing the ideas of Nez (2012) about the participation of citizen and stakeholders in urban projects, we could consider that LL concentrate different types of knowledge useful for an urban project management.

Nez suggests that different types of knowledge can be described in urban co-creation.

■ *Activist knowledge*, which is based on formal and informal knowing of the administrative and political processes. From an individual perspective, it involves knowledge transfer and know-how acquired through one associative membership and belonging to informal networks. From a collective perspective, this type of knowledge is associated to the level of proximity and interactions between citizen collectives and the administrative institutions.

■ *Usage knowledge*, which is derived from a refined local knowing of citizens about a particular territory, which comes from repeated usages of product, infrastructures or services over time. This type of knowledge is usually externalized through stories and testimonies, revealing the particularisms of a given territory as well as usages conflicts over it. Collectively, this kind of knowledge will be formalized through public debates and the expression of "common sense".

■ *Professional knowledge*, which is derived from the technical skills of particular stakeholders in the LL. While experts often generated this type of knowledge, it can also emerge from layperson whether from their belonging to a particular group, formal

or informal (i.e. makers), or from professional skills acquisition in the LL itself along the road. This knowledge can also emerge from the interactions between stakeholders within the LL leading to *collective professional knowledge.*

About the concept of knowledge, we want to underline that, here, the notion of "knowledge" refers to the ideas expressed by Legendre for whom knowledge raises of "facts, information, notions, principles acquired by the study, the observation or the experiment", supposing that knowledge is also the fruit of interpretations and thus "not only outside" an individual, and, also that knowledge is acquired via "the impregnation, the imitation, the concrete experience, the advice of the olders, the demonstration, the errors and the exercises" (Legendre, 2005; Ermine *et al.*, 2012). We agree that "while we find data in records or transactions, and information in messages, we obtain knowledge from individuals or groups of knowers, or sometimes in organizational routines" (Davenport and Prusak, 1998).

Within the context of this study, knowledge is situated and "produced by the activity, the context and the culture" (Brown, Collins and Duguid, 1989).

Knowledge is seen as dynamic, as it is always under construction. And even if "it can be difficult to trace the path between knowledge and action" as mentioned by Davenport and Prusak (1998), we consider that the idea of knowing, as suggested by Argyris (1995), can be a fruitful representation of dynamic knowledge. So, we use here knowledge and knowing indifferently.

About actionable knowledge, a concept which is relevant in the context of our study, we can quote Argyris, for whom this notion "is not only relevant to world of practice, it is the knowledge that people use to create it" (Argyris, 1995), and for whom too, "propositions that are actionable are those that actors can use to implement effectively their intentions" (Argyris, 2003).

Otherwise, we define here experts as "people with deep knowledge of a subject", as Davenport and Prusak (1998) had suggested.

Finally, this study also deals with the concept of "socially distributed knowledge" (Nowotny *et al.*, 2002), within the idea of a project opening toward a particular mode of production of knowledge carried by stakeholders and their collective action (Gadille, 2012).

Research objectives and methodology

Based on the societal environment, the practices, the literature and the conceptualizations exposed earlier in this text, we considered that to explore an LL as a *locus of knowledge creation* (Piaget, 1974) in the context of urban projects represents a unique research opportunity. In particular, when the object of analysis concerns the creation of knowledge in a societal project perspective, LL represent a relevant level of analysis to gain richness and internal validity in a qualitative study. On one hand, researchers can find an easy access to several sources of data concerning some specific projects (creation of an eco-district, transformation of a former industrial site, reconfiguration of an urban healthcare center development of transport, reorganization of a public space, etc.). On the other hand, the design

"**It is also proposed that emerging knowledge might gain in complexity along phase progression of a Living Lab project (ideation, definition, development prototyping, implementation) as stakeholders and users are gaining more and more information and experiences about the services they develop on the long run.**"

of an LL allows researchers to simultaneously study processes and contents of knowledge or knowing (Siemens, 2006). Besides, every researcher can be a participant as well (McIntyre, 2008), at least as a citizen; in the same way, each stakeholder involved in an LL can be seen as a researcher. Moreover, as LL are dealing explicitly with "meaning' and data, a researcher whose epistemological posture is interpretative will be hardly interested in it. Besides, on an operational plan, because an LL follows an iterative route, it allows to explore how a participative "agile" process can contribute to urban projects.

