Spaces to foster and sustain innovation: Towards a conceptual framework

Ferney Osorio Bustamante, José Ismael Peña Reyes
GISTIC - Grupo de Investigación en Sistemas y TIC en las Organizaciones
Universidad Nacional de Colombia
Bogotá, Colombia
{fosoriob, jipenar}@unal.edu.co

Mauricio Camargo, Laurent Dupont
ERPI – Equipe de Recherche sur les Processus Inovatifs
Université de Lorraine
Nancy, France
{m.camargo, l.dupont}@univ-lorraine.fr

***Abstract*—This paper studies the influence of the physical space in the performance of innovation laboratories. As there is a strong emergence of new innovation laboratories all over the world, past experiences have shown that this type of projects are at risk to not succeed in their goals. The physical space is considered as a conscious asset to improve the innovation outcomes that must be carefully designed according with the strategic goals of the project. In the present paper, at first five frameworks from the literature are identified and compared. Then, based on both literature and authors' experience an updated framework is proposed as basis for a future guidance tool for researchers and practitioners aiming to adapt or to start a new laboratory.**

Keywords—spaces, innovation laboratories, innovation environment, physical space, strategy

I. INTRODUCTION

There is an increasingly interest of organizations in creating dedicated environments to foster innovation processes. Depending of the context, these physical environments can take form of laboratories with different kind of spaces such as creativity and prototyping rooms, co-workings spaces, testing rooms, etc. According to the literature an "innovation laboratory" is a room or a set of rooms designed for spatial re-configuration, participant observation [1], writing spaces, materials for visualization (post-it notes, paper, pens, cards), and ICT to support brainstorming and distributed group working [2].

Looking for a more integral definition, an innovation laboratory can be described as facilities for encouraging creative behaviors and supporting innovative projects through the provision of appropriate resources, visualization and prototyping facilities, and the ability to reconfigure new projects [3], [4]. These laboratories shall increase the capability of new product development, decrease time to market, and usually, they are aligned with the firm's or organization's strategic intention and scope [5].

Besides the relative recent definitions on innovation laboratories, understanding the effects of the space in innovation has been a topic of concern years ago. Reference [6] worked on the development of creativity rooms as an input to innovation, whilst [7] proposed the wider implications of how workspace design influences innovation. Also, [3] condensed and proposed the innovation laboratories concept, and [8] designed a prototype for an environment to boost collaborative processes. Finally and more recent, studies like [9] have started to focus on how spaces influence the culture in a workplace within an ambidextrous organization.

Despite the previous work, there still is a gap in understanding how these environments (innovation laboratories) impact innovation performance and how this performance can be aligned with the strategic intentions of the organization at the early stages of their design. This paper takes into account the proliferation of innovation laboratories and the strategic importance of the environment design as a conscious element in their sustainability.

As shown in [10] there is a big quantity and diversity of innovation laboratories and the way they intend to support innovation. Among these, it is possible to find different segmentations by size, regions, countries or specialties. But, two of the questions that motivate this work are; how the original intent to support innovation was realized? And, did the designed environment contribute or interfere to achieve that goal?

The ViveLabs network in Colombia is one example of these small segmentations of innovation laboratories. These laboratories are promoted and financed by the national government, they are leaded by universities, incubators or R&D centers. In this scenario, the ViveLabs are considered innovation laboratories with the objective of foster innovation in the sector of digital content through training, entrepreneurship, research, and product development. In this case, the government defined the basic setups for the laboratories and the operators had to adapt or improve the proposed spaces. After two years of operation, the ViveLabs have shown significant results becoming a reference for the citizens and companies seeking to access to their services. However, as the model of these innovation laboratories is under permanent construction many aspects need to be addressed [11]. In that matter, the way the laboratories were conceived have led some of them to be over or undersized with some of their infrastructure unused causing sustainability issues.

Another example of innovation laboratories is the Design Factories. This type of laboratories emerged in the University of Aalto through their Media, Service and Design Factories. They are considered as co-creation environments for learning,

teaching, research, and industry cooperation [12]. Nowadays, the Global Design Factory Network has been stablished with international cooperation and the replica of this model in countries like Australia, China and Chile. The Aalto Design Factory has been operational since 2008 showing significant results in all of its strategic activities making them a potential reference of good practices [13].

