Management of innovation laboratories: An enabling methodological approach for strategic intention design

Ferney Osorio Bustamante

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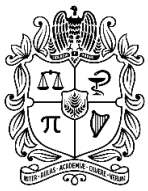

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Ferney Osorio Bustamante

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We are committed to doing good work that minimizes suffering and brings appreciable, positive impact through the collaborative character of our work.

Hilary Bradbury

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Abstract

Since several years now, there has been a proliferation of prodigious spaces for fostering creativity and innovation. Governments, companies, universities, and communities have turned to the implementation of innovation labs as the places where innovation processes are expected to be enhanced through open and agile forms of collaboration. However, there are concerns on how the lack of a clear and shared strategic intent undermines the innovation labs' purpose and how these initiatives struggle to share and align their strategic intent with all the stakeholders. Thus, this dissertation, following an action research approach under multiple research settings, aims to explain how the strategic intent of innovation labs is built and can be used to guide their performance. Throughout this thesis, innovation labs are recognized as intermediary organizational forms created to support and facilitate the innovation intent in multi-stakeholder contexts. Moreover, it is also addressed how innovation lab settings require sensemaking and feedback processes that allow them to create and maintain a strategic alignment among their stakeholders. Accordingly, this work focuses on the design of mechanisms that enable (1) the representation of the constituent elements of the organizational strategic intent of an innovation lab, (2) understanding how this intent unfolds over time and the stages it goes through, and (3) the identification of competences and roles within innovation lab teams that help to navigate the innovation lab intent. Altogether, they constitute a methodological approach to support strategy making processes in such collaborative environments.

Keywords: innovation lab, strategic intent, strategic management, multi-case study, action research, assessment.

Resumen

Título en español: Gestión de laboratorios de innovación: Un enfoque metodológico orientado al diseño de la intención estratégica

Desde hace varios años ha habido una fuerte emergencia de lugares predilectos para fomentar la creatividad y la innovación. Gobiernos, empresas, universidades y comunidades están optando cada vez más por la creación de laboratorios de innovación con el objetivo de facilitar los procesos de innovación mediante formas de colaboración abiertas y ágiles. Sin embargo, existe la preocupación de cómo la falta de una intención estratégica clara y compartida afecta al propósito de los laboratorios de innovación y cómo estas iniciativas luchan para lograr una intención estratégica compartida y alineada con todas las partes interesadas. Siguiendo un enfoque de investigación-acción con varios escenarios de investigación, esta tesis busca explicar cómo se construye la intención estratégica de los laboratorios de innovación y cómo puede utilizarse para guiar el funcionamiento de estos laboratorios. En esta tesis, los laboratorios de innovación se reconocen como formas organizativas intermediarias creadas para apoyar y facilitar la intención de innovación en contextos de múltiples partes interesadas. Además, también se aborda cómo la gestión de los laboratorios de innovación requiere procesos de creación de sentido y retroalimentación que les permitan crear y mantener una alineación estratégica entre sus partes interesadas. En consecuencia, este trabajo se centra en el diseño de mecanismos que permitan (1) la representación de los elementos constitutivos de la intención estratégica organizativa de un laboratorio de innovación, (2) la comprensión de cómo evoluciona esta intención a lo largo del tiempo y las etapas por las que esta pasa, y (3) la identificación de competencias y roles dentro de los equipos de los laboratorios de innovación que ayudan a navegar la intención del laboratorio de innovación. Estos resultados en su conjunto constituyen un enfoque metodológico para apoyar los procesos de elaboración de estrategias en estos entornos de colaboración.

Palabras clave: laboratorio de innovación, intención estratégica, gestión estratégica, estudio de casos múltiples, investigación-acción, evaluación.

Résumé

Depuis plusieurs années, les espaces propices à la créativité et à l'innovation se multiplient. Les gouvernements, les entreprises, les universités et les communautés se sont tournés vers la mise en place de laboratoires d'innovation comme lieux où les processus d'innovation sont censés être améliorés par des formes de collaboration ouvertes et agiles. Cependant, il existe des préoccupations concernant le fait que l'absence d'une intention stratégique claire et partagée fragilise la finalité des laboratoires d'innovation et que ces initiatives peinent à faire converger et à partager leur intention stratégique avec toutes les parties prenantes. Par conséquent, cette thèse, en suivant une approche de recherche-action dans plusieurs contextes de recherche, vise à expliquer comment l'intention stratégique des laboratoires d'innovation est construite et peut être utilisée pour guider leur performance. Dans cette recherche, les laboratoires d'innovation sont reconnus comme des formes organisationnelles intermédiaires créées pour soutenir et faciliter l'intention d'innovation dans des contextes multi-acteurs. En outre, il est également abordé la manière dont les laboratoires d'innovation requièrent des processus de prise de conscience et de restitution qui leur permettent de créer et de maintenir un alignement stratégique parmi leurs parties prenantes. En conséquence, ce travail se concentre sur la conception d'outils qui permettent (1) de représenter les éléments constitutifs de l'intention stratégique organisationnelle d'un laboratoire d'innovation, (2) de comprendre comment cette intention se déploie dans le temps et les étapes qu'elle traverse, et (3) d'identifier les compétences et les rôles au sein des équipes du laboratoire d'innovation contribuant à guider l'intention du laboratoire d'innovation. L'ensemble de ces résultats constitue une approche méthodologique pour accompagner les processus de conception de stratégies au sein des espaces collaboratifs.

Mots-clés : laboratoire d'innovation, intention stratégique, gestion stratégique, étude de cas multiples, recherche-action, évaluation.

Table of contents

List of figures

Pág.

List of tables

1. Introduction

This thesis has been developed in the midst of important socio-technological changes and transformations: the fourth industrial revolution or digital transformation, the COVID-19 pandemic and the climate change crisis have been major events in recent years. Digital transformation and technology democratization are enabling the creation of new business models that lead to new ways to connect, share and create value. Likewise, values such as trust, transparency and openness are becoming more and more present at all socio-economic instances by means of modern collaboration. And at the same time, the environment reminds us how vulnerable our planet is and the responsibility we have as a species to overcome our differences and preserve the future of our ecosystems. These are just some of the characteristics of this transformative moment we are living through, which challenges the traditional foundations of modern society. Precisely, it is through the emergence of new organizational forms the way we can bring out our collective responsibility to lead the evolution of our communities, business and territories.

This thesis offers a novel perspective on how innovation is managed and what it means to develop a mindset to facilitate innovation. The research work presented through this dissertation focuses on the study of innovation laboratories (hereafter, innovation labs) as new organizational forms dedicated to support systemic rethinking, experimentation and proposition of solutions to the complex challenges we face as a society. And how the creation of these inspirational and inclusive places revitalizes the collective sense of people within an organization, a neighborhood, a campus or a territory. Yet, the idea of creating a unique place to innovate and become a beacon of change is not simply a matter of allocating a sophisticated or technologically advanced facility with a catchy name.

The use of narratives such as “change”, “a better future”, “openness”, “inclusion”, “doing things differently”, “social transformation”, and “innovation” are very powerful rhetoric that

can be easily appealing to people in search of hope for a better tomorrow, partners who are open to reinventing their institutions, or even governments willing to include new voices and knowledge in order to reorient traditional political dynamics. This all adds up to very high expectations channeled through a symbolic place in the hope of generating significant changes in our nearby realities. Nevertheless, the belief that systemic changes can be achieved by simply putting everyone together with some resources, ignoring the complex and emotional nature of any creative and collective process, often lead to major frustrations and abrupt ruptures.

Therefore, appealing to people's aspirations under the promise of generating positive change and building a better future requires more than just a top-down directive or the setup of technological infrastructure. In fact, it is about the orchestration of social challenges, ambitions and personalities, together with the knowledge, skills and tools to create a virtuous circle of experimentation, learning and resilience. That is what has been witnessed with the "labification" phenomenon all over the world. Innovation labs, fablabs, makerspaces, living labs, design factories, hackerspaces are just a few examples of the great diversity of spaces that governments, companies, universities and communities have been creating with the intention of realizing their will to innovate. Regardless of the growing popularity of such initiatives in the last decade, they are still a recent and under-researched phenomenon.

The motivation for this thesis lies largely in the personal and professional experience of this author. I had the opportunity to be part of the design, implementation and to lead the operation of ViveLab Bogotá (today called Lab101) between the periods of 2012-2014 and 2016-2018, one of the first innovation lab initiatives in Colombia, promoted by the national government, the Bogotá district government and the Universidad Nacional de Colombia. In addition, I have been associated with the Lorraine Fab Living Lab® (LF2L) of the Université de Lorraine in France first as an intern between 2014 and 2015, and then as a doctoral student since 2018. Both experiences have allowed me to experience firsthand the benefits and challenges of managing this type of initiative in two completely different contexts, but equally complex in terms of the fundamental challenges we face as a society.