Again, as far as we know, no scientific research, until now, has tried to explore empirically the nature and the process of knowledge in an LL, nor has questioned their contribution to the project, from a project management study perspective.

The present study aims to identify and characterize knowledge in LL dedicated to urban service projects and aims to understand how through knowledge path, LL redefines the management of projects.

So, the objective of this research is somehow twofold: to characterize the knowledge emerging from LL and to understand how this knowledge can be integrated, with "relevance", in urban services projects management. Relevance refers here to the idea of adoption of such knowledge by stakeholders and by project management practitioners.

This study is "hybrid exploratory" (Charreire and Durieux, 1999), which allows to work with a conceptual framework and an open approach, as this methodology suggests.

Thus, the methodological approach used here to identify knowledge in LL is "abductive" (Charreire and Durieux, 1999). We have decided to follow an abductive approach to avoid to be in front of an open box (as with grounded methods) and to avoid to be pushed in a restrictive direction (as with tight frames). We also considered that a loose frame allows emergence of ideas and concepts. We believed too that, through this choice, our study will gain internal validity and reliability. Induction and deduction are therefore possible, in a back-and-forth form, to capture specificities, richness and meaning.

To facilitate collection and analysis of data consistent with our objectives and to serve as a guideline during this study, we used the representation of Stahlbrost and Holst (2012) as a conceptual reference (see Figure 5, presented before). We kept also in mind the classification of Nez (2012), exposed earlier in this text. In a way, those two models were our conceptual framework. As expressed, they have been mobilized during the whole research life cycle and they have been used as landmarks.

The scientific posture adopted here embraces the principles of participatory action research (McIntyre, 2008), where people under investigation can be considered as researchers. This research design is close to the partnering methodology (Fontan and René, 2014), where experts and respondents are partners of researcher. When exploring LL, to work as a participatory researcher implies immersive working and direct interaction with stakeholders and users. In such contexts, this methodology allows to get richness and deepness regarding the research object, i.e. the knowledge created through LL and mobilized toward urban projects. We can quote here Leinonen and Durall (2014), who underlined that "the complexity of design requires research, the ability to see both the whole and the details, and the skill to analyze them".

The study emphasizes content analysis, as it identifies the types of knowledge generated and mobilized. It also focuses on processes (Grenier and Josserand, 1999), because it seeks to understand how knowledge has been introduced in projects management practices.

This study is qualitative and contextualized (Mbengue, 2001; Pettigrew, 1985). In terms of data collection, semi-conducted interview, notes and various professional documentations, when available (reports, minutes, corporate documents, Web sites), are used. Participant observation in the field is also performed at the "micro" level in LL activities. We got a lot of data, due in part to the fact that we investigated a design process which requires itself

many research tools (Lafontaine *et al.*, 2013), and it is obvious that it was challenging to cluster as well as to ponder.

The data processing method is done mainly through verbatim analysis from interviews and documentation. Notes taken *in situ* allow exchange sessions between researchers (with some stakeholders and users) for comparison and understanding. The data analysis is performed by data clustering (Miles and Huberman, 2003).

A "relevance" sample has been selected. We considered at first to work on ten LL in activity, but four cases of LL have been realized and analyzed. In addition, data collected during six LL performed previously between 2009 and 2013 have served as complementary data. Upon our case studies, we further elaborate some conceptual propositions (Eisenhardt, 1989), as presented in our conclusions.

