

## Using system analysis to deepen the understanding of open and user-driven innovation initiatives

### Uso da análise de sistemas para aprofundar a compreensão das iniciativas de inovação aberta e centrada nos usuários

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#### Abstract

Open and user-driven innovation initiatives are currently proliferating, for example as Living Labs and Citizen Labs. However, they are still poorly understood. We built a framework based on systems analysis with the aim of exploring these initiatives in more detail. We used the framework to investigate five selected initiatives, three of which are certified as Living Labs by the European Network of Living Labs (ENoLL), one of which is the Brazilian National Programme of Telecentres, which was chosen because telecentres play a core role in the Citizen Lab movement, and the last of which was selected because it is external to those movements but is founded on open and user-driven innovation. The framework allowed us to clarify the distinction between commercial and social innovation related to the main purpose of innovation and technological and social innovation related to the initiative's main outputs. We realised that open and user-driven supra-organisational structures based on triple helix partnerships tend to be more associated with social rather than commercial innovations in terms of their purposes. However, they are well-distributed between social and technological innovation in terms of their outputs, occupying a space not filled by conventional innovation processes and structures.

**Keywords:** Living Lab, Citizen Lab, social innovation, technological innovation.

#### Resumo

Iniciativas de inovação aberta e centrada nos usuários como *Living Labs* e Laboratórios Cidadãos vem proliferando atualmente. No entanto, eles ainda são pouco compreendidos. Construímos uma estrutura conceitual baseada em análise de sistemas que objetiva aprofundar o entendimento dessas iniciativas. Usamos a estrutura proposta para investigar cinco iniciativas selecionadas, das quais três são certificadas como *Living Labs* pela Rede Europeia de *Living Labs* (ENoLL): uma é o Programa Nacional de Telecentros do Brasil, que foi escolhido porque os telecentros têm um papel central no movimento de Laboratórios Cidadãos, e o último foi selecionado porque é externo a esses movimentos, porém, baseia-se em inovação aberta e centrada nos usuários. A estrutura de análise proposta permitiu-nos esclarecer a distinção entre inovação comercial e social no que diz respeito ao objetivo principal da inovação e entre inovação tecnológica e inovação social em relação às entregas ou às saídas principais das iniciativas. Percebemos que as estruturas supraorganizacionais abertas e orientadas ao usuários baseadas em parcerias da hélice tripla tendem a estar mais associadas às inovações sociais que às comerciais em termos de seus propósitos. No entanto, elas estão bem distribuídas entre inovação social e tecnológica em termos de suas saídas, ocupando um espaço não preenchido por estruturas e processos de inovação convencionais.

**Palavras-chave:** *Living Lab*, Laboratório Cidadão, inovação social, inovação tecnológica.

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## Introduction

Innovation is central to sustaining the development of modern societies, collaboration is central to innovation and Information and Communication Technologies (ICTs) are currently central to communication and collaboration.

In this paper, we investigate innovation-related initiatives, and the following elements emerge as being crucial: openness (Chesbrough, 2003); user centrality (Von Hippel, 2005); public-private-civic partnerships (Etzkowitz and Leydesdorff, 1995); and real life environments and virtual networks (Beamish *et al.*, 2012). Initiatives that incorporate these elements are known as Living Labs and Citizen Labs. Despite their widespread diffusion, we still know very little about these new collaborative supra-organisational settings, both theoretically and empirically.

The contribution of this paper is theoretical because we propose a framework that is based on systems analysis and that is useful to researchers and practitioners interested in understanding, promoting and managing such collaborative and supra-organisational settings, and it is also considered empirical because it explores some of these initiatives in detail.

To accomplish these tasks, in the second session, we review the literature to identify the key elements necessary to proposing the analytical framework. "Methods" is dedicated to explaining the development of the framework. In "Initiative analyses based on the proposed framework", we analyse five selected initiatives to demonstrate the use of the proposed framework as well as its value. "Conclusion and future research" summarises our conclusions and presents recommendations for further research.

## Literature review

It is well-recognised that to be able to continuously create value, enterprises need to modify their offerings (product or a service) as well as the methods used to create the offerings (production processes, inputs, suppliers or even organisational structures). This has been recognised since 1911, when Schumpeter first published his seminal work on innovation *The theory of economic development* (Schumpeter, 1985).

Between the 1950s and 1980s, when innovation phenomena were mainly related to large companies, theories of innovation were enhanced through the recognition of the importance of organisational learning. Innovation processes within firms came to be characterised as cumulative, continuous and collective in nature (Dosi, 1982). The relevance of firms interacting with their environments started to be recognised in the innovation literature during the late 1980s and early 1990s, when the broad systemic nature of innovation processes was taken into account (Freeman, 1987; Nelson, 1993).

The 1990s were marked by the revolution in ICTs, which created new possibilities to connect people, facilitate collaboration, and improve information exchange and learning, thus impacting the theory and practice of innovation.

At the beginning of the 21<sup>st</sup> century, the need to identify better ways of establishing cooperation between different actors from academia, industry and government for

innovation purposes was clarified through the Triple Helix Model (Etzkowitz and Leydesdorff, 1995, 2000).