Additionally, there are the so called Living Labs. They constitute probably the biggest worldwide network of innovation laboratories. Among several definitions, from the infrastructure point of view, Living Labs are semi-partitioned spaces in form of innovation arenas integrated in real life environments, equipped with ICT based tools that surface tacit, experiential, and domain-based knowledge such that it can be further codified and communicated [14]. These laboratories have spread to all over the world as context adapted spaces generating a big diversity between them. Therefore, there is no agreement in the way these spaces should be built giving rise to a variety experiences either successful or misplaced. This is the case of FLELLAP, which was created to support the development of innovative information, communication and entertainment products and services. This laboratory operated between October 2010 and March 2013 and according to [15] it failed to reach a common vision amongst all of its stakeholders. As part of the lessons learned, they emphasize in "the importance to have a thematic focus clearly defined, an infrastructure adapted to support such focus and, most important, to include these elements as part of the strategic intention that has to be shared and aligned with all the stakeholders".

Likewise, there are the Fab labs, a global network of local laboratories that enable invention by providing access to tools for digital fabrication, sharing an inventory of capabilities to make almost anything and allowing people and projects to be shared [16]. Fab labs were started by the Centre of Bits and Atoms at MIT in 2003 [17] and today there are more than 260 all over the world [18]. Despite their significant increase and popularity, fab labs are no stranger to the challenges faced by the other innovation laboratories. Indeed, some fab labs are considering to be partially privatized through professionalizing part of its activities in the seeking of sustainability [19]. This could rebound in perceiving fab labs different than their original intent as an open, community-based place for creation.

As has been shown, there are many and diverse types of experiences and research on innovation laboratories, however, in order to give answers to our motivational questions, it is necessary to consider how a new or existing project to create a space to support innovation could be oriented. Is it reasonable to think in an ideal methodology for this purpose? The objective of this paper is to contribute to the literature by proposing a framework to compare and analyze the outcomes of innovation laboratories in order to understand the influence of the spaces to support innovation processes. In the rest of the document, a literature review is presented in which we identify the existing frameworks, next, based on the review, an adjusted framework is proposed and finally the further steps of the research are discussed.

II. THE SPACE AS A CONSCIOUS ELEMENT IN THE STRATEGY OF INNOVATION LABORATORIES

A successful innovation process is usually driven by the personal experiences of managers operating within established networks and leveraging personal connections [20]. This allows to think how these experiences can be improved and how the workplace may influence them. In that way, [21] noted that "environmental design carries the potential of having a direct impact on worker morale and productivity" and it should take into account architectures, interiors and landscaping for both customers and employees.

In the same way, referring to innovation laboratories it is necessary to think in how the space encourage creative behaviors not just for employees but for the users. According to [3] one of the main objectives at the moment of designing an innovation laboratory is to consider the fact that the users need to be in a space that reduces the hierarchy and supports participation. The physical design of the space should promote dynamism, playfulness and debate in order to achieve the three characteristics for a creative climate [22].

That is why managers of spaces that aim to foster innovation face a challenge that goes beyond that just managing them. Reference [23] suggest that innovation needs to be enabled rather than controlled. More concretely, they state that, to manage an innovation space managers have to "learn how to provide an ecosystem of living ambiances of cultivation, facilitation, incubation and enabling, rather than a regimen of control and forced change" and to consider both physical space and organizational climate as part of the enabling context.

Then if physical space and the infrastructure related to it need to be taken into consideration, identify which elements compose an ideal space should be a matter of interest. Recent literature suggest that it is possible to consider an infrastructure-driven laboratory based upon either material or immaterial infrastructure, referring in the first place to those physical elements and technologies to equip a laboratory and second, to those environmental aspects that surrounds the laboratory such as the context, the community and the stakeholders [24]. However, despite of this, the literature is scarce in terms of what type of infrastructure may be implemented according to previously defined strategic goals or how the existing infrastructure has been used to achieve those goals.

Innovation laboratories have to deal with substantial financial investments and the possibility they can have short useful lifespan [3]. This stablishes the biggest challenge and leads to the reality of successfully operate an innovation space: sustainability. As shown before, emerging laboratories such as ViveLabs with significant investments by national governments are at risk of reducing their lifespan due to sustainability issues and here the need to build a model to conceive spaces to foster sustaining innovation is vital. The ViveLabs are not the only ones with this challenge. Since their official launch in 2006, Living Lab initiatives have been funded by the European Commission to tackle Europe's declining economic competitiveness and societal challenges [25], yet, almost ten years later, cases such as FLELLAP

encourages to keep the research efforts towards the understanding of the sustainability of these innovation laboratories.