To provide transparency about the research conditions, a short description of the four LL explored in this study is given below.

1. One selected case in this study is the SAT/CHU Ste-Justine Living Lab. This initiative is jointly supported by SAT (Society for Arts and Technology) and the CHU Ste-Justine (Mother and Children's Hospital) in Montreal. The LL mission is to co-develop technologies and services dedicated to health care humanization through digital art devices. The aim of this LL is to co-construct a large-scale urban healthcare model adapted to the "digital natives" (young patients of the CHU Ste-Justine) mental models. This is achieved through different projects targeting the hospital experience and the development of new therapeutic protocols in several disciplines (pain management, psychiatry, rehabilitation, etc.). The model presented in this LL also promotes a holistic approach of healthcare for the patient and its family, as well as by improving the quality of life for health professionals in hospitals. The discovery of new technological usages and generation of interactive and immersive contents by the users themselves are at the heart of the LL processes.

2. Also under investigation is the case of Rehabilitation Living Lab, initiated by the Centre for Interdisciplinary Research in Rehabilitation of Montreal (CRIR www.crir-livinglabvivant.com/fr/index-fr.html). This lab represent one of the first initiatives of interdisciplinary and multi-sectorial research aimed to explore the main barriers – physical or psycho-social – to participation and inclusion of disabled people in a shopping mall environment. The mission of the CRIR Living Lab is to contribute to an autonomous and social integration of people with physical disabilities, through fundamental and clinical research as well as epidemiological research. Applied researches target biomedical and psychosocial fields and cover all aspects of disability. The mandate of this LL is to co-create the first environment dedicated to the optimization of social participation and inclusion. CRIR Living Lab projects aim to:

   ■ identify environmental, physical and social barriers and facilitators to the participation (shopping, meeting friends, etc.) in the LL;

   ■ co-develop technologies and interventions to optimize cognitive and social functioning, participation and inclusion of people with disabilities; and

   ■ implement and evaluate the impact of technologies and interventions in the LL on physical and cognitive activities, on participation and inclusion of people with disabilities.

3. A third case is the Mandalab Living Lab, initiated by Communautique, a Montreal-based non-profit organization, whose mission is to support citizen participation by promoting digital information literacy and citizen appropriation of ICTs. The Mandalab is open to citizens, to stimulate the emergence, development and networking of actors involved in social, technological and economic innovations across the Montreal territory. To do this, the Mandalab relies on "a culture of openness and creative common approach" and deploys its expertise (co-creation facilities,

animation, etc.) through particular programs such as learning circles and citizen co-design residencies. Teams in residence go on the field to generate new creative solutions for various organizations. They document existing practices, conduct co-creative sessions, disseminate knowledge and propose alternatives to techno-centric approaches (see: www.mandalab.cc).

4. The fourth case study selected was the "Paul-Emile Léger CHSLD Living Lab", carried by the Jeanne-Mance Health and Social Services Agency in Montreal. This lab emphasizes the revitalization of common areas of CHSLD (community habitations for people with disabilities) over the Montreal territory through co-creative processes. It especially focuses on collective discovery of new technological usages and co-design activities to rethink the user experience of those areas with a particular focus on socialization, entertainment, creativity and lifelong learning for both the benefits of residents and health care professionals.

Findings

Based on notes taken during those four LL, which have been compared to other notes and reports we had access to coming from six LL achieved between 2009 and 2013, we were able to characterized knowledge in LL as we expected to do it, in respect with our objective.

Our first findings indicate that Living Labs do not only mobilize acquired (explicit and implicit) stakeholders knowledge and knowing, they also generate new ones consistent with the knowledge creation spiral proposed by Nonaka and Takeuchi (1995), as Figure 6 indicates. Through Figure 6, we attempted to represent knowledge in a single loop of LL.

