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# Living Lab Research Landscape: From User Centred Design and User Experience towards User Cocreation

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## Abstract

New paradigms, such as Open Innovation (Chesbrough, 2003) and Web 2.0 (O'Reilly, 2004) as well as Living Labs operating as a User Centred Open Innovation Ecosystem (Pallot, 2009), promote a more proactive role of users in the R&D process. However, a number of existing methods for involving users are abundantly described in the literature, such as Lead User (Von Hippel, 2005), User Driven Innovation (Von Hippel, 1986), User Centred Design (Von Hippel, 2005) and User Created Content (O'Reilly, 1998) as well as User Co-Creation (Prahalad & Ramaswamy, 2000). This paper explores the domain landscape of Living Lab research, based on the landscape of human-centred design research (Sanders & Stappers, 2008; Sanders, 2008) and later introduced in the domain of Living Lab research (Mulder & Stappers, 2009). It also discusses the links with existing theories such as Social Capital Theory (Nahapiet and Ghoshal, 1998) and Social Cognitive Theory (Bandura, 1986) as well as Socio-Emotional Intelligence Theory (Goleman, 1998). It also explores the creation of User Group Experience concept for bringing the socio-emotional perspective (Norman, 1995; 1998; 2004; 207; Goleman, 1998) into User Experience (Fleming, 1998) that appears too much focusing on individual users and usability.

## Keywords

Open Innovation, User Centred Design (UCD), User Driven Innovation (UDI), Web 2.0 and User Content Creation (web 2.0 UCC), User Experience (UX), User Group Experience (UGX), User Cocreation (UC), Domain Landscape.

## 1 Introduction

Today, 212 Living Labs are members of the European Network of Living Labs (ENoLL). They are geographically located within the enlarged European Union and in other regions such as South Africa, Asia and South America. All of them have the goal to involve users at the earlier stage of the R&D process not only as observed subjects but rather as a participative force for co-creating value. A living Lab is an open research and innovation ecosystem involving user communities (application pull), solution developers (technology push), research labs, local authorities and policy makers as well as investors.

While the Living Lab ecosystem, through openness, multicultural and multidisciplinary aspects, conveys the necessary level of diversity, it enables the emergence of breakthrough ideas, concepts and scenarios leading to adoptable innovative solutions. A Living Lab Empowers user communities like it is done with Web 2.0 (Frappaolo & Keldsen, 2008; O'Reilly & Battelle, 2009) applications such as YouTube, Flickr, Delicious, or Twitter where users are creating content and value. There are even examples of stigmergic or mass collaboration where citizens are collectively creating content (e.g. Wikipedia) for the benefit of the society at large.

A Living Lab is an Open Innovation ecosystem frequently operating in the context of competitiveness clusters and public development agencies within social innovation environments

engaging local authorities in territories such as cities, agglomerations, regions. A Living Lab can operate with a research and innovation platform for providing access to science and innovation services allowing enterprises and users/citizens either as entrepreneurs or communities. The main objectives consist to explore new ideas and concepts, experiment new artefacts and evaluate breakthrough scenario that could be turned into successful innovations. There are different application examples such as eHealth, Ambient Assisted Living, eInclusion, eTransportation, eGovernment, Smart City, ICT for Energy, and ICT for Environment.

The Social dynamics of the Living Lab approach ensures a wide and rapid spread (viral adoption phenomenon) of innovative solutions through the socio-emotional intelligence mechanism (Goleman, 1998). A Living Lab environment needs to have one or several specific technology platforms (eHealth, eParticipation, eInclusion and so on), science & innovation services and user/citizen communities enabling the exploration of innovative scenarios including new concepts turned into technological artefacts. The experimentation and evaluation of the resulting scenarios and technological artefacts are driven by users within a real life context through a socio-economic (societal, environmental, health and energy cost/value), socio-ergonomic (user friendliness) and socio-cognitive (intuitive level) as well as adoptability perspectives (potential level of viral adoption).