The recognition that integrating all the different actors involved in innovation processes could improve results led to the proliferation of supra-organisational structures. Technology-based business incubators, technology parks and research consortia were some of these types of structures, whose purpose was to approximate universities, enterprises and public agencies to generate innovation (Tidd *et al.*, 1997). In addition to physical proximity, virtual contact was also largely promoted to intensively exploit the possibilities created by ICTs.

By this time, two elements established the foundations of the initiatives examined in this article: user centrality and openness in the innovation process.

The idea of users' direct involvement in the innovation process was first proposed by William Mitchell, to whom the proposition of Living Labs as research and development (R&D) methodologies in which the final users were considered to be central is attributed (Garcia and Oliveira, 2008).

On another research front, Eric von Hippel investigated innovation promoted by users, especially lead-users, who aimed to address needs that were not being met by any available market product or service. This is called user innovation (Von Hippel, 2007).

The open innovation concept was proposed by Henry W. Chesbrough, who argued that "In the new model of open innovation, a company commercialises both its own ideas as well as innovations from other firms and seeks ways to bring its in-house ideas to market by deploying pathways outside its current businesses" (Chesbrough, 2003 p. 37).

The open innovation approach, which is centred on firms, was recognised as being very useful by both the academic community and users. Its openness can be related either to inbound or outbound innovation and can be pecuniary or non-pecuniary (Dahlander and Gann, 2010). The ideas of users driving design and the value of openness relating to innovation processes advanced in Europe and in 2005 a small number of Living Labs were created by the Computer Supported Cooperative Working research community. In 2006, that group created the European Network of Living Labs (ENoLL) (Beamish *et al.*, 2012). ENoLL grew by integrating Living Labs not only in Europe but all over the world. In 2011, 236 Living Labs from the Europe and 38 from abroad were integrated into ENoLL (Oliveira, 2011).

In addition to Living Labs, Citizen Labs are considered in this study because they display the same basic principles. However, Citizen Labs were derived from a distinct perspective. Efforts to reduce the digital gap through digital literacy and inclusive Internet access policies had already taken place at the turn of the century and, as a result, global telecentres and 'community network' movements took off (Serra, 2010). People involved with these movements began to question whether citizens themselves could be more than users if they were able to act as network agents. Citizen Labs attempted to become a positive organisational answer to that question. One of the key elements of this proposition was the opening of Research, Development & Innovation systems to the general public. Citizen Labs, then, were conceived as new social devices to

enable R&D and innovation systems to include the users themselves. They are aligned with Living Labs. However, Living Labs are more related to universities or companies, whereas Citizen Labs are generated through the interests and activities of citizens (Serra, 2010). Therefore, the core characteristics of both Living Labs and Citizen Labs include the open and user-driven innovation processes that we are interested in.

## Living Labs

Accordingly to the proposition of William J. Mitchell, Living Lab represent a user-centric research methodology to sense, prototype, validate and refine complex solutions in multiple and evolving real life contexts (Eriksson *et al.*, 2005). This is the starting point of our analysis. The key elements of this methodology are as follows: (i) the first important idea is the *centrality of the user* in the entire process; (ii) second, it relates to a *research methodology*; (iii) it is oriented toward *solutions*; and (iv) it takes place in *real life contexts*.

Diverse ways to implement the concept were identified. Dekkers (2011) proposed classifying them into three dimensions, which we identify as three types of Living Labs.

The Type I Living Lab is based on the idea that a Living Lab is a building that should function as a normal home with all the required facilities for the temporary residence of experimental subjects to experience novel technologies while researchers investigate the use of these technologies in situations that are as realistic as possible (Markopoulos and Rauterberg, 2000).

In this model of a Living Lab, all the elements proposed by Mitchell are present if we consider that the “realistic context” is simulated. One main limitation to its success is that it generally fails to capture the influence of the broader contexts of life, such as work places or entertainment and social spaces.

A Type II Living Lab represents a methodology for open innovation fostered by its users and is also an organisation that coordinates and facilitates activities based on this methodology. It is related to experimentation and co-creation with real users in real-life environments where users, in collaboration with researchers, companies and public institutions, seek new solutions, products, services, business models or markets (Garcia and Oliveira, 2008).

This understanding of Living Labs is also centred on users, but beyond this, they are driven by them. Because it is still a methodology, in this case, it includes an organisation that is responsible for coordinating and facilitating the activities based on it, which are also oriented toward new solutions or innovations and take place in real-life environments.

In addition to the four already known Living Lab elements proposed by Mitchell, two new ones can be identified in Type II Labs: (i) open innovation (Chesbrough, 2003) and (ii) a four-helix structure, in which users, researchers, companies and public institutions work collaboratively to innovate. The openness of innovation means that there is some level of permeability related to the exchange of knowledge among the innovation agent, generally an enterprise, and the environments of its clients, suppliers and other stakeholders. It is basically an innovation process in

which knowledge goes in and out the process. Whereas closed innovation refers to innovation methodologies that restrict the use of a company's internal knowledge, with little or no exchanges with the outside, open innovation uses knowledge flows in and out of the company to accelerate internal innovation.

The openness of innovation relates to either inbound or outbound innovation and it can be pecuniary (acquiring or selling knowledge) or non-pecuniary (sourcing and revealing) (Dahlander and Gann, 2010).

Two general strategies for open innovation were proposed from another perspective: a free revealing “democratic” strategy and a formal collaborative one. The former is characterised by the proliferation of partners, whose technical and creative skills are specific to the industry.