As the Figure 6 draws up, along a single loop, co-creation activities involving heterogeneous stakeholders enable knowledge recombination and filtering processes through collective externalization. They help generate cognitive metaphors of products and services under development and give insights about the emotional experience and perceptive appreciation from users. Exploration activities, on their side, focus on knowledge internalization–documentation–externalization dynamics to enrich current cognitive metaphors, often leading to new ones. They also generate new knowledge related to sensory experiences of the product/service.

These activities also activate the user individual reflexive process associated with the experience itself, which is assessed through field interviews, cultural probes, etc. Experimentation activities deepen user knowledge internalization process and stimulate the creation of new tacit knowledge related to cognitive ergonomic, sensory and emotional experience from usages performed in realistic set-ups.

This knowledge is assessed through ethnographic observation of socialization patterns emerging from the collective usage of the product/service in the field.

Finally, evaluation activities help identify and appreciate new product/service design opportunities by bringing back stakeholders together to share their view of the knowledge generated during the current iteration. Cognitive metaphors, emotional experience and perceptive appreciation of the service are reviewed, filtered and recombined toward a more consensual perception of the product/service under development and to prepare the next iteration.

Based on notes taken during those four LL, which have been compared to other notes and reports coming from six LL achieved between 2009 and 2013, we got other findings aligned to the first ones. We discovered that different types of knowledge or knowing (Nez, 2015) are mobilized during particular activities belonging to LL loop (co-creation, exploration, experimentation and evaluation), as Figure 7 suggests.

As Figure 7 shows, individual activist K (knowledge/knowing) takes part in each activity along the loop: it is a fact that any activist stakeholder stays "awake" and contributes actively, at each moment. His or her stakes seems to be of importance, for him or her, but