Living Labs are standing at the crossroads of different society trends like citizens engaged into a more participative approach, businesses and local authorities as well as user communities are gathering within public-private–people partnership initiatives. They are also at the crossroads of different paradigms and technological streams such as Future Internet, Open Innovation, User co-Creation, User Content Creation and Social Interaction (Web2.0), Mass Collaboration (i.e. Wikipedia), and Cloud Computing where the Internet is the cloud, also named “the disappearing IT infrastructure”.

However, there are still open questions such as articulating the various relevant research areas, methods and tools within the Living Lab research domain and identifying appropriate concepts for supporting user cocreation.

## 2 The Domain Landscape of Living Lab

### 2.1 The Living Lab Approach

As demonstrated by the Web 2.0 in empowering users, new R&D approaches are emerging where users are not considered anymore as being the observed subjects in functional tests but rather as being able to contribute and create value. William Mitchell<sup>4</sup> argued that a Living Lab represents a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts. He identified several impact and benefits. The first noticeable impact is the integration of the users into the development process for ensuring highly reliable market evaluation. The second one is the reduction of technology and business risks. The third one is that a Living Lab is beneficial to SME, micro-organizations and start-ups, since they can share resources without so much venture capital. Finally, the fourth one is that large companies have access to a broader base of ideas.

### 2.2 Existing Related Domain Landscapes

#### 2.2.1 Domain landscape of Test and Experimentation Platforms

Ballon and colleagues (2005) found that Test and Experimentation Platforms (TEPs) constitute a new and relatively uncharted territory. Therefore, they launched an extensive exploratory research on TEPs theoretical literature and empirical data. They identified six types of TEPs, namely

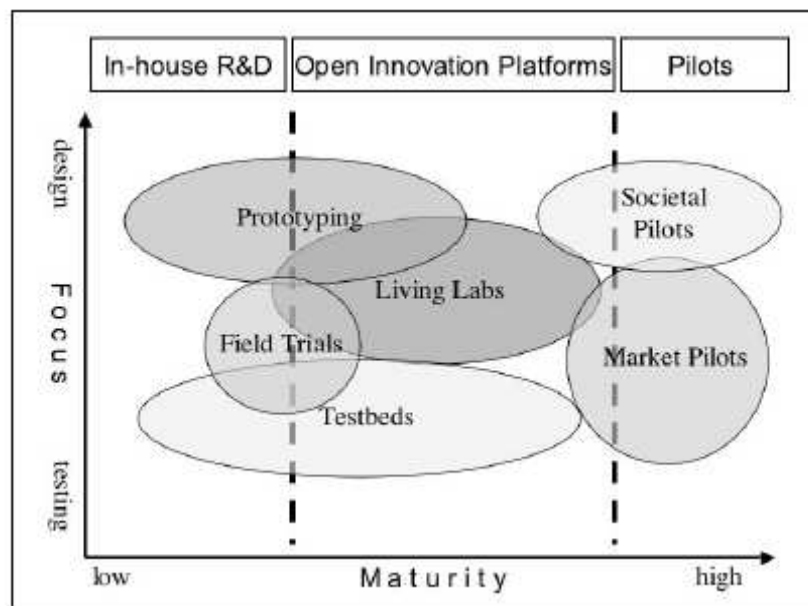
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<sup>4</sup> MediaLab and School of Architecture and city planning at MIT

prototyping platforms (including usability labs, software development environments), testbeds, field trials, living labs, market pilots, and societal pilots.

Interestingly, they gave the following definition to Living Lab, “An experimentation environment in which technology is given shape in real life contexts and in which (end) users are considered ‘co-producers’.”

They elaborated a domain landscape of TEPs with three different dimensions (see Figure 2.2.1). The first dimension consists in the technological readiness that scales from low (immature technologies) to high maturity (mature technologies or applications that are almost market ready). The second one addresses the focus and balances in between testing and design. However, one can assume that this dimension is about evaluation. Finally, the third one consists in making a differentiation in between the degree of openness, ranging from in-house activities to open platforms.