Dekkers (2011) analyses Living Labs according to the proposition of Rothwell (1994) relating to generations of innovation management. In that model, the first three generations correspond to managing innovation and keeping it exclusively within firms. The 4<sup>th</sup> generation considers the supplier chains of firms and the 5<sup>th</sup> generation considers one leading innovator company that integrates internal development processes and strong external linkages (including reaching out to lead customers). Innovation, in this case, depends on collaborative precompetitive research, joint R&D ventures and strategic alliances based on R&D. Nobelius (2004) claims that a 6<sup>th</sup> generation exists, through which a large number of companies collaborate by openly exchanging information within a loosely connected network.

Following this reasoning, Living Labs represent the 5<sup>th</sup> or 6<sup>th</sup> generation of innovation, which involves networking innovation that is oriented toward increasing the throughput of innovation processes, reducing uncertainty about inventions or improving access to markets, thus making the concept of open innovation central to Living Labs.

Type III Living Labs correspond precisely to innovation networks (Dekkers, 2011). In this case, a Living Lab is not only the organisation that coordinates and facilitates activities among all actors to generate innovation, but it is the entire network.

If Living Labs are some type of technological test-bed or test platform; an organisation that facilitates and coordinates open and user-driven innovation processes or an innovation network; regarding tools, ICTs play a powerful catalytic role in user engagement and most Living Labs are focused on using such technologies to support user engagement, research novel ways of engaging with users and communicate findings quickly and accurately using low-cost, mass-adopted tools such as social networks (Beamish *et al.*, 2012).

## Citizen Labs

Since the end of the 1990s, community networks and the *telecentres* movement were looking to become more deeply involved in innovation activities. The First World Congress of Community Networks in Barcelona, Spain, in 2000, gathered the majority of the global leaders of that movement for the first time. The event was followed by the second and the third editions in Buenos Aires and Montreal, respectively. As a result of these meetings, the next genera-

tion of community networking was conceived, considering citizens to be not only “users of technology” but also its producers. The question “Can a community network become a ‘co-laboratory’; or a virtual research facility for its community?” was introduced (Serra, 2000). To search for answers to that question, two community centres were created in Catalunya, Spain in 2003 and 2006: respectively, the i2cat Foundation, which was more technology oriented, and the Citilab, which was more citizen-driven. In 2006, i2cat was recognised by EnoLL as the first Spanish Living Lab. Citilab was also recognised by EnoLL in the following year.

Although they follow the basic principles of Living Labs, Citizen Labs seem to have particular characteristics with regard to their interactions with users or citizens.

The activities of Citizen Labs should contribute to reflections on something that already exists that depart from new experiences (Colobrans, 2010). In this context, citizen participation means collaboration. Citizens are integrated in ongoing holdings and share their experiences, knowledge and expertise with the researchers, who investigate new ways of interacting and communicating in the knowledge society.

The processes observed at Citizen Labs led to the consideration of social innovation phenomena because, at Citizen Labs, social technologies are developed as much as digital ones (Serra, 2010).

The meaning of social innovation given by Serra (2010), however, is distinct from the meaning given by OECD. This institution recognises that not only ‘commercial’ or ‘for-profit’ innovative solutions are important but also that it is necessary to develop new solutions to address and serve unmet social needs; this is ‘social innovation’ (OECD, 2010). The actor responsible for this is the social entrepreneur, who puts the creation of social value at the heart of his mission to improve the lives of individuals and communities and increase their well-being. Accordingly, social entrepreneurship aims to provide innovative solutions to unsolved social problems to improve people’s lives by promoting social changes (OECD, 2010).

According to the previous concepts, social innovation has two different and relevant meanings. First, in terms of its purpose, social innovation has a not-for-profit orientation that contrasts with the more common commercial or profit-seeking orientation. In this case, a distinction is established between ‘social innovation’ and ‘commercial innovation’.

Second, in terms of its outputs, social innovation corresponds to innovation that is related to social organisation. It can be as broad as the implementation of social security systems, microcredit offerings without formal guarantees or the establishment of global social networks using the Internet as their main foundation, or it can be narrow in the Schumpeterian sense of organisational innovation. In this case, a distinction is established between ‘social innovation’ and ‘technological innovation’.

Returning to Citizen Labs, it is relevant to note their essential involvement with ICTs due to their origin in Community Networks and their strong relationship with Living Labs being generally of Type II. They are always focused on social innovation relative to their purposes but, relative to

their means, they can be focused on social or technological innovation.

## Methods

To deepen the understanding of open and user-driven innovation initiatives, we developed a framework based on the conceptual study of Living Labs and Citizen Labs and on systems analysis based on Deming (1982) and Scholtes (1999). According to their propositions, organisations are systems and their analysis must begin with the identification of the system’s purpose<sup>1</sup>. The analysis continues by recognising whose needs must be met to achieve the system’s purpose (clients in the case of firms; citizens in the case of public agencies, for example). Then, it is necessary to understand what their needs are and which are the necessary deliverables or outputs to satisfy the identified needs.

After defining a system’s users, it is necessary to visualise the processes that make it possible to meet client needs or produce the identified outputs. Because a process turns inputs into outputs, what the inputs are and who will provide them, the stakeholders, are the final pieces of information required to understand the system and its interactions with its surroundings, as shown in Figure 1.