Figure 6 Knowledge generated along a single loop of a Living Lab
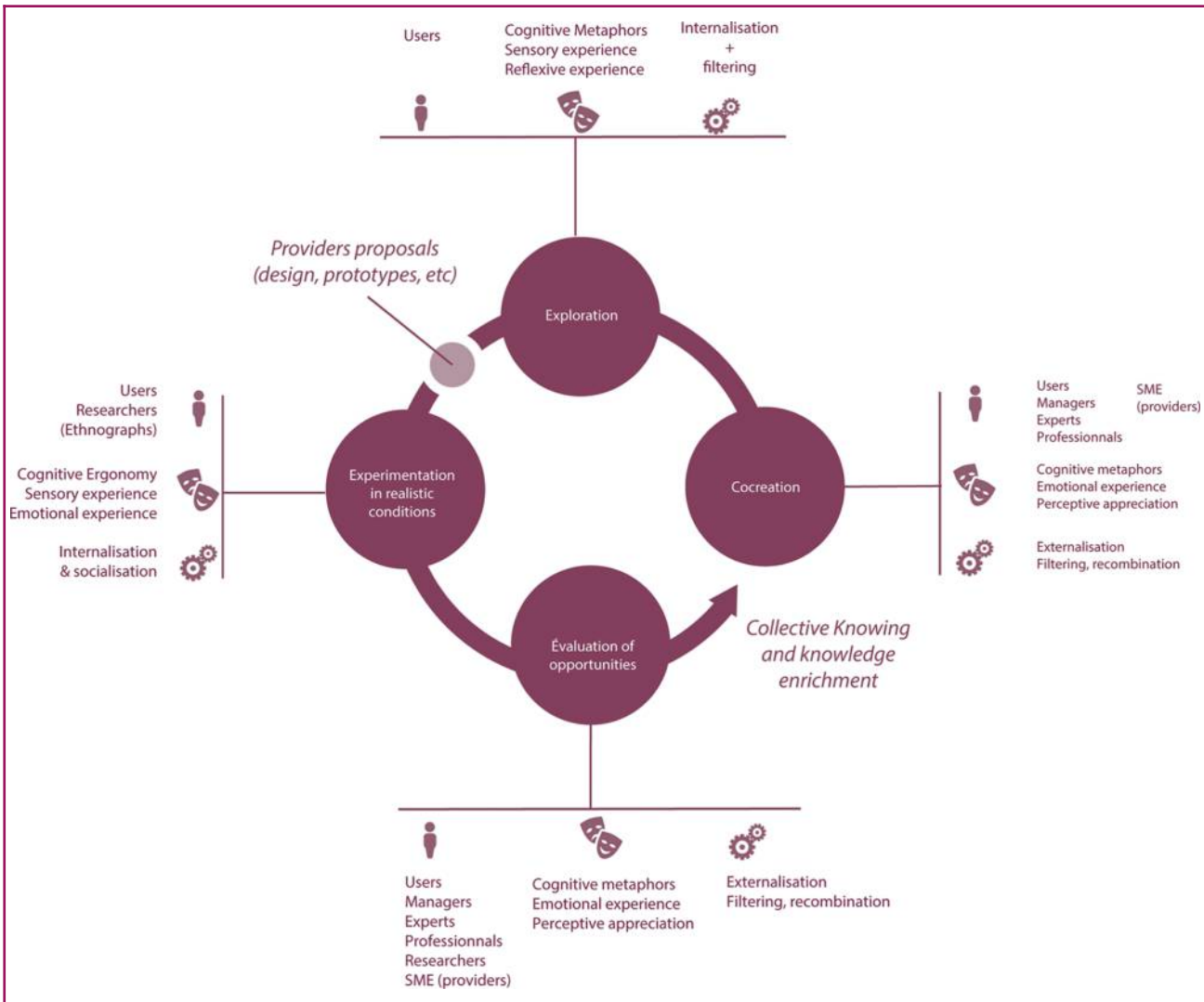
the contribution is mainly directed to the project itself. Collective usage knowing as well as professional knowing are also very present in an LL loop, but strangely, collective usage knowing is not so present during exploration. If it is rather easy to understand that a "profane" (a layman) meets difficulties to contribute when it is time to evaluate a proposition, and this that knowing is merely discreet at this moment, it could be surprising that exploration is not fed by collective usage knowing. We thought as that LL we explored refers mostly to individual uses, this dimension of collective usage appears poorly in our study. It appeared also to us that a large part of "profane" K contributes directly to the content of the project itself (what, how), while activist K contributes above all to the conditions of the project (why, where, when). We understood that as reflects of different collective postures and stakes.

But globally, the way the different types of knowing appeared here along the loop are consistent with the design of an LL and its target to produce a full project.

Precisely, about projects and their management, based on notes taken during those four LL, compared to others notes and reports taken during the other six LL, we were able to understand how project management is produced through knowledge path, in the LL we investigated.

Figure 7 From notes and participatory observations on knowledge/knowing mobilized in Living Labs

About this topic, our findings indicate that traditional and modern project management conceptualizations (Figures 1 and 2) do not quite well-represent project management as performed in LL. We think a third conceptualization of project management is needed to represent the way some actual projects – in particular urban service projects – are conducted: Figure 7 attempts to do so. Figure 7 shows that project management is iterated, and shows that stakeholders are involved in each loop of the project, not only at the beginning, nor at some specific moment during the process. Only a very few research works (Murtoaro and Kujala, 2007) mention that project management concerns joint appropriation, as proposed in Figure 8.

Figure 8 also emphasizes that an LL approach represents *in fine* a systemic approach. Even if loops are organized in a temporal perspective, from project idea to its use (using means here experiencing the project), all the loops compose rather a Noria than a sequential or semi-sequential methodology. Time is not linear, so stages are not distributed through a specific previous order. As the whole LL process follows open innovation principles, the projects are also set-up in a way that new discoveries made along the road are made visible to every stakeholder at each moment of the process.

Also, it can be seen that the management of the project is jointly driven by users, stakeholders and professional experts as (here) urban planners, architects, physicians, IT specialists, project managers and other specialists depending on the object of the project. Those practitioners play a role of consultants, from the beginning to the end of the project.