**Figure 2.2.1 – Conceptual Framework of Test and Experimentation Platforms (Ballon et al, 2005)**

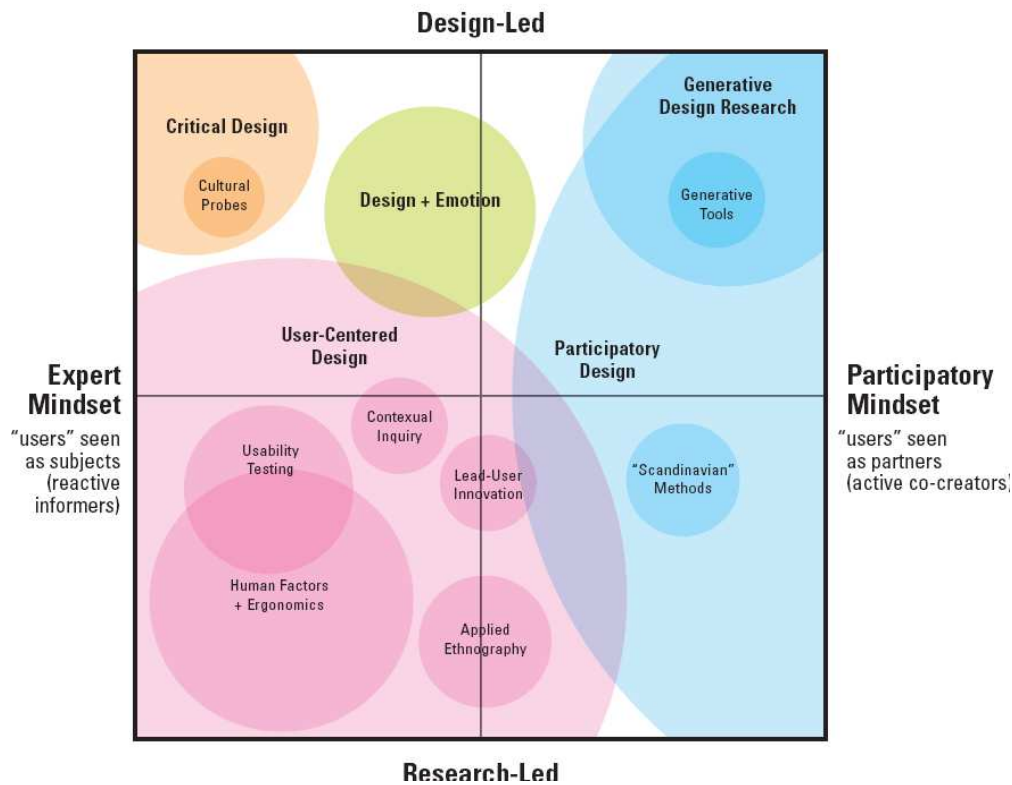
The different areas appearing like bubbles in the landscape correspond to the six identified TEPs. They are positioned in the landscape according to the two dimensions of focus and technology maturity they are intended to deal with

## 2.2.2 Domain landscape of Human-Centred Design Research

Sanders and Stappers (2008) started to draft a domain landscape of design research (see Figure 2.2.2) for developing a paper on the state of design research. She found that the design research map is described by two intersecting dimensions, namely: the design research approach and the mind-set. She explained that the dimension on approaches is split into research-led on the bottom side and design-led on the top side. The dimension on mind-set is split into expert mind-set on the left hand side, where users are considered as subjects, and participatory mind-set on the right hand side, where users become value co-creators. Sanders identified the shift of the mind-set dimension as a significant cultural change.

The largest areas in the map represent the most populated ones, such as User-Centred Design and Participatory Design. She explains that the UCD area includes social and behavioural sciences as well as human factors and ergonomics. Two smaller bubbles inhabit the UCD territory, namely contextual inquiry and lead-user innovation. On the right hand side, the Participatory design territory is inhabited by physical artefacts as thinking tools throughout the process, common among the methods issued by the Scandinavian research norms. The design and emotion bubble appeared in 1999, said Sanders, as a combination of research-led and design-led approaches to

design research. Critical design where designers are the experts (instead of the researchers) appeared as an opposite force of UCD. It focuses on cultural probes rather than usability and utility. Finally, the generative design bubble appeared to empower people to create and promote alternatives to current situations. Generative tools instil a shared design language used by designers, researchers and stakeholders (users) for communicating visually. This technique suits particularly the Front-End of Innovation in order to feed the process with people ideas, dreams and insights.