Accordingly, this dissertation is not intended as a theoretical discussion only, but rather a compilation of a constant work of reflection and contrast between theory and practice, observation and experience, and the individual and the collective work with both my supervisors and my fellow colleagues who were involved in this research. This way, the contributions of this research are the results of all the readings, observations, ideations, discussions and criticisms of people who are passionate about the collaborative work and who believe that innovation labs can be a catalyst for empowerment and social change.

The remainder of this introductory chapter presents a synthesis of the theoretical arguments underlying this research, explains the research problem and its relevance as well as the research question that guides this work. Next, the methodological approach is described and the main contributions of the thesis are listed together with the general structure of the manuscript.

1.1 Research background

In a world of dramatic and rapid technological changes that are constantly transforming our society at all levels, people have been looking for special places of inspiration and empathy that trigger their collective desire to act and improve things in their environment. Privileged conditions for this to happen are emerging around the world through new organizational forms that are conceived as safe places, where creativity is ignited and innovation processes enhanced through open and agile forms of collaboration (Morel et al., 2018). For some years now, governments, companies, universities and even communities have been turning to the implementation of such organizations through the notion of innovation lab, as iconic places where a sense of belonging, shared learning, and the spark to create new solutions can be found (Acevedo & Dassen, 2016; Bloom & Faulkner, 2016).

With the purpose of fostering collective intelligence, guided by a sense of trust and collaboration, innovation labs emerge as particular organizational forms that provide neutral and stimulating environments for all related actors to interact (Dupont et al., 2019; Morel et al., 2018). With their high-tech equipment, inspiring indoor designs and enabling cultures, they are often embodied as dedicated facilities managed by passionate teams devoted to

enhancing creative behavior and facilitating the innovation process (Moultrie, Nilsson, et al., 2007). Indeed, the importance of the innovation lab phenomenon relies on their intermediate nature that contributes to mediating the challenges of uncertainty and complexity of innovation processes (Howells, 2006; M. Lewis & Moultrie, 2005).

The range of operations of an innovation lab is wide and flexible and can cover the whole process of innovation from idea generation and evaluation, prototyping and testing of solutions, through to implementation and feedback acquisition (Memon & Meyer, 2017). Their functional roles may vary from providing assistance to business organizations in the development of new products or services, or the improvement of existing ones (Memon et al., 2018), to supporting entrepreneurial activities in university environments (Delgado et al., 2020; Pittaway et al., 2019), or to designing crowdsourced solutions for addressing issues of public interest and delivering public services (Carstensen & Bason, 2012). However, despite their popularity, innovation labs around the world are struggling to keep up and running. Cases like the closure of MindLab in Denmark and of the Laboratorio para la Ciudad in Mexico are proof that maintaining and sustaining an innovation lab is a challenge that goes beyond well-meant intentions since they are in fact very sensitive to changes in leadership, to the lack of understanding of what they can really offer and to abrupt shifts in priorities due to changing policies (Apolitical, 2019).

This should be no surprise, as innovation labs are semi-autonomous organizations that are shaped by their local context and their team experiences. But despite their relative freedom to supporting innovation projects, they still need to respond to their partners' interests and goals (Gryszkiewicz et al., 2016; Tõnurist et al., 2017). This is the reason why authors have started to raise awareness of the importance of strategic alignment and shared values in the management of innovation labs. While lab management teams are constantly striving to create favorable conditions for creativity and innovation to happen (e.g., collaborative culture, non-hierarchical interactions), at the same time they are often embedded in rigid and traditional environments, driven by broader political and economic interests (Klooker et al., 2015; Osorio Bustamante et al., 2016). This is especially important as lab teams today need to strike a balance between users' needs and stakeholders' interests, maintaining a

certain degree of autonomy, while also trying to ensure their financial sustainability (Jezierski et al., 2014).

This global issue should be of interest as embarking on the adventure of creating an innovation lab often involves dealing with substantial financial issues and great difficulty in getting the best out of it (Moultrie, Nilsson, et al., 2007). Because of their relative novelty and mediating nature, they are difficult to understand, manage and value their results (Howells, 2006; M. Lewis & Moultrie, 2005). Thus, the motivation to pursue this topic is to contribute to the comprehension of this phenomenon and to provide managers, academics and interested parties with practical knowledge and useful tools for the design and management of innovation labs.

1.2 Research problem and goal

According to Lewis and Moultrie (2005), innovation labs are the embodiment of the will of a group of people or organizations to create a favorable environment to encourage creative behavior and support innovation processes. However, Lewis and Moultrie's propositions are mainly grounded on the idea that the innovation lab belongs to a single parent organization dedicating its operation to reinforce the institutional commitment to creativity and innovation. Nonetheless, today's context and the way in which innovation labs have been evolving are much open, collaborative, multistakeholder and social. Consequently, innovation labs are today increasingly used for the implementation of collaborative processes and experimentation that ultimately seek to strengthen people's and stakeholders' innovative and technological competences while fostering the creation of new solutions to demanding challenges (Mortara & Parisot, 2016).

If the aforementioned is true, this means that the people in charge of assuring the functioning of such places find themselves in a conjunction of expertise, cultures, mindsets, and interests that change depending on the project or activity that takes place (Rayna & Striukova, 2019). Innovation lab teams need therefore to be able to deal with constant conditions of uncertainty and complexity (Osorio et al., 2020). In this regard, scholars have already raised concerns on how the lack of a clear thematic focus and a shared intent

among its stakeholders undermines the innovation lab purpose (Moultrie, Nilsson, et al., 2007; Osorio, Dupont, Camargo, Palominos, et al., 2019). In fact, past experiences have shown that innovation labs need to adapt rapidly without losing their thematic focus and continuously share and align their strategic intent with all the stakeholders (Veeckman et al., 2013).

This is why Moultrie, Nilsson, et al. (2007) assign a fundamental role to the existence of an underpinning strategic intent, so a desired innovation lab initiative does not become a vacuous space with a superficial focus. In addition, given the conjunction of interests, mindsets, cultures and expertise that often collide in today's more open and social innovation labs, it is of paramount importance to not only use intent to provide a meaningful purpose but to help ensuring strategic alignment over time (Osorio et al., 2020; Rayna & Striukova, 2019). Defining a strategic intent is indeed a proactive mode in strategy-making, providing a north for everyone in an organization from which resources, competences and evolutionary processes are then guided (Hamel & Prahalad, 2005). Although it is well-known that strategy-making processes are key to successful innovation endeavors (O'Shannassy, 2016), there is a lack of understanding of how these processes are carried out within collaborative innovation structures as innovation labs. Even though concerns have been raised about the importance for collaborative structures to have a clear thematic focus and shared intent for their success, literature is scarce in how strategic intent is built within an innovation lab.

Thus, the research question of this dissertation is:

How can strategic intent be built and used in order to guide innovation lab performance?

To tackle this research question, the theory on strategic intent is used. According to (Mantere & Sillince, 2007), strategic intent can be used to create cohesion, by acknowledging the multiplicity of intents in an organization in order to orient efforts towards a common north. In fact, the potential of using strategic intent as a tool for creating coherence among multiple intentions lies in making strategic decisions understandable and communicable all the way from their conception to their implementation. Likewise,

understanding how the temporal unfolding of strategic intent helps to reorder past experiences and enable retrospective sense-making. Therefore, it seems reasonable to propose a tool to help guide the intent building of an innovation lab initiative.

In any case, given the relative novelty of this phenomenon as a research field, relying solely on the existing body of literature may be insufficient. Moreover, the idiosyncratic nature of this type of initiative has led to a significant diversity of labs, management practices and results (Gryszkiewicz et al., 2016; Memon et al., 2018; Morel et al., 2018; Schaeffer, 2017). Then, the idea of capturing good practical knowledge using an iterative and mixed-method process as applied by Moultrie, Clarkson, et al. (2007; 2006) seems pertinent in this case. Following this, it is possible to think that, *if at the nascent stage of an innovation lab initiative there is a way of assessing the proper environment for the intended goals, the outcomes of such strategic intent might be better oriented*. Likewise, *if during this process, the way the lab is used and how its intent changes is unfolded, certain guidelines could be established for lab teams to reorient or adapt their strategy*.