We developed a framework, which is shown in Table 1, to analyse open and user-driven innovation initiatives based on specific questions oriented toward each of the system’s elements: its purpose, users, outputs, processes, inputs and stakeholders. The answers to each question allow the analyst to deepen his or her understanding of the examined initiative.

We used the framework to investigate five selected initiatives: three are certified Living Labs by EnoLL; another is the Brazilian national programme of Telecentres and was chosen because telecentres play a core role in the Citizen Lab movement; the final initiative was selected by searching for initiatives that are external to those movements but are based on open or user-driven innovation.

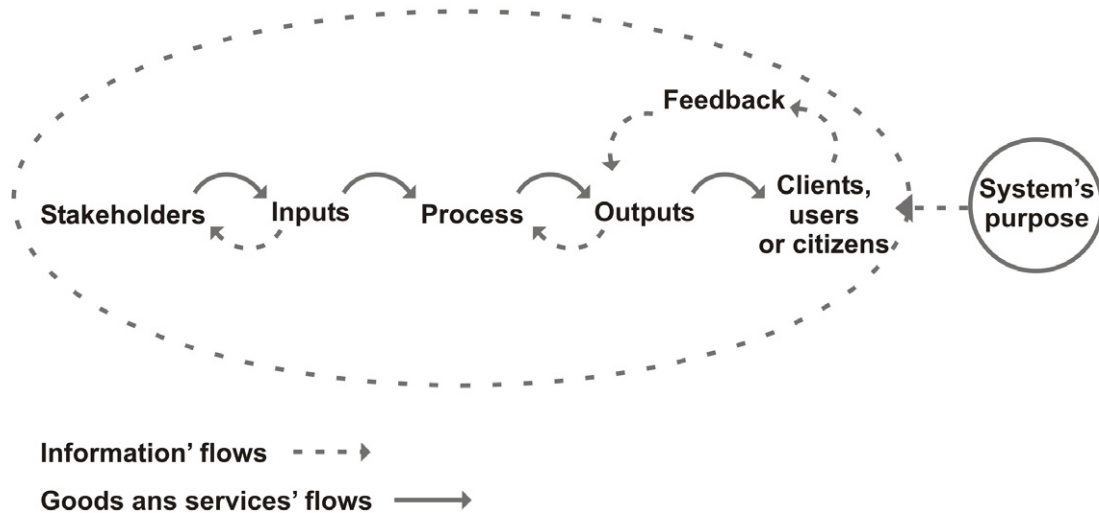
The selected EnoLL-certified Living Labs were Habitat and Núcleo de Cidadania Digital, both from Brazil, and Citilab Cornellà, from Spain. The fourth initiative is a very widespread programme in Brazil related to ICTs – Telecentros.BR – and the fifth is an initiative designed to produce and diffuse new solar technologies – SoSOL or Sun Fellowship – which is also based in Brazil.

The data required to conduct the analysis were gathered from the initiatives’ web sites. Any remaining doubts were clarified through e-mail exchanges between the authors and the leadership of the initiatives as well as by interviews conducted by phone.

## Initiative analyses based on the proposed framework

(i) The first analysed case is Habitat Living Lab, which was recognised as a member of EnoLL in 2010. Habitat defines itself as a social network ecosystem whose purpose is to develop and apply environmentally friendly techno-

<sup>1</sup> In general, any system is purposeful, although some are conscious of their purpose and others are not. In the case of this article, in which we address organisations and supra-organisational arrangements, all the considered systems have conscious purposes.



**Figure 1.** Deming's systemic proposition complemented by Scholtes' perspective.

**Table 1.** Framework to analyse open and user-driven innovation models.

<p>Purpose</p> <p>Q: Which is the main purpose of the initiative (programme, project, foundation, NGO, etc.)?</p> <p>(They can have a not-for-profit orientation or the more common commercial or profit-seeking orientation. <b>At this level, a distinction is made between social innovation and commercial innovation</b>).</p>
<p>Users</p> <p>Q: Who are the initiative's primary targets?</p> <p>(They are the direct users).</p> <p>Q: Does the initiative have any other targets? List them all.</p> <p>(They form the users' chain. It could be relevant to involve them in the analysis).</p>
<p>Outputs</p> <p>Q: Which outputs does the initiative intend to deliver to users?</p> <p>(They can be tangible, such as products, partially tangible, such as services or organisations, or completely intangible, such as knowledge, abilities or attitudes. <b>At this level, a distinction is made between social innovation and technological innovation</b>).</p>
<p>Processes</p> <p>Q: What is accomplished by the initiative?</p> <p>Q: Are users somehow involved in the process? Q: If the answer is yes, how are they involved?</p> <p>(Whether the initiative is user-driven can be determined here).</p> <p>Q: What types of knowledge interactions occur?</p> <p>[Whether the initiative is a test-bed, a test platform, an organisation that facilitates and coordinates open innovation processes or an innovation network, and if it has open innovation characteristics can be determined here. If it is open, this can be related to either inbound or outbound innovation and can be pecuniary (i.e., acquiring or selling knowledge) or non-pecuniary (i.e., sourcing and revealing)].</p>
<p>Inputs and Stakeholders</p> <p>Q: Which infrastructure resources or facilities are necessary for the implementation of the initiative? Who guarantees them?</p> <p>Q: Which are the knowledge resources, including explicit and tacit forms of knowledge, necessary for the initiative? Who provides them to the initiative?</p> <p>Q: Who provides the required financial resources?</p> <p>(According to the answers, it is possible to determine if the initiative relates to physical or virtual facilities, or both. The stakeholders build the set of actors that supports the initiative. By considering the set of stakeholders, it is possible to determine if the quadruple helix model is present. The users as providers of knowledge resources are also an important element for identifying user-driven initiatives).</p>



logies for low-income communities to improve their living conditions. Habitat works on a project basis, with each project counting on the support and involvement of many actors in establishing a network ([www.labtar.net.br/site/habitat/](http://www.labtar.net.br/site/habitat/)). An analysis of Habitat LL using the proposed framework is shown in Table 2.