**Figure 2.2.2 – Domain Landscape of Human-Centred Design Research (Sanders & Stappers, 2008)**

Later, Mulder and Stappers (2009) argued that Northern Europeans led the participatory approach (see Figure 2.2.2) combined with explorative actions using tools and techniques from design, such as making collages, diagrams, models, and other visualizations as a means to support self observation and reflection. She notes that these “*Research techniques have not only evaluative power (prove/disprove a hypothesis or idea), but also generative value (provide insights not yet known to the researchers).*”

Mulder also states that the notions of co-creation and co-design have been growing within the participatory design landscape. She proposes to involve active users by making use of generative techniques in order to practice more the concept of engaging users as co-creation contributors as re-enforcing the living side of the Living Lab environment. Finally, she argues that “*Cocreation in open innovation requires an open mindset towards sharing and collaboration. This is not trivial. Although board members preach open innovation in pre-competitive collaboration, companies seem not eager to share with competitors. Even within companies, employees are not always keen in sharing ideas.*”

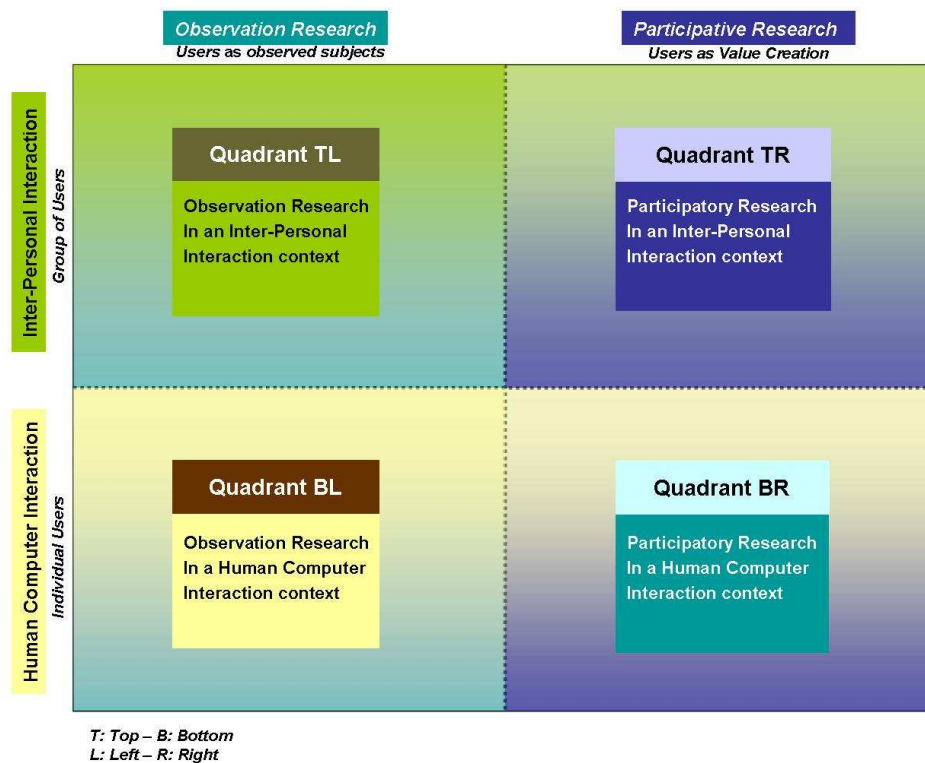
### 2.3 Towards a Domain Landscape of Living Lab Research

As we were working on the development of a paper about the research area of User Experience and discussing about the scientific program of the first Living Lab Summer School and more

specifically about the Living Lab domain mapping and landscaping sessions, it came to our mind that it could be useful to prepare a map as a tentative landscape of Living Lab research.