That represents an important shift for most of the practitioners in project management. During the past 15 years, project management has gained in expertise and visibility, due

Figure 8 A third avenue in project management
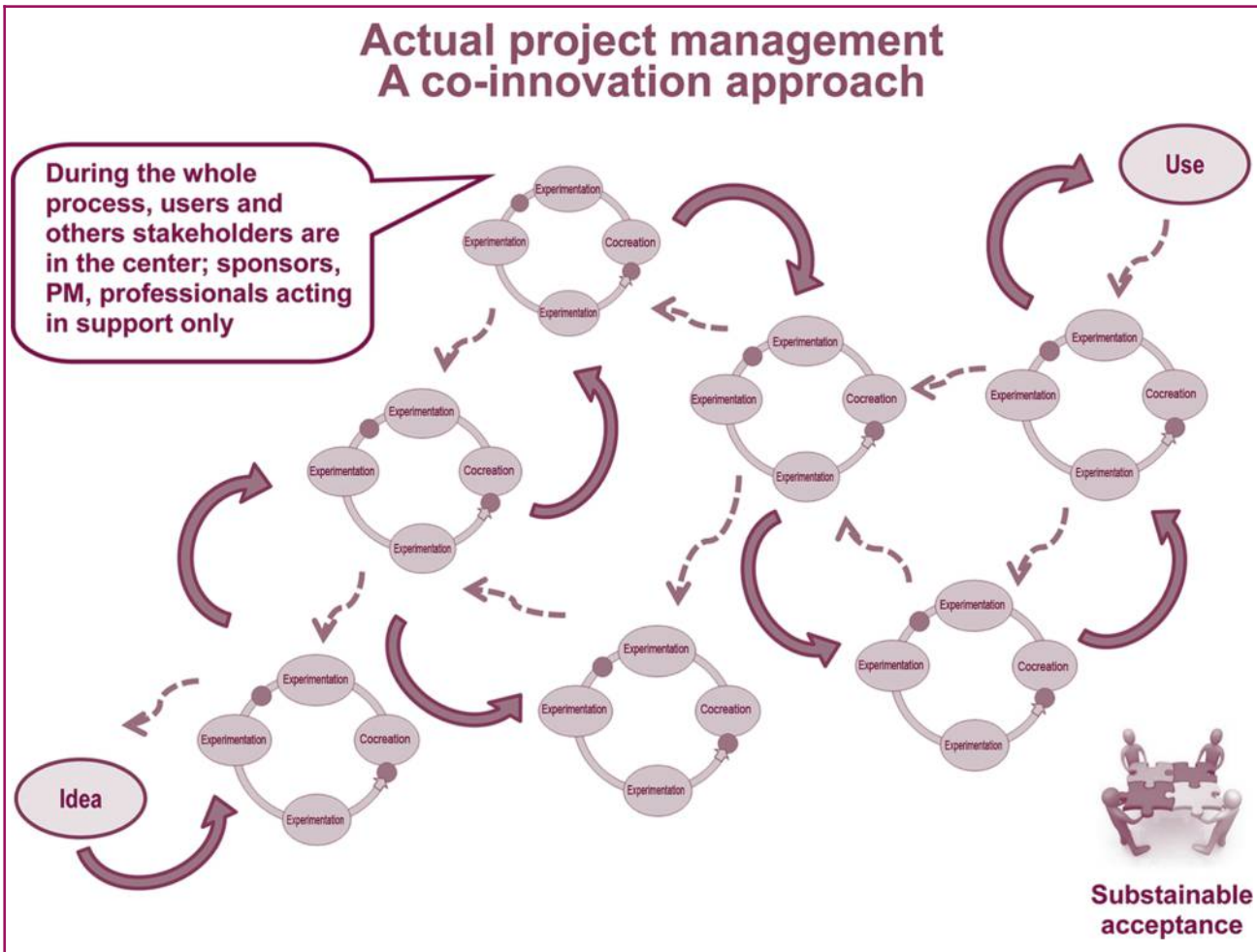
especially to the explosion of IT projects and change projects. Most of the large organizations got a PMO (Project Management Office) and reframed their project methodologies to suit the impetuous challenges of cost reduction versus innovation (Hobbs and Aubry, 2010). To realize it is already time to modify their new toolboxes will certainly be painful for some of those organizations and their managers. On another hand, for senior project managers, to discover their jobs are becoming "tailor-made" and their roles "optional" could be quite disturbing.