III. RESEARCH APPROACH

This research is based on the authors' experience and the collaboration between both universities and two of their laboratories. These are the Lorraine Fab Living Lab (former Lorraine Smart Cities Living Lab) of the Université de Lorraine in France and the ViveLab Bogotá of the Universidad Nacional de Colombia. With 5 and 2 years of operation respectively, common issues have been shared and identified, giving place to the questions that motivate this research.

Although, at the beginning of this research it was considered to focus only in the Living Labs domain, due to the lack of research efforts to analyze and understand influence of the physical environment and the infrastructure in the outcomes, we decided to open the landscape to a broader and more generic domain such as innovation laboratories. This allowed us to identify and compare other concepts like innovation environments and enabling spaces.

Based upon the literature review, five frameworks were selected due to the specific focus or relevance given to the space and environmental aspects as part of the laboratory. Next, a comparison between the five frameworks was performed remarking the positive aspects or the disadvantages of each of them. As none of the frameworks seemed to be totally oriented to the objective of this research and some of them still remain as theoretical works, we attempt to propose a conceptual framework adjusted to the conditions of this research.

IV. COMPARISON OF EXISTING FRAMEWORKS ON PHYSICAL ENVIRONMENTS FOR INNOVATION

TABLE I. summarizes the five frameworks identified in the literature. Here, we show the main features, the year it was proposed, as well as the differences between them based in five comparison criteria. It is important to notice that some frameworks comprise a more detailed level of elements by disaggregating specific components for certain constitutive blocks (or dimensions). However, not all of them reach that level of specificity, therefore, we only present the main blocks. Regarding to the comparison, we established a set of five criteria in order to identify the comprehensiveness of the current frameworks. These criteria are:

1. Space & infrastructure focus: As the motivation and research questions rely on the role of the physical space to support innovation, we look to compare whether the space or the infrastructure has been considered as one of the main feature of analysis.
2. Strategy vs outcomes approach: To understand the performance of the space it is required to analyze how it was conceived and how has been the space actually used, threfore we seek to identify a framework that contributes in this regard.
3. Criteria definition: Almost all frameworks have a solid theoretical base although not all of them define criteria for each block or dimension. Those with criteria definition are considered a significant input.
4. Operationalized & metrics: Besides the criteria, we look at whether instruments and metrics were developed for each framework.
5. Case study: Finally, we compare which frameworks have been tested and deployed through single or multi case studies.

Along this section, the identified frameworks will be discussed, the main features and the context in which they were developed are going to be underlined. The first framework [4], recognizes that the environment itself can take part of the organization's innovation strategy (rather than ad hoc) and it can influence performance in innovation. Subsequently, "if resources are going to be invested in the creation of an innovation environment, then it is essential that strategic intentions underpinning this space are explicit".

A remarkable point of view of [4] is the outcome approach. They used the transformation model (progression from inputs and outputs) [26] as conceptual foundation to consider how strategic intent may be transformed into specific innovation environments and how these are subsequently used to deliver new products and services. In addition, they did a specific study of what should be the physical embodiment of such spaces. These elements seem to be a useful tool in order to examine and compare which kind of real environments are implemented in different laboratories. In that sense, this framework is comprehensive and detailed, it identifies for each block or process which elements are involved. Although, the framework was never operationalized, it is a significant input to advance in this research.

Afterwards, [8] presents a physical environment specifically designed to facilitate collaborative work. The author proposes a coherent framework to enable the involvement of the end user at the early stage of an urban project. He highlights that the key pillars of the framework are the involvement of various stakeholders, the attitude towards collaboration and a structured process. Then, those pillars shall be embedded into a customized space to accelerate such process from the sharing of stakeholders' requests to a reached consensus. This framework was deployed, tested and analyzed [27] through the Lorraine Smart Cities Living Lab. Still, identified points for improvements remain its reproducibility and the definition of key performance indicators to measure the steps of the process and its outcomes.