The starting point was a previous article on Living Lab research that was published in the ECOSPACE Newsletter (Pallot et al, 2008). Several possible dimensions were identified and finally two main dimensions, namely the interaction mode and research type allowed designing four quadrants (see Figure 2.3-a). The main idea behind the design of this map is to show, like in the Sander’s map, a progress from functional tests and usability analysis toward User co-Creation. However, the selection of these two dimensions is self-explained by the evolution of the role of users.

The first dimension called “Interaction Mode” illustrates the way interaction with users is perceived. This dimension scales from Human-Computer Interaction (HCI), which addresses individual users, to Interpersonal Interaction that embeds social interaction within a group of people, especially the large ones like online communities. The second dimension “research type” splits the domain landscape into Observation Research where a user is considered as a subject and Participative Research where users actively contribute in co-creating value. This dimension resemble to the dimension on mind-set of Sander’s map.



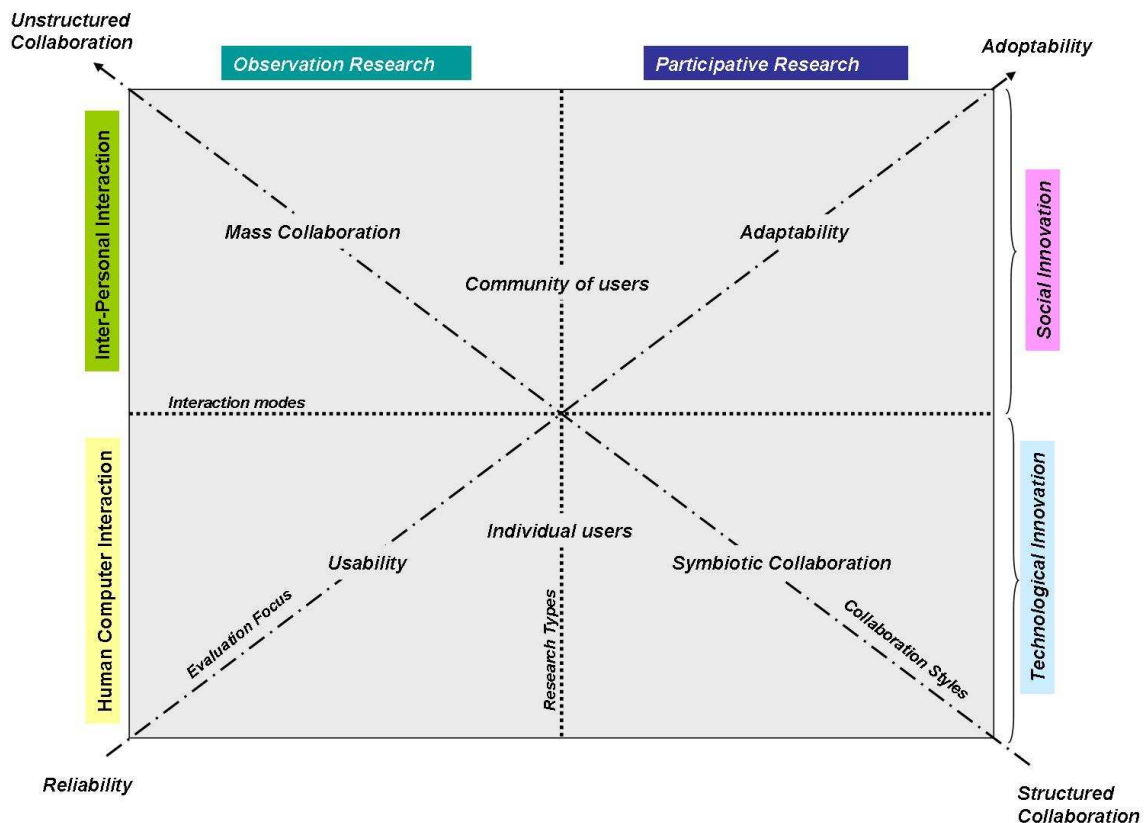
**Figure 2.3-a – Dimensions and Four Quadrants of the Living Lab Research Map**