(ii) The second analysed case is *Telecentros.BR*: the Brazilian National Programme to support Digital Inclusion in the Communities (Brasil, 2010). Telecentros.BR was established in 2009, in the context of the Federal Government's policy of digital inclusion. It aims to develop activities that enable the deployment and maintenance of public and community telecentres throughout the nation. The programme is coordinated by the ministries of Science and Technology, Communications and Planning, Budget and Management, the last of which is responsible for Executive Coordination.

For programme purposes, public and community telecentres are spaces where free public access to ICT is provided. The telecentres are available for multiple uses, including free and assisted navigation, courses and other activities to promote local development in its various dimensions, under the supervision of a local public or private non-profit entity.

The Telecentros.br programme offers telecentres new computer equipment with furniture or refurbished computer equipment without furniture, connectivity to the Internet, scholarships for monitors (digital inclusion agents of these spaces) and training for fellow and non-fellow monitors. Currently, there are approximately 3,500 active telecentres in the country. The analysis of Telecentros.BR using the proposed framework is shown in Table 3.

**Table 2.** Habitat Living Lab analysis.

<p><b>Purpose</b>  Q: Which is the main purpose of Habitat Living Lab?  The development and diffusion of environmentally friendly technologies for low-income communities to improve their living conditions.  This statement indicates first that the initiative is focused on innovation and also that it has a primary not-for-profit orientation indicating its focus on social innovation.</p>
<p><b>Users</b>  Q: Who are the initiative's primary targets?  A community of approximately 31,000 people in Vitoria, in south-eastern Brazil, who are mostly economically, socially, culturally and educationally vulnerable.  Q: Does the initiative have any other targets? Please list them all.  Low income communities all around the world that can use the technologies developed here.</p>
<p><b>Outputs</b>  Q: Which outputs does the initiative intend to deliver to users?  Social solutions, such as a community bank and a community forum, and technological solutions, such as ecological bricks, low-cost solar panels to heat water for bathing and collective intelligence platforms. At this level, the innovation is both social and technological.</p>
<p><b>Processes</b>  Q: What is done by the initiative?  Searching for good ideas and effective solutions to problems identified through continued interactions with the served populations. Elaborating and conducting projects to develop and implement new technologies in the community.  Q: Are users somehow involved in the processes? Yes, they are.  Q: If the answer is yes, how are they involved?  Community leaders are directly involved in all projects because the consultation and mobilisation of the population and the implementation of the projects occur side-by-side with the NGO. Other members of the community are involved in different ways, such as through educational projects or by using the local currency, provided by the community bank.  Q: What type of knowledge interactions occur?  Because it searches for and diffuses social technologies without exchanging money, it is clear that the initiative is practicing open innovation that is non-pecuniary in both directions – sourcing and revealing. However, it is involved in partnerships in which the pecuniary exchange of knowledge occurs. Because its processes involve a great number of partners as sources of knowledge, funding and other resources, it is configured as an innovation network.</p>
<p><b>Inputs and Stakeholders</b>  Q: Which infrastructure resources or facilities are necessary for the implementation of the initiative? Small offices that serve as headquarters for the community bank, the communication agency and the forum, for example. Hardware and software related to the use of ICTs, which are provided by a great number of both private and public partners.  Some examples are the community's demands, social technologies being developed all around the country, the testing of bricks, architecture projects, wastewater reuse projects, and improvement of the manufacturing processes in the brick factory. They are provided by community members, NGOs, foundations, and universities.  Q: Who provides the required financial resources?  Public and private enterprises, foundations, and banks.  The set of actors involved with Habitat LL shows that government, industry, academia and users can work together to innovate. Habitat runs open and user-driven innovation processes and is a Network Living Lab.</p>

**Table 3.** Telecentros.BR programme analysis.

<p>Purpose</p> <p>Q: Which is the main purpose of the Telecentros.BR programme?</p> <p>It aims to develop activities that enable the deployment and maintenance of public and community telecentres throughout Brazil. The Telecentres programme aims to promote local development through digital inclusion. This statement indicates that the initiative is not focused on innovation, so this initiative cannot be considered to be an example of open and user-driven innovation and its analysis stops here.</p>
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(iii) If the Telecentros.BR programme is not an example of an open and user-driven innovation initiative, it is valuable to investigate one specific project that is similar to a telecentre but that was recognised by ENOLL in 2009 as a Living Lab: Núcleo de Cidadania Digital (NCD) (<http://www.openlivinglabs.eu/LivingLab/esp%C3%ADrito-santo-cidadania-digital-living-lab>). NCD is a programme created at the main university in its region. The available infrastructure includes computers with multiple open source applications and a high speed Internet connection. It develops and provides computational services to the community to promote digital inclusion. NCD developed a web system named Tela Cidadã, or Citizen Screen, which brings together indicators and graphs of the institutional and political life of the country encompassing the Executive, Legislative and Judicial branches, at the national, state and municipal levels as well as studies carried out by governmental or non-governmental institutions that are of interest to society (<http://www.telacidada.ufes.br/>). The analysis of NCD according to the proposed framework is shown in Table 4.