Based on the above, the objective of this research is to propose an enabling methodological approach for the design of strategic intent of innovation labs. The aim is to build a set of tools in which researchers and practitioners can find a compendium of practices and experiences in the way innovation labs have been implemented to build their own strategy. The outcome of this thesis shall ideally lay the foundations for new management tools in strategy and innovation. Further, the contributions of this work should add to the scientific discussion on the strategic management of innovation intermediaries and collaborative innovation processes; innovation labs are undoubtedly privileged settings for knowledge sharing and community empowerment.

1.3 Methodology

1.3.1 Action research approach

The purpose of this work is fundamentally practical and action-oriented. I personally hope that in addition to contributing to scientific knowledge, the contributions of this thesis can

be used, reproduced or adapted by practitioners and academics in their own context. Considering this motivation and several reasons, we decided to undertake this study using an action research approach. According to Susman & Evered (1978) action research contributes both to solve problematic situations in society in a practical way, to the generation of scientific knowledge and to develop people's competences facing such problems, all in a collaborative way and under a mutually accepted ethical framework.

Acting under an action research approach means that the researcher is sensitive to not only understand the complexity of the challenges we have as a society, but that our actions as researchers and our influence on stakeholders contributes to democratize knowledge, research processes, strategy implementation and evaluation (Bradbury, 2015). I believe that innovation labs are a fundamental tool for the empowerment of communities and the activation of collective intelligence. In the same way, the action research perspective recognizes and draws on both our experience as researchers and our participation in the process (Bradbury, 2015; Vickers, 2005). This allowed me to embrace my experiences in the ViveLab Bogotá and the LF2L not as a source of bias but as a catalyst for a continuous cycle of interpretation, analysis and proposition of alternatives.

Good action research happens when it is done with, and not about, people (Bradbury, 2015; Susman & Evered, 1978). This work also represents the knowledge generated with co-researchers and participants throughout the different stages of this research. Although this dissertation is presented as a degree requirement of this author, it is to a substantial extent a compilation of knowledge built from multiple sources. The findings and discussions resulting from the contributions of respondents, interviewees and workshop participants are evidence of this. Such diversity in collaboration can also be seen in the diversity of co-authors (besides my supervisors) with whom I had the opportunity to work on the publications resulting from this thesis (see section **8.1**).

Another aspect worth pointing out is the iterative and evolutionary manner in which this work was developed. While the way in which this document has been structured seeks to facilitate its reading through a consistent narrative that illustrates all the learning and results of this project, its development was actually much more uncertain and progressive,

discovering and connecting new opportunities along the way, guided by preliminary results and conjectures.

First, a hypothetic-deductive approach was used in order to draw from existing literature to identify key issues that would help explain how innovation labs operate and are managed (see Chapters **2** and **3**). Eventually, this led to the establishment of a conceptual framework based on existing knowledge to be applied in an international survey that would give form to the first prototype of an assessment tool (see Chapter **5**). Results and feedback from participants suggested several areas for improvement of the tool, but also indicated its usefulness. However, at this point the research would take an important turn. The limitations of a method such as an online survey only allowed for a partial appreciation of the phenomenon.

Although the preliminary results reinforced our assumption about the strategic issues of an innovation lab, they did not allow us to really appreciate what goes on “behind the scenes” in the management of such organizational forms. Therefore, during the second half of this research, efforts were mostly dedicated to conducting a multiple case study with three of the laboratories surveyed (see Chapters **4** and **6**). The intention was to inquire deeper into the reasons that gave life to the lab, how it was embodied and is currently used, and to what extent its role within the organization has changed over time. This new approach proved to be much more demanding than expected, but it was also very enriching when it came to identifying possible explanations to the research problem and generating new propositions.

Finally, a major collaboration opportunity came up in the last part of the development of this thesis: Climate Labs – an Erasmus+ project between Europe and Latin America aimed at the capacity building for the implementation of social innovation labs for climate change in 10 Latin American universities. The Climate Labs project was still ongoing at the time of writing this manuscript and therefore not all its results were included, but it represented a very valuable terrain to expand the scope of this research. The Climate Labs project not only allowed us to put into practice (in another context) the knowledge acquired, but also enabled us to continue learning and to develop the last contribution of this thesis. This was

the scenario to explore which roles and competences are key in the conformation of innovation lab teams (see Chapter **7**).

Overall, this experience was a challenging journey of reflection and growth in both personally and professionally. Indeed, this dissertation required being able to use multiple methods, to see the experiences not only through theory but from the point of view of the participants and to develop useful knowledge during that process (Vickers, 2005).

1.3.2 Multimethodology design

Ensuring that the choice of research methods fits the research problem in such a way that scientifically valid explanations and constructs can be produced is one of the main concerns of working under an action research approach (Baskerville & Wood-Harper, 1996). Particularly in this thesis, having a coherent but flexible methodological guideline to orient the selection of methods was very important. Since this research involved three different fields of action (international survey, multiple case study and competence self-assessment workshop) and not all of them were necessarily planned from the beginning, to maintain a consistent thread was a challenging task. Therefore, the multimethodology was chosen to guide the methodological development of this thesis.

A multimethodology design encourages exploration and combination of different methodologies, methods and tools in order to accomplish the research objectives (Mingers & Brocklesby, 1997). This approach, mainly used under the management science or operational research, acknowledges real-world problems as multidimensional situations (material, social and personal). Then, the use of different methodologies is proposed to deal effectively with the full extent of the real world. Moreover, combining multiple methods including those which perform similar functions can serve as a triangulation on the situation, helpful to generate new insights and more confident results (Mingers & Brocklesby, 1997). The final decision about which methods and techniques relies on the researcher (or research team) because it is ultimately their choice, and it reflects their personal skills, experience, values, and personality (Mingers, 2006).

The process of multimethodology covers the questions: What is happening? Why is it happening? How could the situation or explanation be different? And what shall we do? This is done through four stages (Mingers & Brocklesby, 1997; Peña-Reyes, 2010):

- Once the research problem has been identified, the process starts with the *appreciation* of the situation. This involves the identification of the concerns to be addressed, constraints, boundaries, conceptualization and the design of the study, and the retrieval of initial data based on observation, surveys, interviews, experiments or qualitative approaches.
- Next, the information produced is *analyzed* so it helps to understand and explain why the situation is as it is. The main goal here is to identify hypothetical structures or mechanisms that would produce the phenomena that have been experienced, measured, or observed.
- Followed this, the proposed explanations are *assessed* in terms of effects, alternative possible explanations, interpretation of the results and inference to other situations. This will lead to the identification of the appropriate structure or mechanism.
- Lastly, the multimethodology encourages practitioners to undertake the *actions* that will effectively bring about agreed changes.

Following the guidelines of the multimethodology, a set of methods and techniques were applied (Table **1-1**). As mentioned in the previous section, the development of this research was not linear, so the methodological design was subject to several modifications. This also required for the researcher to be able to switch between modes of appreciation, analysis, assessment, or action. Yet, according to the three main moments (or iterations) of this research, it can be said that three methodological "sub-designs" were followed. Methods and techniques listed in Table **1-1** in *blue* color correspond to the first part of this research related to the development of the assessment tool and applied through an international survey which are further explained and developed in Chapters **2**, **3** and **5**. Below, in *purple*, are those that were applied in the second part and that correspond to the multiple case study presented in Chapters **4** and **6**. And finally, in *orange* are those used in the competence-based role model discussed later in Chapter **7**.

Table 1-1: Thesis multimethodology design

	Appreciation	Analysis	Assessment	Action
Social World	Literature review & bibliometric content analysis International survey Literature review Multi-case study research: • Participant observation • Archival Data Literature review	Framework comparison Cross-case analysis Role model comparison	Updated framework Maturity grid Strategy-oriented assessment tool Strategic intent stage-model Competence-based role model	International survey Self-assessment & retrospective workshop
Personal World	International survey Literature review Multi-case study research: • Semi-structured interviews Literature review	Cross-case analysis Role model comparison	Strategic intent stage-model Competence-based role model	International survey Self-assessment & retrospective workshop
Material World	Literature review & bibliometric content analysis International survey Multi-case study research: • Participant observation • Archival Data	Framework comparison Cross-case analysis	Updated framework Maturity grid Strategy-oriented assessment tool	International survey

1.4 Contributions

The goal of this dissertation is to propose a methodological approach for the strategic design and guiding of the innovation lab initiatives. Along with my supervisors, we expect that results from this work can bring forward research on the design and management of

collaborative innovation environments such as innovation labs and innovation intermediaries in general. This is achieved by several contributions:

1. An updated perspective on innovation labs as key organizational forms for the intermediation of (increasingly open and social) innovation ecosystems and their focus on innovation process facilitation.
2. Consolidation of innovation lab management research building upon the initial propositions made by Lewis & Moultrie (2005), Moultrie, Nilsson, et al. (2007) and Magadley & Birdie (2009) to establish an updated conceptual framework for representing the strategic intent of innovation labs.
3. Operationalization of the 5 blocks and 30 criteria of the conceptual framework through a strategy-oriented assessment tool for innovation labs consisting in a maturity grid and a multilingual online questionnaire.
4. Demonstration of the evolutionary nature of an innovation lab and the underlying stages of its organizational strategic intent.
5. Both the strategy-oriented assessment tool and the intent stage model constitute the fundament for a methodological approach for the collective design and orientation of innovation lab intent.
6. Construction of an ad-hoc methodology to support the conformation of innovation lab teams consisting of a competence-based role model, a self-assessment tool and a retrospective workshop.