There are two complementary dimensions that could be useful in order to better characterise the current R&D and innovation trends and evolution (see Figure 2.3-b). As a way to show the complementary to the main dimensions, they appear as diagonals. The first diagonal (BL, TR) illustrates the evolution current trend in terms of evaluation focus starting with reliability, as a first stage, where a functional test is applied in order to check if a feature works properly but without necessarily considering whether this feature could really be useful to the users. The second stage consists to carry on usability analysis for the obvious motivation of evaluating the user friendliness (degree of intuitivity) and ergonomic design. While the third stage “adaptability” brings the evaluation of personalisation capacities (degree of look and feel recomposing), the fourth one “adoptability allows users to create new features (composing their own services).

The second diagonal (BR, TL) shows the recent evolution of collaboration style induced by network technologies such as the Internet and the Web. This dimension scales from structure collaboration with for example Symbiotic collaboration style (physical collocation) up to unstructured collaboration (Dorigo & Stützle, 2004; Elliott, 2006) with for example Mass collaboration style (virtual or online collocation).

These two diagonal complementary dimensions are also important for positioning the different research areas in the landscape of the Living Lab research map. However, one could argue that another potential dimension could represent the current trend induced by a specific focus on societal issues (eCare, eInclusion, eHealth, eTransportation, eGovernment, Smart City, ICT for Energy, and ICT for Environment) as an R&D shift from technological innovations towards more socially based innovations.

Technological innovation is included in the figure as corresponding to the HCI of the interaction dimension. Social innovation is also included in the figure as corresponding to the Interpersonal Interaction. While in the first case the focus is on developing a product (hardware), in the second case the priority is much more on developing specific services for people.



**Figure 2.3-b – Diagonal Dimensions of the Living Lab Research Map**

The next step consists to populate this map with the existing research areas in order to design the landscape of the Living Lab Research Map. A number of research areas already exist for involving users in the R&D and innovation processes, such as Web 2.0 User Created Content (Web 2.0 UCC) (Garrett, 2002), User Centred Design (UCD), User Experience (UX) (ISTAG EAR report, 2004; Aarts & Marzano, 2003; de Ruyter, van Loenen & Teeven, 2007), User Cocreation (UC), User Centric-Innovation (UCI) and Driven-Innovation (UDI). Like in Sander's landscape of design research, it makes sense to include participatory design.

The largest areas in the map represent the most populated ones like in Sander's landscape on design research. User-Centred Design (UCD) and Participatory Design (Schuler & Namioka, 1997) as well as Web 2.0 User Content Creation (UCC) represent the largest areas that are confirmed by the number of published scientific papers. In contrast with Sander's Landscape,

besides the fact that it also includes usability analysis as well as human factors and ergonomics, the UCD area overlaps with User Experience (UX). The concept of UX was widely disseminated by Norman (1995) and became a research area by its own. Two smaller bubbles inhabit the UCD territory, namely contextual inquiry and lead-user innovation.

On the right hand side, the Participatory design territory is inhabited by various artefacts intended to engage users in the group cognition leading to the emergence of new ideas, scenarios and concepts. Several smaller bubbles are overlapping the participative design territory; among them appear the Empathic Design (ED), User Cocreation (UC) (Interact, 2009), User Driven Innovation (UDI) or User-Centric Innovation (Bilgram, Brem & Voigt, 2008) and Socio-Emotional Intelligence (SEI). Those bubbles are linking UCD with Participative Design. Action Research (AR) could be included as a bubble also linking UCD and PD. Even Participatory Action Research (PAR) has emerged in recent years as a significant methodology for intervention, development and change within communities and groups. The SEI bubble appeared in 1998 as a combination of views issued from Goleman books on Social Intelligence and later on Emotional Intelligence.