(iv) *Sociedade do Sol*, or Sun Fellowship, is a not-for-profit NGO founded in 2001 in São Paulo, to develop environmental activities. Its specific objectives are environmental education and the development of technologies based on renewable sources of energy. It works in collaboration with private and public organisations ([www.sociedadadosol.org.br](http://www.sociedadadosol.org.br)).

Among its projects, we choose to analyse the Low-Cost Solar Heater. This project aims to develop not only the heater but also low-cost and easy production process to allow for the product's wide dissemination mainly among low income families. The project is also concerned with the diffusion of the technology through manuals, videos, courses, and web sites.

It is free and open to anyone who is interested. Of the people who are in charge of the project, each one who has installed one solar heater unit should provide feedback regarding his or her experience to facilitate continuous improvements. SoSol also offers technical support for those who cannot make their own heaters with guidance only from the available manuals as well as in-person courses. A detailed analysis of the SoSol following the proposed framework is shown in Table 5.

(v) *Citilab Cornellà* (<http://www.openlivinglabs.eu/livinglab/citilab-cornella>) is a centre for social and digital innovation in Cornellà de Llobregat, Spain. It is a mixed model that incorporates a training centre, a research centre and an incubator for business and social initiatives. It is based on the idea that digital technologies, especially the Internet, favour innovation in ways that are much more focused on citizens. Its working methods are basically de-

sign thinking and user-centred creation. Citilab Cornellà has been promoting its activities as a centre of digital innovation for the public dissemination and promotion of the knowledge society. An analysis of Citilab Cornellà following the proposed framework is shown in Table 6.

The five conducted analyses allowed us to determine the utilities of the proposed framework.

The first is the ease of understanding different innovation-related concepts. "Social innovation" can be used instead of "commercial or profit-oriented innovation" or "technological innovation". By using the framework, it is possible to clearly determine when one initiative is dedicated to "social innovation" as a purpose orientation (rather than commercial innovation) or to "social innovation" due to its outputs, such as new organisational forms (rather than technological innovation). The use of "social innovation" frequently leads to confusion because of its two meanings.

An effort to organise the initiatives investigated in the article according to these categories is displayed in Table 7.

Although only two of the five investigated initiatives were considered to be Living Labs, four of them were included in Table 7 as well as in the following discussion since they are producing innovation.

SoSol is directed toward "social innovation" relative to its purpose but related to technology with regard to its outputs, similarly to NCD. Citilab Cornellà and Habitat, however, are "social innovation" initiatives relative to their main purposes. At the same time, both are "social innovation" and "technological innovation" initiatives relative to their outputs, shifting them to the central part of the graph.

Therefore, the most traditional form of innovation – that having a commercial purpose – seems not to be the focus of the recent open and user-driven models of innovation. We realised that those open and user-driven supra-organisational structures tend to be more associated with social innovation than commercial innovation in terms of their purposes. However, they are well-distributed between social and technological innovation in terms of their outputs. Such combination allows them to occupy a space not filled by conventional processes and structures of innovation.

The framework also helped to identify if particular innovation initiatives are open as well as the type of openness employed: related either to the input or output of knowledge and to its pecuniary or non-pecuniary character.

It is natural to expect initiatives with commercial innovation purposes to be related to the pecuniary exchange of knowledge associated with a strategy of formal collaboration among a small number of partners, and initiatives with social innovation aims to be non-pecuniary