1.5 Thesis structure

As illustrated in Figure **1-1**, this thesis is structured in 8 chapters organized in two parts:

First, Chapter **1** is introductory and presents the main motivations and background of this research, as well as the research problem and methodological considerations.

Then, the first part constitutes the full extent of the theoretical background. Chapter **2** introduces the concept of innovation lab, its origins and related concepts and provides an overarching view on the research of innovation labs by means of a bibliometric analysis.

Chapter **3** narrows the discussion specifically to the design and management of innovation labs highlighting what scholars have contributed to this regard. Next, Chapter **4** closes the theoretical part by developing the strategic intent concept and exploring how it can be applied in this research.

The second part gathers the main contributions of this work. Chapter **5** establishes the theoretical framework from which the strategy-oriented assessment tool is built and tested via an international survey. Results are used to discuss the potential of the tool to assist in the assessment and understanding of innovation lab intent. Following this, Chapter **6** sets up a multi-case study on three innovation labs and illustrates how innovation labs evolve. Discussing the results lead to the proposition of an innovation lab intent stage model. Then, Chapter **7** is focused on the development of a competence-based role model for the conformation of innovation lab teams which is subsequently tested with ten nascent lab teams in Latin American universities.

Lastly, Chapter **8** is dedicated to concluding remarks. This chapter gathers the main contributions and implications of this research. It ends with a discussion in terms of the limitations and future research paths.

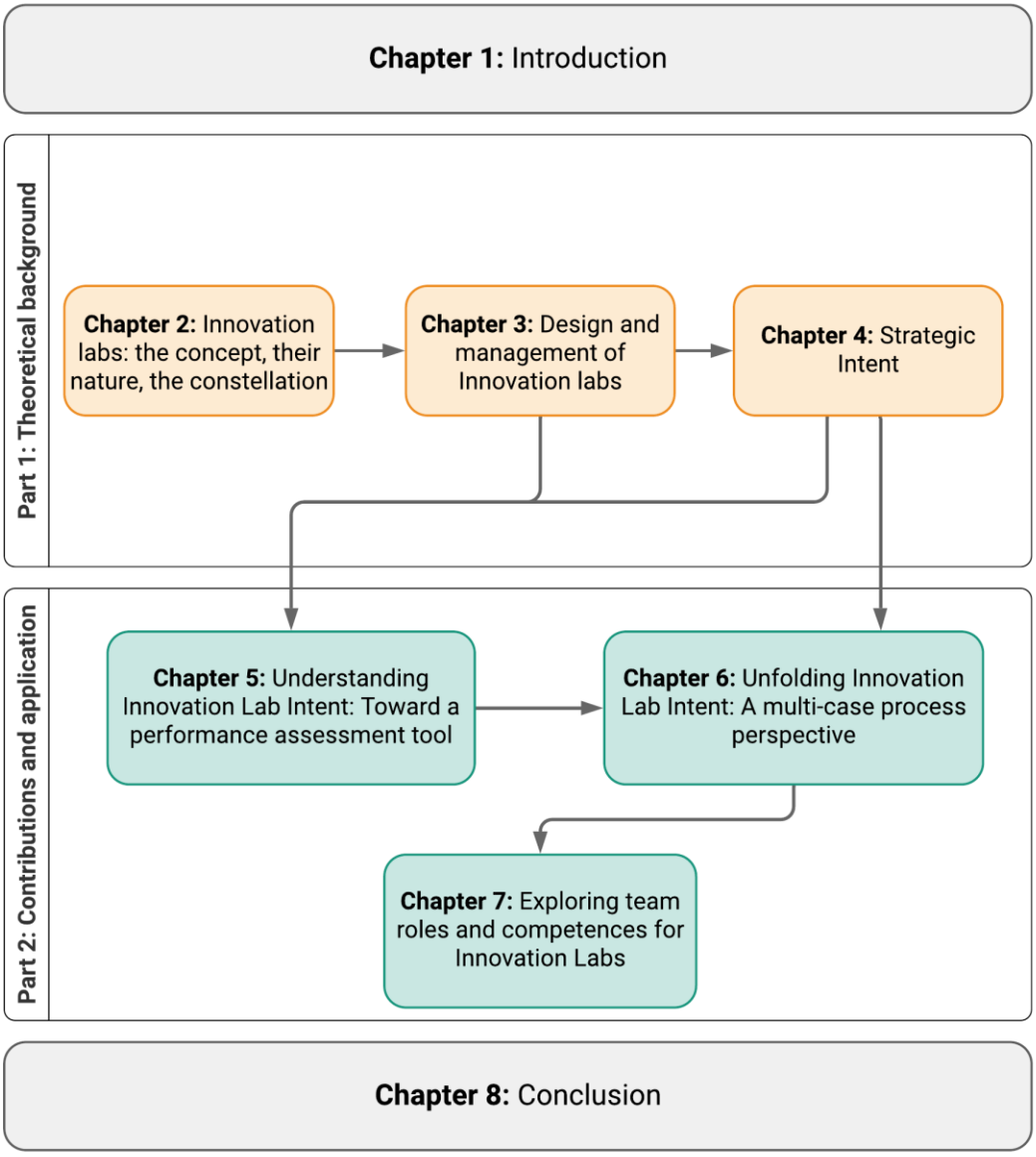


Figure 1-1: Structure of the document

2. Innovation labs: the concept, their nature, the constellation

In recent years, the idea of having "our own lab" as a tangible way to manifest "an organization's desire to innovate" has become widely spread. This idea, which has been and continues to be replicated by governments, companies, universities and communities all around the world, has led to multiple interpretations and a significant proliferation of labels and practices. This chapter is intended to offer a comprehensive view to the innovation lab concept, its origins and how has evolved in the scientific literature over the last two decades. The intermediary nature of the innovation lab phenomenon is also explored, which allows for a broader picture about the relevance of research in innovation labs to assist in the facilitation of the innovation process. Finally, by means of a bibliometric analysis, trends in the research on innovation labs are identified, leading to the construction of a research agenda in the management of innovation labs.

2.1 The nature and definitions of the innovation lab phenomenon

Amid a variety of definitions, innovation labs are defined as dedicated organizational forms for the facilitation of innovation processes through uniquely designed environments, creative and inspiring cultures, and high-tech facilities (M. Lewis & Moultrie, 2005; Magadley & Birdi, 2009; Moultrie, Nilsson, et al., 2007). They are considered semi-autonomous organizations within real complex contexts allowing all related actors to interact under a "somewhere else feeling", away from everyday problems, with the purpose of creating communities of knowledge, strengthening people's innovative and technological competences and imbuing values of sharing and collaboration towards a common objective

or project (Gryszkiewicz et al., 2016; Morel et al., 2018; Mortara & Parisot, 2016). However, despite being relatively recent, this phenomenon has been studied for several years and has been addressed from different perspectives, giving rise to important contributions that help to understand its nature and diversity.

Early studies on innovation labs focused on the ideal environments for promoting a creative climate and how the physical design should reflect that purpose (Ekvall, 1997; Kristensen, 2004; Snead & Wycoff, 1999). Later, by studying three cases from the corporate, government and university sectors in the UK, Lewis & Moultrie (2005) introduced the organizational dimension of this kind of physical spaces. They argued that the benefits of innovation labs go beyond specific outcomes and consist in fact of a learning process for both the individuals, groups or projects and their parent institution. In addition, they also discovered that these benefits appear to be closely related to the specific application and operational context. This means that in a small organization with an already creative culture, these results could be more easily welcomed and valued. While in the more reluctant and larger corporations or government institutions, the process may be more difficult.