Still about the Figure 8, we would like to quote that, if our conceptual approach as presented in Figure 8 differs from the methods surrounding the C-K theory where the uses and the users are also input to projects (Le Masson *et al*., 2014), it is because here we do not discuss the inception of a project but the project itself from ideation to action and experience. A specific theoretical discussion could pinpoint too that some aspects in the C-K theory borrow from traditional project management.

Conclusions

In the context we have described, we can conclude that co-innovation approaches as LL might represent a relevant way to create "socially acceptable" projects, and more than that, effective "stakeholders-driven" projects. Therefore, the role of intermediation entities such as LL might be of great importance to the development of complex urban projects and the renewal of project management practices in such contexts, following the ideas of Lehmann (2014), Nez

(2015) and Terrin (2014) about the need to acquire new knowledge – not already codified – to deliver more relevant projects. Knowledge exploration is already not an option nor a "nice to have", but a necessity in some extreme situations, as Lièvre has discussed (2012). Upon our results, we can understand that urban projects as well as healthcare projects could benefit from open design processes as well as knowledge exploration.

Our findings suggest also that knowledge emerging from open innovation modalities such as LL is partly unexpected knowledge, especially in experimentation activities, while more predictable in co-creation and exploration phases. It is also proposed that emerging knowledge might gain in complexity along phase progression of a Living Lab project (ideation, definition, development prototyping, implementation) as stakeholders and users are gaining more and more information and experiences about the services they develop on the long run. Further findings should help to develop those suggestions, but, in our point of view, the proposal made here (Figures 6-8) represents a pattern and, so, several implications can already be offered.

Our concern here is more than to meet the new challenges of the twenty-first century (Manyika et al., 2013). Yet, project management cannot lead to successful projects without users, stakeholders and professionals as "co-managers".

It urges to consider project management with the perspective of knowledge management as itself. Knowledge management is often assimilated to "lessons learned" in project management, a method which is generally time-consuming and poorly rewarding, as the reuse of information is limited in scope and deepness, especially when projects are original or innovative (Sargis Roussel, 2011).

Our findings could also lead to examine how complexity can be introduced in project management practices, as Pollack (2007) proposed. Since the past decade, more and more researchers in this field, such as Jaafari (2003) or Blomquist et al., (2010), urged to think and practice complexity, following the work of Martinet (2006) in strategic management.

On another hand, we believe that our findings reinforce the suggestions made by Söderlund and Maylor (2012) to teach project management by using some new lenses; to some extent, our study invites to re-visit stakeholders management, often taught trough an unique communicational perspective (Bourne, 2009) as to re-invent social risk analysis, often oversimplified in didactic material (Courtot, 1998) and to re-define some learning approaches in project management (Córdoba and Piki, 2012).

From our study, it appears also that LL should be studied as "systemic entities" to reveal how process and content are embedded but also to analyze knowledge flows in more depth as well as how stakeholders evolve and transform themselves throughout LL processes and activities.

Certainly, our suggestions need to be validated to grow up. But, as the number of LL increases rapidly all over the world and as more and more complex projects are built by co-innovation approach in the aim to get sustainable projects, the evaluation and the extension of our propositions will certainly constitute some interesting enrichment of our contributions.

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