**Table 4.** *Núcleo de Cidadania Digital LL analysis.*

<p>Purpose</p> <p>Q: Which is the main purpose of NCD?</p> <p>It is the development and provision of computational services to promote digital inclusion among the community. Clearly it has a not-for-profit orientation. The question that remains here is if it is focused on innovation. Although very similar to telecentres, NCD has activities including systems development and support for other digital inclusion projects that shift it in the direction of having innovation-related goals.</p>
<p>Users</p> <p>Q: Who are the initiative's primary targets?</p> <p>The local community.</p> <p>Q: Does the initiative have any other targets? Please list them all.</p> <p>People from other localities, mainly the surrounding areas.</p>
<p>Outputs</p> <p>Q: Which outputs does the initiative intend to deliver to users?</p> <p>Direct interaction with the public, courses, the production of technical notes, brochures, handouts, newspapers, websites such as Citizen Screen, systems and support for other digital inclusion projects.</p> <p>In other words, NCD produces and spreads knowledge. Citizen Screen can be considered a new product and service because it provides a new way of accomplishing a task (obtaining information about governmental procedures). In this sense, it is a technological innovation.</p>
<p>Processes</p> <p>Q: What is done by the initiative?</p> <p>It develops and offers computational services to the community to promote digital inclusion. It produces computational content such as handouts, newspapers, websites, and systems developed based on scientific research and development, practical experiments and a great deal of personal effort.</p> <p>Q: Are users somehow involved in the processes?</p> <p>The users seem to have a passive role in the process without interactions that justify calling it a user-driven innovation process.</p> <p>Q: What type of knowledge interactions occur?</p> <p>Knowledge basically passes from NCD personnel to users through non-pecuniary revealing.</p>
<p>Inputs and Stakeholders</p> <p>Q: Which infrastructure resources or facilities are necessary for the implementation of the initiative? The infrastructure includes computers with multiple open source applications and a high speed Internet connection, and some resources for people with special needs, such as voice synthesiser software and Braille prints.</p> <p>Q: Who guarantees the infrastructure resources or facilities needed for the implementation of the initiative?</p> <p>The Federal University, the local municipality, and state funding agency for S&amp;T support .</p> <p>Q: Which are the knowledge resources, including explicit and tacit forms of knowledge, necessary for the initiative? Who provides them to the initiative?</p> <p>Because their processes are "developed based on scientific and practical experiments and a great deal of personal effort" we can infer that traditional sources of knowledge such as scientific publications, theses, manuals and personal knowledge exchanges among the academics in charge of NCD are their main knowledge sources. Whether the knowledge of users is required remains unclear.</p> <p>Q: Who provides the required financial resources?</p> <p>The university, the local municipality and a private enterprise. Accordingly, NCD's stakeholders represent academia, government and the private sector, exhibiting a triple helix partnership. The authors could not find that the users are the drivers of the innovation processes at NCD. Accordingly, it is not considered to be a Living Lab.</p>

and associated with a free revealing strategy including a large proliferation of partners. However, as previously noted, enterprises may participate in sourcing and revealing procedures and initiatives such as Habitat LL, whose innovation purpose is mainly social, but may be involved with specific actions in which the knowledge exchange is pecuniary in character.

Another key element is user centrality. Whatever the purpose of the initiative, the involvement of its users, the people who are affected by it, is crucial. The users can be involved as clients, partners or citizens. In some cases, only direct users are considered; however, in other cases, it could be necessary to involve the entire user chain. One clear example of this situation is given by educational projects in which students, teachers, parents and representatives from the labour market should be involved.

A specific place in the framework identifies whether the examined initiative is user-driven: the process description. If users are involved, this will be evident in the process. How the users are involved can reveal whether the initiative is user-driven.

Initiatives that present open and user-driven innovation processes are candidates to be characterised as Living Labs or Citizen Labs in accordance with our discussion "Living Labs".

Turning to the inputs, we can identify at least three types: infrastructure resources or facilities, financial resources and knowledge resources, including explicit and tacit forms of knowledge. Each of these resources must be provided by some actors, be they users, enterprises, academia or the government. By observing the initiative's stakeholders and processes, it is possible to determine if the triple helix structure is present. Naturally, the presen-



**Table 5.** *Sociedade do Sol* analysis.

<p>Purpose</p> <p>Q: Which is the main purpose of the SoSol/low cost solar heater project?</p> <p>Developing and widely disseminating a low cost solar heater.</p> <p>This purpose shows that the initiative aims to create social value and is based on open innovation because it promotes the wide diffusion of knowledge.</p>
<p>Users</p> <p>Q: Who are the initiative's primary targets?</p> <p>All the Brazilian families who want to adopt the low cost solar heating system developed by SoSol.</p> <p>Q: Does the initiative have any other targets? Please list them all.</p> <p>Students and teachers, mainly from elementary and high schools, as well as vocational schools.</p>
<p>Outputs</p> <p>Q: Which outputs does the initiative intend to deliver to users?</p> <p>Courses, manuals, videos, and technical assistance. They do not produce and sell the heaters but support those who wish to do so.</p>
<p>Processes</p> <p>Q: What is done by the initiative?</p> <p>Development of technology to assemble low-cost solar heaters. Dissemination of the technology.</p> <p>Q: Are users somehow involved in the processes? If the answer is yes, how are they involved?</p> <p>Yes. User participation, however, is limited to providing feedback on the experience of assembling the solar heater. It cannot be considered to be a user-driven innovation initiative.</p> <p>Q: What type of knowledge interactions occur?</p> <p>The diffusion process induced by the NGO indicates characteristics of open innovation that are essentially outbound and non-pecuniary due to its revealing character. Inbound processes also occur because user feedback is relevant. Because it is located on a university campus, it is expected that technical and scientific knowledge are incorporated into the initiative.</p>
<p>Inputs and Stakeholders</p> <p>Q: Which infrastructure resources or facilities are necessary for the implementation of the initiative and who guarantees them?</p> <p>SoSol is located inside a technological business incubator on the campus of the University of São Paulo.</p> <p>Q: Which are the knowledge resources, including explicit and tacit forms of knowledge, necessary for the initiative? Who provides them to the initiative?</p> <p>Knowledge resources are mainly related to the R&amp;D process conducted within the SoSol research laboratory. User feedback is also relevant.</p> <p>Q: Who provides the required financial resources?</p> <p>Public funding agencies, the technology based company incubator, international NGO, and private enterprises. It is possible to observe the presence of the triple helix model. The innovation process, however, is not user-driven. The initiative cannot be considered to be Living Lab.</p>

ce of users as knowledge stakeholders is fundamental in user-driven initiatives.