Moultrie, Nilsson, et al. (2007) then synthesized their experiences in innovation labs in the private sector into a conceptual framework. In this case, the innovation lab is considered part of the company's innovation strategy and therefore its operation should always be aligned with this purpose. Meanwhile, Magadley & Birdi (2009) showed, through a single case study in the public sector, why creative outcomes, human-technology interaction, and group facilitation are equally important as considering the overall context around the lab. This was to be expected, as new paradigms began to change the way innovation was understood - open and democratized - (Chesbrough, 2006; von Hippel, 2005), as was the case of innovation labs. In that sense, Dupont (2009) argued that the key pillars for collaborative environments are the participation of end-users, the involvement of multiple stakeholders and the attitude toward collaboration. The composition of the innovation labs and their operating scenarios were becoming increasingly complex.

More recently, studies have continued to show the diversity and idiosyncrasy of this issue. On the one hand, there are those focused on the physical embodiment and spatial

configuration in different conditions, such as Knoll Workplace Research (2013), Kallio et al. (2015) or Klooker et al. (2019). On the other, there are studies providing insights into how the innovation process is actually facilitated and how this facilitation could be improved. This has led to contributions on the impacts on human development (Stercken, 2015), the challenges of implementation in ambidextrous organizations (Schaeffer, 2017), how they perform in the financial industry (Fecher et al., 2020) and whether they can contribute to solving wicked problems (Zivkovic, 2018). Studies such as the one by Memon and Meyer (2017) have also made an important contribution by characterizing the activities that innovation labs have been undertaking and showing that the spectrum of innovation lab services is in fact so diverse that they cover the entire innovation process, but that they do so by specializing only in some of them, according to their own niche.

In any case, innovation labs are not the only concept in the literature that is used to explain the emergence of enabling structures for mediating innovation processes. Alongside this phenomenon, concepts such as Living Labs, FabLabs, Makerspaces, Hackerspaces, Coworking spaces or even Third Places have also positioned themselves as tangible manifestations of the will to create favorable environments to support innovation. When looking at these concepts in a holistic way, previous studies have focused on establishing the differences between these innovation structures by contrasting experiences and conducting classifications (Capdevila, 2013; Schuurman & Tõnurist, 2016) while others more recently, have opted to analyze what they have in common. For instance, Leminen et al. (2019) concluded, after analyzing 48 cases in the urban context, that despite being understood from different points of view, they may all be seen as an embodiment of each other. Moreover, Memon et al. (2018) based on 21 cases, showed how innovation labs seem to be functioning analogously to living labs, fablabs, coworking spaces, and the like. In this research, we therefore look at the vein of innovation labs as an integrating construct that helps us to address the “labification” phenomenon through its different structures, set-ups, and practices.

Despite the increasing popularity of the innovation lab phenomenon among scholars, practitioners and policy makers, it is important to revisit the theoretical foundations behind this concept. Accordingly, the following section explores notion of innovation intermediaries

as an umbrella term for those organizational forms that support any aspect of the innovation process between multiple actors.

2.2 Innovation labs as the facilitators among the intermediaries of innovation

The challenges often posed by the uncertainty and complexity of innovation processes have led to the creation, consolidation and general recognition of innovation intermediaries (Kivimaa et al., 2019; van Lente et al., 2003). Such connotation has historically been used to refer to a number of actors such as brokers, third parties or agencies, as a way of bringing together all the entities that support the innovation process (Howells, 2006). Over time, this perception has evolved from mere supporters to facilitators and even to be considered carriers of innovation (Howells, 2006; Katzy et al., 2013). In general terms, innovation intermediaries are recognized for seeking to improve innovation capacity. This is usually done through inter-organizational networking, technology development and financing activities aimed at reducing the innovation gap among the actors of an innovation ecosystem (Dalziel, 2010).

Intermediaries act as bridges in situations where multi-stakeholder interactions are challenging, finding suitable partners to collaborate with is difficult or dialogue becomes problematic due to differences in culture, interests or capabilities for knowledge exchange (Kivimaa et al., 2019). This means that innovation intermediaries are attributed a wide spectrum of functions and roles such as foresight and diagnostics, scanning and information processing, knowledge processing and combination/recombination, gatekeeping and brokering, testing and validating, accreditation, validation and regulation, protecting results, commercialization or evaluation of outcomes (Howells, 2006). This continuum of activities has led scholars to investigate and postulate typologies of innovation intermediaries based on their organizational nature, size, scope or the role they play in an innovation ecosystem.

In this sense, van Lente et al. (2003) distinguished three types: *hard intermediaries* referring to those organizations who provide technical possibilities and engage in the transfer of technology and technical knowledge such as scientific parks or innovation districts; *soft*

intermediaries referring to organizations who contribute to develop and implement business strategies, knowledge and skills such as chambers of commerce, incubators or accelerators; and *systemic intermediaries* acknowledging those organizations focused on supporting the management of complex innovative projects, organizing discourse, alignment and consensus, and creating conditions for learning. In the same line, recently works such as the one of Agogué et al. (2017) have continued the efforts of synthesizing the core functions of intermediaries that bridge innovation gaps in innovation ecosystems. Drawing from the literature they identified four core functions: connecting actors; involving, committing, and mobilizing actors; solving, avoiding, or mitigating potential conflicts of interests; and actively stimulating innovation processes and outcomes. They particularly emphasize that stimulating innovation requires developing favorable conditions for learning and experimenting, enhancing feedback mechanisms and mutual adaptions, or in other words to create a place for collective innovation (Agogué et al., 2017; van Lente et al., 2003).

This is why, among innovation intermediaries, innovation labs are receiving increasing attention. Even though the idea of having a “lab” is not new at all, from the intermediaries standing point, laboratories were mostly seen as chambers or test beds whose main purpose were testing, validation and training (Howells, 2006). Nowadays, as new paradigms transform the way innovation is carried out, so the notion of laboratories as “mediators” of innovation has evolved to become active agents during the development phase of an innovation project (Katzy et al., 2013). This new conception of collaborative spaces is now representing new forms of organizational and systemic intermediation between the societal actors to stimulate innovation ecosystems (Memon et al., 2018; Mérindol et al., 2018). From then on, a whole set of innovation labs under different concepts and catchy labels have started to emerge all around the world.

2.3 The various manifestations of the lab phenomenon

In order to further understand how the research field on innovation labs is interconnected, it is important to first make a general review on some of the most influential concepts in the literature and in practice. Starting with *Living Lab*, it is the broadest and most developed

concept in the scientific domain. This notion of laboratory is defined as the place in which all stakeholders from public-private-people partnerships collaborate to create, prototype, validate and test new technologies, products, services or systems in real-life contexts (Hossain et al., 2019).

Alongside this are the spaces where sophisticated manufacturing technologies are available to non-specialists. *FabLabs* are also a very popular concept (and label) worldwide. Inspired by the maker movement, they are conceived as the cultural seedbed for sharing knowledge, experimenting with new technologies and exploring interdisciplinary projects while at the same time achieving personal achievement and enjoyment (Mortara & Parisot, 2018, 2016). Closely related are the *Makerspaces*, which are defined as open-access community workshops where members (known as makers) share digital fabrication tools and machines to design and make objects for professional benefit and hobbyist pursuits (Holm, 2015; Kohtala, 2018). In the same way, *Hackerspaces* appears as a place with a spirit of equality, non-profit and openness, where people share tools and ideas with a strong emphasis on digital technologies (Moilanen, 2012). As FabLab, Makerspace and Hackerspace are strongly influenced by the maker movement, they are frequently understood as the same kind of space.

The *Third-place* concept is also recently being used as a term associated with innovation, although this is not a new concept at all. Third places are usually described as social settings separated from the first place (home) and second place (workplace). In addition, they are given some characteristics as anchors of community life and promoters of creative interactions (Oldenburg, 2001). When these elements are compared to other innovative spaces is easy to see the similarities. That is the case of the *Coworking spaces* which are envisaged as the places for the "third way" of working, halfway between the well-delimited traditional workplace and independent working life as a freelancer, where the worker stays at home in an isolated way. This third way is known as 'coworking' to indicate the practice of working individually in a shared environment (Gandini, 2015).

Another well-known kind of lab, particularly in university contexts, are the so-called *Design Factories*. They are conceived as co-creation environments for learning, teaching, research,

and industry cooperation (Björklund et al., 2011; Laakso & Clavert, 2014). Nowadays, the Design Factory model has been consolidated as an international network of co-creation hubs with presence in countries such as Australia, China, Spain, Turkey, Colombia, Chile among others (Björklund et al., 2019). The Design Factory model has been operational since 2008 showing significant results in all of its strategic activities making this lab model a potential reference of rich methodological practices (Björklund et al., 2017). In addition, also closely related to academic contexts, there is the *open lab* concept. According to Mérindol et al. (2016) the open labs constitute a place and a multi-stakeholder process aimed at renewing innovation practices through collaborative and iterative actions. These practices are often associated with stimulating the generation of knowledge, facilitating cooperation between social actors or fostering creativity (Lépine & Martin-Juchat, 2020; Mérindol et al., 2018).