In contrast with Sander’s Landscape for a second time, this is the Web 2.0 UCC, where developers and users are the experts (instead of the researchers), appeared as an opposite force of UCD. It focuses on User Content Creation, Crowd Sourcing and Social Networking as a kind of cultural probes (Gaver, 1999; 2004) rather than focusing on usability analysis.

Finally, the User Group Experience (UGX) bubble appears to have a group of users experience instead of individual user experience (UX) (Fleming, 1998) in order to let a community share experiences that lead to new insights, ideas and breakthrough scenarios. Contextual Design (Beyer & Holtzblatt, 1998) is currently still to be included in the Participatory Design territory.

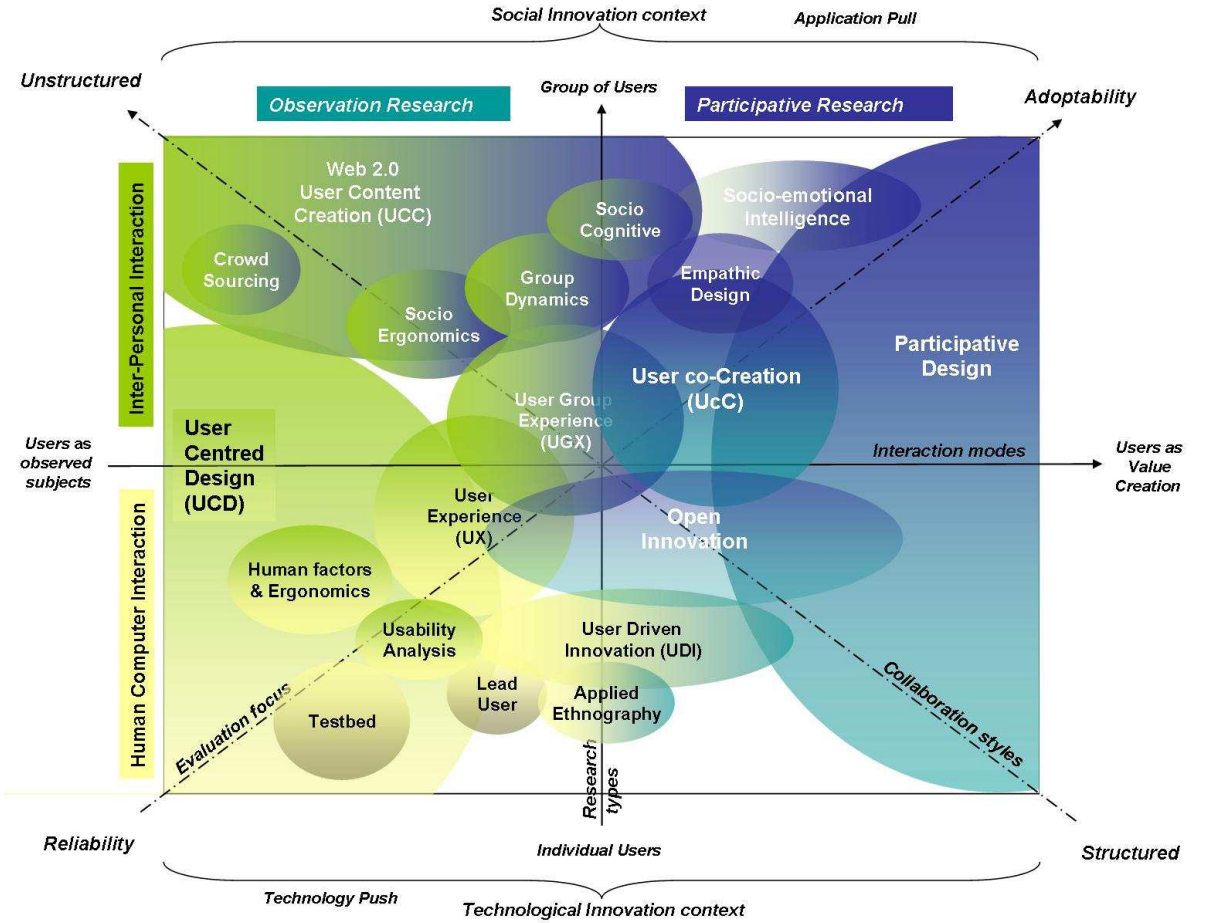


Figure 2.3-c – Domain Landscape of the Living Lab Research Map



We do believe that the concept of UGX brings the socio-emotional perspective into user experience. This would constitute a major step forward in the direction of experiential service platform with a strong connection to Empathic Design and Socio-Emotional Intelligence. This would allow researchers, developers and users to move more concretely towards User Cocreation. This new research area suits particularly the Front-End of Innovation in order to feed the R&D process with group and empathical insights unleashing the power of people ideas.