Our analysis revealed that the Telecentros.Br programme is beyond the scope of interest because it is not focused on innovation. However, this could serve as an insight for policy makers to change the programme and expand its scope. SoSol and NCD are open innovation initiatives that exhibit the triple helix structure; however, they are not user-driven and, therefore, are not considered to be Living Labs according to the definitions in this paper. Habitat and Citilab display characteristics of open and user-driven innovation as well as triple helix arrangements. The former is an innovation network and the latter is a core organisation that coordinates innovation processes.

## Conclusion and future research

The main purpose of this article is to better understand current propositions to foster innovation: the open and user-driven innovation models. To accomplish this task, we first identified the key characteristics of Living Labs and Citizen Labs, two representatives of open and user-driven innovation models, revealing that both types of models have

some basic commonalities. First, they are initiatives that are focused on innovation. Second, their mode of action is necessarily user-driven in the sense that users, as co-creators, are central to the entire innovation processes. Third, innovation may be open in for-profit inbound (buying) or outbound (selling) processes or not-for-profit inbound (searching) and outbound (revealing) processes. Finally, they are based on the interaction among firms, government, and academia (triple helix) as well as users.

Based on these principles, there is a great variety of methodologies used in practice to establish and operate Living Labs. Three types of Living Labs were considered: type I, technology test-beds or test platforms; type II, organisations that coordinate open and user-driven innovation processes; and type III, innovation networks.

The framework allowed for distinctions to be made between social and commercial innovation at the level of initiative purpose and social and technological innovation at the level of initiative outputs.

The system analysis framework used to investigate the initiatives as 'models of open and user-driven innovation' has proved to be very useful in helping to deepen the understanding of organisations involved with a complex set

**Table 6.** Citilab Cornellà analysis.

<b>Purpose</b> Q: Which is the main purpose of Citilab Cornellà? It is a centre for social and digital innovation. Because it aims to create social and economic value, it is focused on social and commercial innovation.
<b>Users</b> Q: Who are the initiative's primary targets? Local citizens in general.
<b>Outputs</b> Q: Which outputs does the initiative intend to deliver to users? Knowledge that facilitates digital inclusion, new businesses, jobs, and software. At this level, social and technological innovation is conducted.
<b>Processes</b> Q: What is done by the initiative? Teaching and training as well as research and incubation for business and social initiatives. Q: Are users somehow involved in the processes? Q: If the answer is yes, how are they involved? Its working methods are basically design thinking and user-centred creation. Q: What type of knowledge interactions occur? It incorporates a user-centric design methodology in which the knowledge exchange is mainly non-pecuniary.
<b>Inputs and Stakeholders</b> Q: Which infrastructure resources or facilities are necessary for the implementation of the initiative? Citilab is located in an old textile factory that was renovated to fulfil its new purpose. The building has preserved its essence but at the same time has been connected to advanced academic networks and Anella Cultural, a new infrastructure of digital networks that connects the major cultural facilities of Barcelona with theatres and municipal centres in Catalunya's major cities. Citilab is prepared for the Internet of the Future. Q: Who guarantees the infrastructure resources or facilities necessary for the implementation of the initiative? A non-profit foundation based on collaboration among the municipality, public institutions, universities, enterprises, and citizens' representatives. Q: Which are the knowledge resources, including explicit and tacit forms of knowledge, necessary for the initiative? Who provides them to the initiative? Academia, enterprises and users are the main sources of knowledge at Citilab Cornellà. Q: Who provides the required financial resources? In addition to public funding, Citilab Cornellà also generates income by selling services to the community, such as serving as a business incubator, renting out space and providing courses. It is clear that at Citilab Cornellà, the quadruple helix model is present. Their processes are open and user-driven, giving it a Living Lab profile. Moreover, the citizen participation in the entire initiative makes it clear that it is really a Citizen Lab. Citilab Cornellà is considered to be a type II Living Lab, which is an organisation that facilitates open innovation processes.

**Table 7.** Innovation initiatives orientation related to purposes and outputs.

Innovation purpose	Innovation outputs		
		Technological	Social
	Commercial	New products, new processes	New business models, new markets, new supply chains
	Social	SoSol NCD	Habitat LL Citilab Cornellà

of interrelated concepts such as social innovation, technological innovation, and open and user-driven innovation. In particular, the analysis allowed for the perception of Living Labs and Citizen Labs as new entities within the knowledge society and, therefore, new social technologies themselves conceived to induce social and technological innovation. We realised that open and user-driven supra-organisational structures based on triple helix partnerships tend to be more associated with social than commercial innovation in terms of their purposes. However, they are well-distributed between social and technological innovation in terms of

their outputs, occupying a space not filled by conventional innovation processes and structures.

Although we could perceive the value of the proposed framework, only five initiatives were analysed in this paper. Extending the analysis to a larger number of cases is necessary to better evaluate its strengths and weaknesses.

Another promising way forward is the investigation of the real contributions that the open and user-driven initiatives are producing because, although they are proliferating, there is a lack of data indicating the effectiveness of their results. Investigations with this aim can be conduc-

ted by gathering data from a large number of open and user-driven initiatives from a wide range perspective or, alternatively, by using action-research and case studies to provide a deeper perspective on a few initiatives. The framework can also be helpful in this task because it explicitly considers the identification of outputs. In this article, only qualitative outputs were considered, but quantitative outputs can be gathered and analysed.

Therefore, we expect further empirical studies to review the framework in the future and test its validity in different research contexts.

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