More recently, [24] propose a framework for "infrastructure driven laboratories" under of Living Labs domain. Their proposal is based on the experience with the LeYLab, which basically offered fiber-optic Internet access to a panel of 115 households and organizations, to stimulate innovation on media and eHealth. After years of operation, they realized that a heavily infrastructure-driven laboratory imposes some risks, such as the roll-out which can take longer and the integration of the external cases to the original intent. All the external cases they had were situated in the media domain, whereas no further

eHealth cases were held. This evidence the need of a clear thematic focus for a laboratory in order to easily define which projects attract and realize. The framework proposes that the infrastructure represent the core of the laboratory and the other five general elements depend on this infrastructure.

TABLE I. COMPARISON OF FRAMEWORKS

Comparison of Frameworks							
Author	**Description**	**Blocks**	**Space & Infrastructure Focus**	**Strategy vs Outcomes Approach**	**Criteria Definition**	**Operationalized & Metrics**	**Case Study**
Moultrie, 2007	Role of Physical Environment in Innovation	Strategic intent Process of creation Physical space Process of use Realised intent	**X**	**X**	**X**		
Dupont, 2009	EMA Space - Environments to foster collaborative innovation	Governance & stakeholders Collaborative methodologies Change management processes Technology (equipment & methods) Creative space	**X**		**X**		**X**
Schuurman, 2013	Living Lab Constellation	Infrastructure Natural setting Multi-method Medium-to long-term User-centric Multi-stakeholder	**X**				**X**
Veeckman, 2013	The Living Lab Triangle	Innovation Outcome Technical Infrastructure Ecosystem Approach Level of Openness Community Lifespan Real-world context Evaluation Context Resarch Co-creation User role			**X**	**X**	**X**
Peschl, 2014	Enabling Spaces Framework	Arquitectural and Physical Space Social, Cultural and Organizational Space Cognitive Space Emotional Space Epistemological Space Technological and Virtual Space	**X**				**X**

Reference [24] made another significant contribution in the literature by also defining the scope of the term infrastructure. They propose that a laboratory can be composed by material infrastructure as all the tangible assets that are brought to the space: physical networks, user devices, research equipment. But also, they consider the immaterial infrastructure referring to all the intangible assets that surrounds a laboratory such the environment, the stakeholders and the end-users. Nevertheless, this work does not deepen on what exactly those elements are and what are their contributions to the outcomes.

The Living Lab constellation presents an original approach based on a single case experience at generic level but it is also possible to think in a multi-project level by analyzing each project as a unique constellation. However, this framework is still exploratory and preliminary. Nonetheless, finding out that the motivation for this research is a common interest by other authors, it validates the emergence of this issue.

On the other side, the Living Lab triangle is centered to find a way to measure the innovation outcomes of these laboratories. This framework is one of the most comprehensive in the literature gathering previous concepts and elements which aim to understand the behavior of Living Labs [15]. However, the infrastructure aspect is limited to technical matters and it does not seem to be considered an influential factor within the framework. Despite of this, as part of the conclusions further in this work, the authors realized that infrastructure actually plays a bigger role and it needs to be clearly defined as part of the general strategy of the laboratory. Between the selected frameworks, the Living Lab triangle is the only one which has been operationalized to perform a multi-case analysis among four laboratories [28]. Therefore it represents an important reference to be considered in our path to propose our own adapted framework.

Finally, as part of the literature review, the term "enabling spaces" has been studied by [23] through several years. They develop a framework based on the premise that innovation should be enabled (facilitated) rather than managed (referred as controlling). This framework considers that an enabling space is designed as a multi-dimensional space, in which architectural/physical, social, cognitive, technological, epistemological, cultural, intellectual, emotional and other factors are taken into account and integrated.

Following this work, in [29] the authors state that each space has to be specifically designed for each organization and its quality relies in carefully choosing the parameters of each space: scenic location, almost no tables, different seating scenarios including a private situation for individual thinking, as well as a more public setting for negotiating knowledge, mobile ICT-infrastructure, lots of space for presenting things, workshop equipment facilitating the transformation of ideas into tangible prototypes, etc. The enabling spaces framework proposes an original approach that has been developed through previous research but it is still not operationalized.