Moving forward, in the literature exists the notion of *Enabling space*, which addresses the mediation role in the innovation of such spaces as enabling rather than controlling. In this respect, innovation processes are seen as the creation of knowledge and hence, enabling spaces are conceived as multidimensional, in which social, cognitive, cultural, technological and other factors are considered (Peschl & Fundneider, 2014). Similarly, the concept of *Innovation space* has been used as an attempt of bringing together the main characteristics of the favorable spaces for innovation. Thus, they have been defined as physical environments that promote community, learning and making, providing opportunities to engage people and technologies, experience participatory culture and acquire modern skills (Stercken, 2015). However, the innovation space concept seems to go further and is used as much as in the overarching context in which knowledge creation occurs (Badilescu-Buga, 2013), as well as a knowledge-based urban development strategy (Pancholi et al., 2015).

Besides the plethora of definitions, innovation labs face the challenge of their impact may not be directly perceived due to their “intermediate” nature (Howells, 2006). Hence, it is especially important to understand how they perform and are sustained overtime so facilitation efforts and systemic changes can be achieved (Kant & Kanda, 2019). Attention should therefore be paid not only to observing the effects they have on their context, their

communities and their partners, but also to the generation of value within these initiatives and how they are organized.

2.4 The constellation of innovation labs: a bibliometric outlook

Since the proliferation of this particular set of innovation intermediaries, distinguishing among the multiple concepts under which lab initiatives are labeled can be tricky. Often, it is possible to see that researchers refer to them indistinctly as analogous innovation structures and practitioners seem to use them interchangeably. Even though it has been showed that literature provides specific concepts for each one of them, we believe that a broader view of the scientific outlook around the ensemble of innovation labs could be useful for establishing further paths of research. This motivated us to conduct a bibliometric analysis on the literature of innovation labs looking for connections, proximities and trends between the most common concepts of these innovation intermediaries. A first version of this review was originally published in (Osorio, Dupont, Camargo, & Pena, 2019) initially covering publications between 2000 and 2018 but has now been updated within this manuscript to include publications from 2019 and 2020.

The goal for the remaining of this chapter is to provide a scientific outlook on the constellation of innovation labs. This is done by presenting insights on where research efforts have been concentrated during last years, which concepts are more positioned among researchers, how they have related to each other and finally, which opportunities we identified towards the consolidation of a research agenda in the strategic management of innovation labs.

In that sense, conducting a bibliometric content analysis is useful to discover up-and-coming fields as well as identifying trends in the observation of extended periods (Ellegaard & Wallin, 2015). This approach favors the theorizing phase during research, since mapping the literature works as a brainstorming stimulus, bringing out the researcher's assumptions to the surface. In addition, if these assumptions are followed by a bibliography discussion

by means of selection processes, code structures and concepts' representations, then the accuracy of these representations is increased (Sinkovics, 2016). Also, this process can be supported by technology. In this case, a search strategy was executed using the Scopus database. Then, the literature mapping was supported by VOSviewer and finally, content analysis was performed using NVivo. This process is explained below.

2.4.1 Search strategy and methodology

The search strategy was defined by a set of keywords, representing the most common concepts that are used referring to innovation labs or spaces according to our experience and the literature. Then, as preliminary searches were done, the observation window was defined from 2000 to 2020. Finally, title and keywords were the search fields selected as well as only articles and conferences papers. The strategy employed is summarized in Table **2-1**.

Table 2-1: Search strategy

Specifications	Description
Keywords	"innovation laboratory" OR "innovation lab" OR "innovation space" OR "enabling space" OR "living lab" OR "design factory" OR "fablab" OR "fab lab" OR "makerspace" OR "hackerspace" OR "coworking space" OR "third place" OR "open lab"
Source	Scopus
Search fields	Title & Keywords
Data range	2000 - 2020
Document type	Article or Conference Paper

Afterwards, data visualization and analysis were performed under 2 stages. First, results from Scopus are exported in a CSV file in order to harvest all the keywords from the articles and papers retrieved. Then, the data is uploaded to VOSviewer software, where keywords can be mapped and clustered as a way to visualize how structures or concepts are composed by means of co-occurrence analysis (Ellegaard & Wallin, 2015; van Eck & Waltman, 2010). Second, aiming to provide a more detailed content analysis, a sample of

most recent articles is imported to NVivo software. There, titles, abstracts and keywords are analyzed by a coding process where key issues can be identified and classified. The synthesized process is shown in Figure **2-1**.

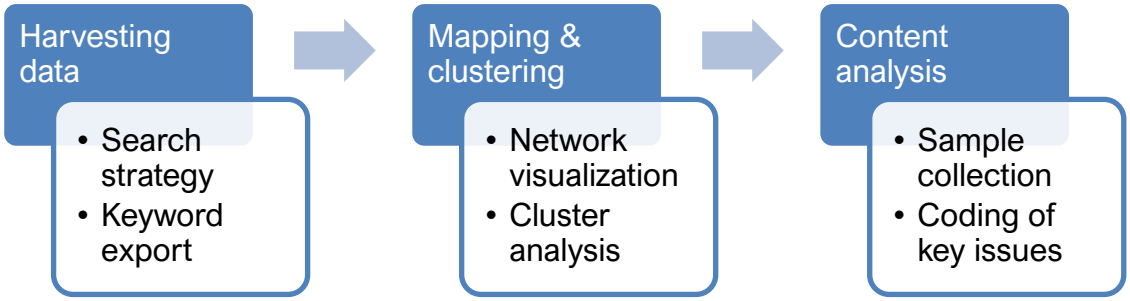


Figure 2-1: Bibliometric content analysis methodology

2.4.2 Results and keyword network visualization

As a result of applying the search strategy described before, 2106 publications were retrieved from the Scopus database. In Figure **2-2** it is possible to observe the increasing interest among scholars in this phenomenon during the last years. In any case, it is not until 2005 that a real and sustained growth begins to become visible, reaching 339 publications by 2020.

From a general perspective, it is worth to remark that around 53% of the publications are conference papers while the rest correspond to journal articles. Additionally, Computer Science, Social Sciences, Engineering, Business and Mathematics are the five main disciplines more actively involved within our search topics. Likewise, the countries that are publishing the most are United States, Germany, Italy, United Kingdom and France accounting 1046 papers for the established range.

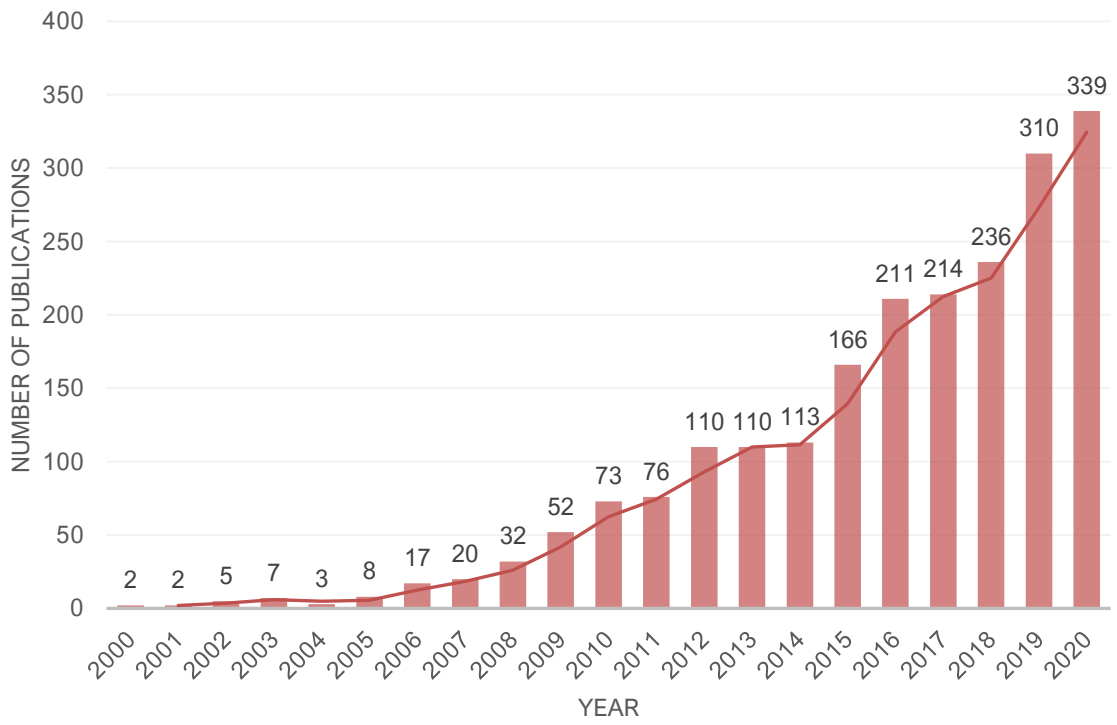


Figure 2-2: Scientific publications per year

Table **2-2** shows the conditional specification defined for network construction. The total of 2106 references retrieved from Scopus were uploaded to VOSviewer as bibliographical data. Co-occurrence analysis using the authors' keywords as the unit of analysis was selected. Additionally, the full counting method was chosen in order to maintain the full weight of keywords (Perianes-Rodriguez et al., 2016). Due to variations among the way scholars have labelled some concepts, a data cleaning process was necessary to merge different variants of keywords for the same concept, e.g., *innovation laboratory*, *innovation labs*, *innovation lab*. Thus, a thesaurus file was created which was included in the conditions. Finally, the minimum number of occurrences was set at 8 ensuring that we could observe most of the keywords included in the search equation. In this case, *design factory* was the only keyword left out with only two occurrences.