A table of concepts and definitions (see Table 2.3) provides useful information for disambiguating the used terminology. This table will be completed and extended.

Concepts	Descriptions	Key Notions
Living Lab	<a href="http://en.wikipedia.org/wiki/Living_lab">http://en.wikipedia.org/wiki/Living_lab</a>	User-centred Innovation ecosystem
UX	<a href="http://en.wikipedia.org/wiki/User_experience">http://en.wikipedia.org/wiki/User_experience</a>	
UCD	<a href="http://en.wikipedia.org/wiki/User-centered_design">http://en.wikipedia.org/wiki/User-centered_design</a>	
UCC	<a href="http://en.wikipedia.org/wiki/Web_2.0">http://en.wikipedia.org/wiki/Web_2.0</a>	
UGX		
UDI	<a href="http://en.wikipedia.org/wiki/User_innovation">http://en.wikipedia.org/wiki/User_innovation</a>	
Open Innovation	<a href="http://en.wikipedia.org/wiki/Open_innovation">http://en.wikipedia.org/wiki/Open_innovation</a>	Lead-user
ED	<a href="http://en.wikipedia.org/wiki/Empathic_design">http://en.wikipedia.org/wiki/Empathic_design</a>	
AR	<a href="http://en.wikipedia.org/wiki/Action_research">http://en.wikipedia.org/wiki/Action_research</a>	
PAR	<a href="http://en.wikipedia.org/wiki/Participatory_action_research">http://en.wikipedia.org/wiki/Participatory_action_research</a>	
PD	<a href="http://en.wikipedia.org/wiki/Participatory_design">http://en.wikipedia.org/wiki/Participatory_design</a>	
Social Cognition	<a href="http://en.wikipedia.org/wiki/Social_cognition">http://en.wikipedia.org/wiki/Social_cognition</a>	
SEI	<a href="http://www.eiconsortium.org/about_us.htm">http://www.eiconsortium.org/about_us.htm</a>	
SI	<a href="http://en.wikipedia.org/wiki/Social_intelligence">http://en.wikipedia.org/wiki/Social_intelligence</a>	
EI	<a href="http://en.wikipedia.org/wiki/Emotional_intelligence">http://en.wikipedia.org/wiki/Emotional_intelligence</a>	
UC	<a href="http://en.wikipedia.org/wiki/Co-creation">http://en.wikipedia.org/wiki/Co-creation</a>	

**Table 2.3 – Concepts Belonging to the Domain Landscape of the Living Lab Research Map**

### 3 Conclusions and Future Work

The lack of domain landscape on Living Lab research appears to be an important issue for researchers in the movement towards user cocreation. It would help to reach a broader understanding of the Living Lab concept. Exploring the domain landscape of Living Lab research was an exciting task as well as drafting the map with area bubbles inhabiting the various territories. During this work, UGX emerged as a necessary area bubble linking the traditional UX, which focuses very much on usability analysis, and UC in order to bring the social elements. This work was performed as a diversion in the UX study we are currently carrying on.

Developing a domain landscape like this one is an important task but considerable amount of work. We hope that this first exercise and issued draft will motivate enough other researchers for contributing to its future development. Furthermore, the current figure of the domain landscape of Living Lab research we have developed, could be re-used for describing complementary layers for related techniques, methods and tools as well as examples based on previous studies

that could be positioned in the landscape and illustrate the different areas. Another layer could be described for locating the already published papers on Living Lab and related research areas.

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