As result of the comparison of frameworks, we summarize the main findings as follows:

- Despite of the laboratory's label, it is clear that spaces have an active role in the innovation processes and outcomes.
- In general, research efforts to understand its role and its contribution remain as theoretical and exploratory.
- To diagnose physical environment performance, it is necessary to analyze how it was conceived, materialized and used.
- It is important to stablish a common understanding of what composes the physical embodiment of an innovation laboratory.
- The framework can work just as a tool or guideline. Each space has to be designed for each laboratory according to its context.

V. TOWARDS AN UPDATED FRAMEWORK

Along to this work, it has been remarked the close relation between physical environment and the strategic intention with the innovation performance. Then, it is possible to think that if at the project stage of a new laboratory it is possible to have a way to analyze and design the proper environment for intended goals, the outcomes of such intention could be better oriented. In addition, if during that process we contribute to understand the way physical space and resources are used, thus, it could be possible to stablish some guidelines to those laboratories that are already in operation to re-direct their strategy or to adapt the existing space.

Considering this and the results of the comparison, we believe [4] provides the fittest framework for the purpose of this research. They comprise the process of creation of the innovation environment (physical space) in order to satisfy strategic goals (strategic intention), and the process by such space is used and the degree to which the strategic goals are met (realized intention). Additionally, elements that compose each block and process are described. However, as we addressed in the previous section, this framework has some shortcomings regarding to its theoretical status, strong firm orientation and its lack of research and methodologies assessment.

As part of our contributions in this work, in Fig. 1 we propose an updated framework based on the experience of the projects described in section III, and the literature discussion presented earlier in this paper. As has been shown, to establish a clear strategic intention at the early stage of the project is fundamental, and just in that regard the literature has evolved actively during last years. Among the other frameworks studied in this work, it is possible to identify common elements that define which aspects should be taken into account to set up the strategy for an innovation laboratory.

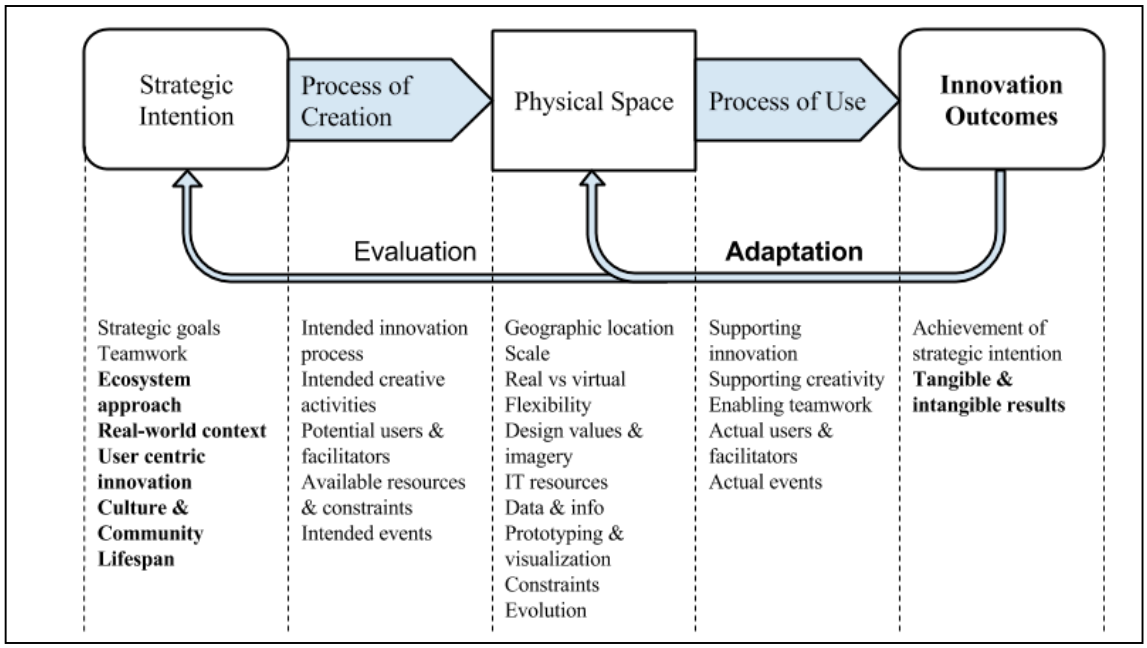

Fig. 1. Updated framework

Precisely, our main contributions to this updated framework relies in this point (strategic intention), where we keep from the original framework only strategic goals and teamwork elements, and we propose 5 new ones:

- Ecosystem approach: To generate added value for all the stakeholders involved, to create long-term engagement and identification with the laboratory.
- Real-world context: To capture or resemble real life environments (through space, equipment or methodologies).
- User centric innovation: To involve users in the different phases of innovation cycle in which they can test, evaluate, contribute and co-create.
- Culture and community: To build an identity and to grow a community of users engaged and motivated with access to the laboratory.
- Lifespan: To estimate the length of the project as a whole (short, mid or long-term).