Table 2-2: Co-occurrence analysis parameters

Specification	Condition

Total of documents	2106
Total of keywords	5028
Counting method	Full counting
Thesaurus	Yes
Minimum occurrences	8
Keywords meeting threshold	106

The network visualization is shown in Figure **2-3**. The circles are a representation of the number of occurrences of each keyword. The higher the number of keywords, the larger the label and the circle of each item. The distance between two keywords indicates their relatedness in terms of co-occurrence links. In general terms, the closer two keywords are located to each other, the stronger their relatedness is.

2.4.3 Cluster analysis

The colors in Figure **2-3** show the cluster to which the keywords belong. Clusters that are located near to each other indicate closely related fields. For this case, eight clusters were created as a result of the co-occurrence analysis. As can be seen in the map, Clusters 1 (red), 2 (green) and 3 (blue) are the largest while the rest of them are located around them. Here some relations can be remarked between the lab concepts and the composition of the clusters (see **Error! Reference source not found.**).

Table 2-3: Cluster composition

Cluster	Main Keyword	Related keywords
Cluster 1 (red)	**third place**	community, coworking, **coworking space**, diversity, diy, empowerment, entrepreneurship, ethnography, gender, **hackerspace**, inclusion, leisure, maker culture, makers, methodology, social capital, social interaction, social networks, social support, urban planning
Cluster 2 (green)	**makerspace**	children, constructionism, creativity, curriculum, digital fabrication, education, engineering education, **fablab**, maker, maker education, maker

		movement, making, open source, pedagogy, prototyping, rapid prototyping, steam, stem
Cluster 3 (blue)	**living lab**	ambient assisted living, augmented reality, design, future internet, internet of things, interoperability, older adults, quality of experience, service design, smart city, smart home, usability, user experience, user involvement, user-centered design, virtual reality
Cluster 4 (yellow)	innovation	3d printing, academic libraries, collaboration, community of practice, crowdsourcing, **enabling space**, knowledge management, learning, libraries, motivation, participatory design, project management, public libraries
Cluster 5 (purple)	co-creation	action research, business model, circular economy, co-design, co-production, collaborative learning, experimentation, ict4d, participation, sustainability, sustainability transitions, **urban living lab**
Cluster 6 (cyan)	**innovation lab**	case study, energy efficiency, experiential learning, governance, ict, knowledge and innovation space, renewable energy, smart grid, social media, sustainable development
Cluster 7 (orange)	open innovation	**innovation space**, innovation system, sme, social innovation, university, user innovation, user-driven innovation
Cluster 8 (brown)	evaluation	**open lab**, recommender systems

First, Cluster 1 (red) groups together research subjects such as *community, entrepreneurship, empowerment, DIY (do-it-yourself)* and *diversity*. Also, this cluster gathers three of our lab concepts: *third place, coworking space* and *hackerspaces*. Here, such spaces seem to be closely related to studies that combine social interactions and inclusion with entrepreneurship and the maker culture. Next, there is Cluster 2 (green) which gathers the concepts of *makerspace* and *fablab*. This cluster is mainly characterized by research topics such as *digital fabrication, open source, prototyping, engineering education* and *creativity*. In this case, research on the fablab and maker movement seems to be most focused on bringing prototyping and maker skills to children's and engineering education.

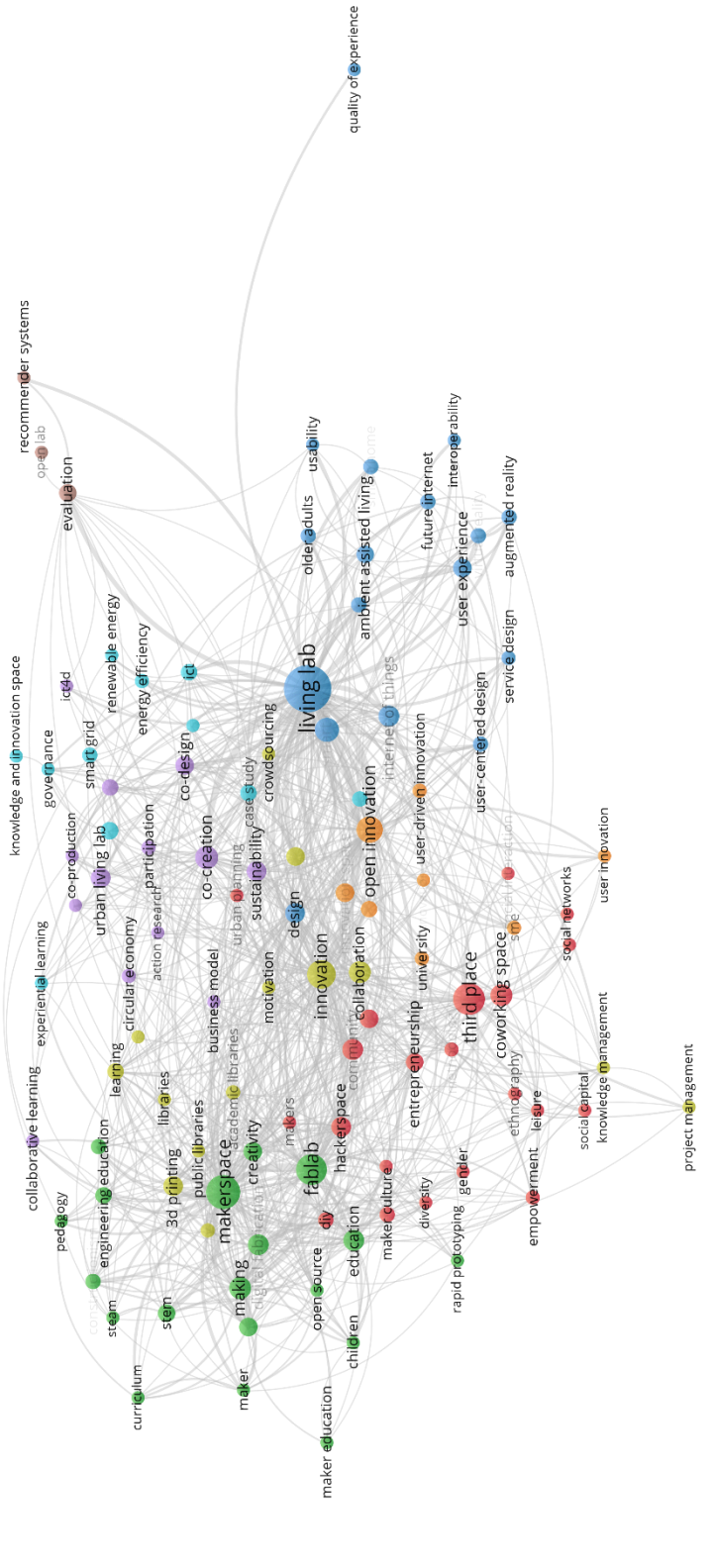


Figure 2-3: Network visualization

Following this, *living lab* is by far the largest keyword in terms of occurrences and links across the network. Although the living lab concept relates to most of all other keywords, the concepts in Cluster 3 (blue) are the ones with the strongest relation to it. In this sense, areas such as *ambient assisted living, augmented reality, internet of things, service design, smart city, user experience* and *user-centered design* are those which are leaning the most on living lab, whether as a laboratory setup, a methodology or an approach. In any case, it is possible to say that experimentation of new technologies in diverse contexts through user-centered design is what seems to distinguish the research around living labs.