Furthermore, we also believe that realized intention should be seen as innovation outcomes with tangible and intangible results that allow us to assess impact and determine how the setup performed. With these results decisions can be made either to early modify the space (adaptation) or to deeply address the strategic intention (evaluation).

Further steps in this research aim to operationalize this framework. In order to build an analysis and a comparing tool, indicators and evaluation criteria need to be defined for each element of the proposed framework. With this, gathered information and experiences from different running laboratories could help to build, for example, a maturity grid based model that will enable us to fulfill the assessment of the innovation performance and the influence of the space.

VI. CONCLUSIONS

This paper studied why the space should be considered a conscious asset within the strategy of an innovation laboratory. The proposed framework makes it possible to study the processes of creation and use of a space intended to support innovation and to measure the outcomes according to the original strategic intention. This work evidences the concern to understand the influence of the physical environment in the innovation processes and through the updated framework it glimpses a guidance tool for those who want to start a new project of creation of an innovation space.

As this work is just in the early stages of the research project, it presents several limitations. Further research efforts will focus in co-designing with directors and managers of innovation laboratories an analysis instrument in order to provide qualitative and quantitative data about multiple cases. Beyond that, we encourage the academic community to deepen in this issue by studying the users' perspective in the performance of the physical space, for example. Likewise, to characterize the type of outcomes from an innovation laboratory is required.

ACKNOWLEDGMENT

The authors would like to thank all the partners of the LILA project (Living Labs Application for start-ups company) for their participation in this research work. The LILA project is co-funded by Interreg IV-B North West Europe

REFERENCES

[1] R. Griffin and K. Michele Kacmar, "Laboratory research in management: Misconceptions and missed opportunities," *J. Organ. Behav.*, vol. 12, no. 4, pp. 301–311, Jul. 1991.

[2] J. F. Nunamaker, L. M. Applegate, and B. R. Konsynski, "Computer-Aided Deliberation: Model Management and Group Decision Support," *Oper. Res.*, vol. 36, no. 6, pp. 826–848, Dec. 1988.

[3] M. Lewis and J. Moultrie, "The Organizational Innovation Laboratory," *Creat. Innov. Manag.*, vol. 14, no. 1, pp. 73–83, Mar. 2005.

[4] J. Moultrie, M. Nilsson, M. Dissel, U.-E. Haner, S. Janssen, and R. Van der Lugt, "Innovation Spaces: Towards a Framework for Understanding the Role of the Physical Environment in Innovation," *Creat. Innov. Manag.*, vol. 16, no. 1, pp. 53–65, Mar. 2007.

[5] R. Gey, L. P. Meyer, and M. Thieme, "A Conceptual Framework for Describing the Phenomenon Innovation Laboratory: A Structurational Viewpoint," 2013.

[6] L. Snead and J. Wycoff, "TOOLS@ WORK: Stimulating innovation with collaboration rooms," *J. Qual. Particip.*, pp. 55–57, 1999.

[7] T. Kristensen, "The Physical Context of Creativity," *Creat. Innov. Manag.*, vol. 13, no. 2, pp. 89–96, Jun. 2004.

[8] L. Dupont, "Transfert du génie industriel vers l'ingénierie urbaine : vers une approche collaborative des projets urbains," Institut National Polytechnique de Lorraine - INPL, 2009.

[9] J. Andersson Schaeffer and Y. Eriksson, "Tool-complexes of innovation. : Spaces for explorative innovation in four manufacturing companies," *Design Research Society Biennial International Conference 16-19 June 2014, Umeå, Sweden*, vol. 1, no. 1. pp. 663–676, 2014.

[10] L.-P. Meyer, J. Schultz, M. Foradi, M. Thieme, and K. Meyer, "Innovation laboratories worldwide," 2014.

[11] OECD, *OECD Reviews of Innovation Policy: Colombia 2014*. Paris: OECD Publishing, 2014.

[12] M. Laakso and M. Clavert, "Promover la creatividad y las habilidades del pensamiento de diseño entre los estudiantes universitarios," *Rev. Estud. Juv.*, vol. 104, pp. 215–228, 2014.

[13] T. Björklund, S. Luukkonen, M. Clavert, S. Kirjavainen, and M. Laakso, "Aalto University Design Factory through the eyes of its community members." Study report. Aalto University Design Factory, 2011.

[14] E. Almirall and J. Wareham, "Living Labs: arbiters of mid-and ground-level innovation," *Technol. Anal. \& Strateg. Manag.*, vol. 23, pp. 87–102, 2011.

[15] C. Veeckman, D. Schuurman, S. Leminen, and M. Westerlund, "Linking Living Lab Characteristics and Their Outcomes: Towards a Conceptual Framework," *Technol. Innov. Manag. Rev.*, vol. 3, no. 2, 2013.

[16] The Fab Foundation, "The Fab Charter," 2012. [Online]. Available: http://www.fabfoundation.org/fab-labs/the-fab-charter/. [Accessed: 02-May-2015].

[17] N. Gershenfeld, "How to Make Almost Anything: The Digital Fabrication Revolution," *Foreign Aff.*, vol. 91, 2012.

[18] The Fab Foundation, "Fab Labs around the world," 2015. [Online]. Available: http://www.fabfoundation.org/fab-labs/. [Accessed: 02-May-2015].

[19] C. Guthrie, "Empowering the hacker in us: a comparison of fab lab and hackerspace ecosystems," in *5th LAEMOS Colloquium (Latin American and European Meeting on Organization Studies)*, 2014.

[20] D. Dougherty and C. Hardy, "Sustained Product Innovation in Large, Mature Organizations: Overcoming Innovation-To-Organization Problems.," *Acad. Manag. J.*, vol. 39, no. 5, pp. 1120–1153, Oct. 1996.

[21] E. M. Olson, R. Cooper, and S. F. Slater, "Design strategy and competitive advantage," *Bus. Horiz.*, vol. 41, no. 2, pp. 55–61, Mar. 1998.

[22] G. Ekvall, "Organizational Conditions and Levels of Creativity," *Creat. Innov. Manag.*, vol. 6, no. 4, pp. 195–205, Dec. 1997.

[23] M. F. Peschl and T. Fundneider, "Spaces enabling game-changing and sustaining innovations: why space matters for knowledge creation and innovation," Sep. 2012.

[24] D. Schuurman, B. Baccarne, F. Kawsar, C. Seys, C. Veeckman, L. De Marez, and P. Ballon, "Living labs as quasi-experiments: results from the Flemish LeYLab," *XXIV ISPIM Conference : Innovating in Global Markets: Challenges for Sustainable Growth*. 2013.

[25] B. Dutilleul, F. A. J. Birrer, and W. Mensink, "Unpacking European Living Labs: Analysing Innovation's Social Dimensions," *Central European Journal of Public Policy*, vol. 4, no. 1. pp. 60–85, 15-Jul-2010.

[26] R. W. Woodman, J. E. Sawyer, and R. W. Griffin, "Toward a theory of organizational creativity," *Acad. Manag. Rev.*, vol. 18, no. 2, pp. 293–321, Apr. 1993.

[27] N. Skiba, L. Dupont, L. Morel, and C. Guidat, "A space for innovation process acceleration, supporting collaborative citizens workshops," in *2012 18th International ICE Conference on Engineering, Technology and Innovation*, 2012, pp. 1–9.

[28] C. Veeckman, D. Schuurman, S. Leminen, B. Lievens, and M. Westerlund, "Characteristics and their outcomes in living labs: a Flemish-finnish case study," *XXIV ISPIM Conference : Innovating in Global Markets: Challenges for Sustainable Growth*. 2013.

[29] M. F. Peschl and T. Fundneider, "Designing and Enabling Spaces for collaborative knowledge creation and innovation: From managing to enabling innovation as socio-epistemological technology," *Comput. Human Behav.*, vol. 37, pp. 346–359, Aug. 2014.