Subsequently, clusters 4 (yellow) and 7 (orange) appear in the middle of the network between clusters 1 and 2 on the left and cluster 3 on the right (see Figure **2-3**). Specifically, Cluster 4 appears to be intertwined with clusters 1 and 2 in terms of its distribution on the map, but nevertheless, certain research areas are grouped as follows: *innovation, collaboration, learning, 3D printing, libraries, crowdsourcing,* and *enabling space*. In this case, the term enabling space does not seem to have a strong presence in the network, relating mainly to areas on participatory design, co-creation and innovation. Furthermore, Cluster 7 shows well-defined relations among its keywords conveying a clearer line around *open innovation, social innovation, innovation system, SME* and *user-driven innovation*, highly linked to the *innovation space* concept.

Moreover, on the top of the map there are located clusters 5 (purple) and 6 (cyan). Cluster 5 is mostly defined by *co-creation, sustainability, sustainable transitions, circular economy, experimentation* and *co-design*. This cluster also includes the *urban living lab* concept, which has become a specific strand of the living lab approach that is explicitly used to address urban sustainability challenges (Klautzer et al., 2020; Lacroix et al., 2017). In turn, cluster 6 comprises experiential learning, governance, sustainable development, energy efficiency, renewable energy and smart grid most of which situated around the *innovation lab* concept.

Lastly, on the top right of the map is Cluster 8 (brown). This cluster, composed of *evaluation*, *open lab* and *recommender systems* keywords which seem to be more distant from the rest of the network elements and almost solely related to the living lab keyword. This is to be

expected insofar as the living lab concept is also widely used as a methodology for the design and user experience evaluation of new technologies (Hossain et al., 2019). Therefore, through co-occurrence analysis it is possible to identify not only shared links between research areas and lab concepts, but also those topics that appear to be more distantly and exclusively related.

Once the cluster network has been explored, understanding the evolution in time of our research subject is a useful approach to identify trends as well as some missing issues in our network. As shown before in Figure **2-2**, publications regarding our selected issues are very recent. Nevertheless, we can still take a closer look at what are the trends in recent years. Using the overlay visualization of VOSviewer, Figure **2-4** presents the same network distribution but in this case, colors are defined by the average publication per year of each keyword, with yellow for the most recent and dark blue for the oldest.

The keywords to the top left of the map seem to be the most popular since 2016. In particular, *makerspace*, *maker movement*, *fablab*, *engineering education* or *maker education* are recently attracting the attention of researchers. This shows a clear tendency for making practices to become more connected to educational and academic environments. Following this, *coworking space* looks like an issue that is developing closely to entrepreneurship in recent years.

Regarding living lab's side of the map, we can find that there is a recent interest in addressing the user experience of older adults who interact with new technologies. Likewise, it is possible to note that the concept of *urban living lab* along with *circular economy* and *co-production* are gaining attention from scholars. Further, the *sustainability* keyword appears as an emerging theme that is not only related to the sustainable development of the territories but is also widely related to the diverse manifestations of the laboratories that this work intends to address. This makes us wonder how researchers are addressing the sustainability issues in relation to the operation and continuity of innovation lab initiatives.

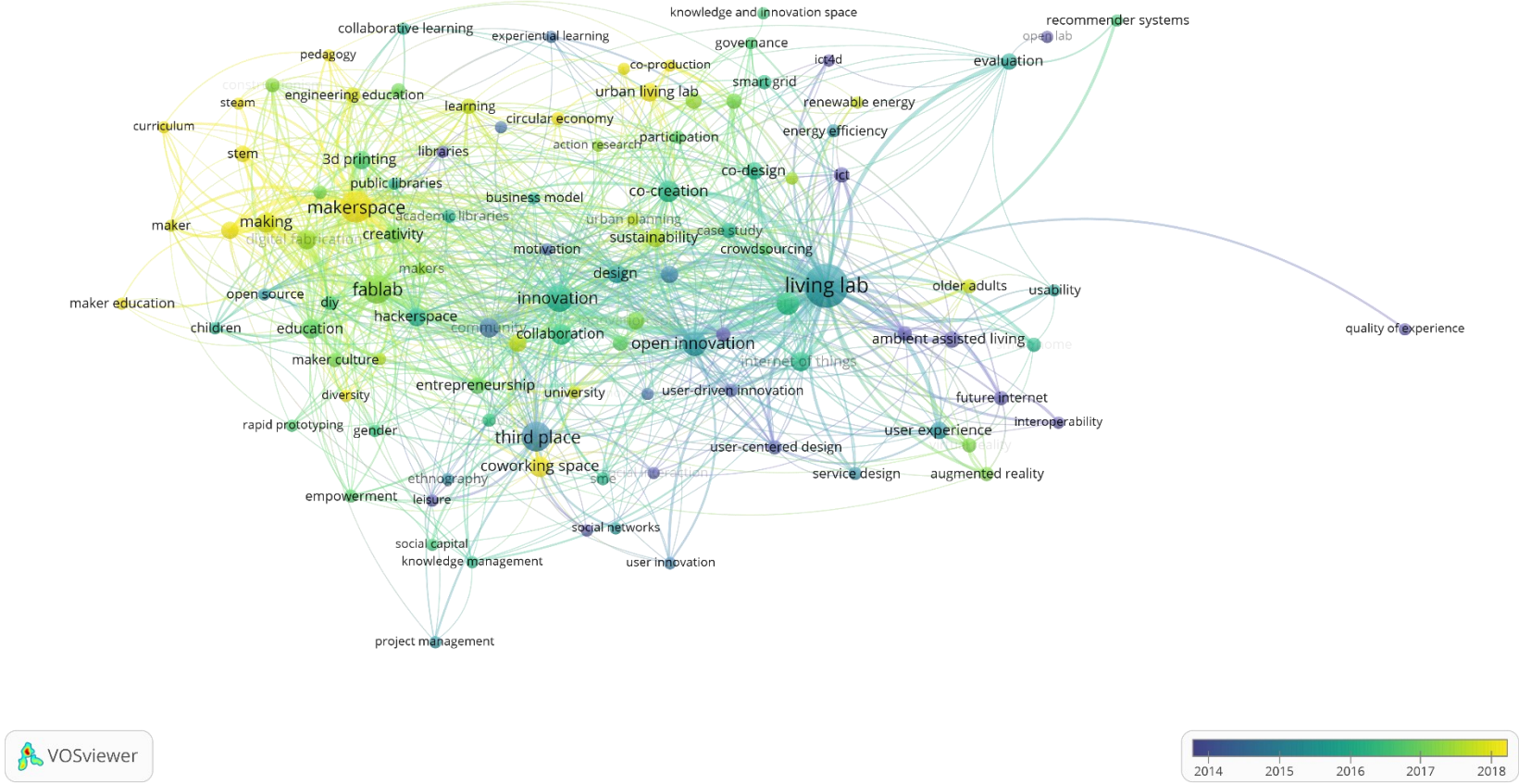


Figure 2-4: Evolution over time of keyword co-occurrence

2.5 Toward a research agenda on the management of innovation labs

As has been previously stated, in this work we are interested in understanding what are the factors and practices that most influence the designing and managing innovation laboratories. One thing that is worth noting from the present analysis is the absence of keywords related to management, strategy or assessment issues. Yet, if a thorough analysis of the 2106 publications retrieved from Scopus is carried out, it is possible to find several works related to these matters. For this purpose, we decided to take a sample of 103 publications and analyzed the content of their titles, abstracts and keywords, with the aim of identifying research trends in this topic. The 103 publications were found by including the *management* keyword as a condition in our main search equation, focusing only on documents between 2017 and 2020. As a result of a first screening, 6 papers were eliminated from the sample because neither their research context, their objective nor their contribution were related to any of the lab concepts of interest for this study, leading to a final sample of 96 publications.

In performing content analysis, several categories can be identified by coding e.g., the goal of the research, the context in which it was developed, the methods or tools that were used and the main findings the authors claim they achieved. The abstracts of each publication were first coded/screened in terms of the context, research objective and the associated lab concept. This step allowed a closer understanding of the sample. Even though the search equation was narrowed down using the *management* as a keyword, it was possible to identify several different research trends on this topic. With this in mind, this analysis was then focused on retrieving from the sample the *type of publication*, the main *method or tool* applied, and the *main contributions*. Consequently, we proceeded to retrieve the contributions from the abstracts of the 96 documents and then manually grouped them into six categories. The results of this process are summarized in Appendix **A**.

Furthermore, as a result of this coding exercise, it is possible to visualize through a hierarchical chart the proportion represented by each category, composed of the codes

extracted from the corpus analysis. Figure **2-5** shows the contributions of each study distributed under *urban, rural & public experiences* (**UE**), *technology testing* (**TT**), *collaborative project applications* (**CA**), *lab management experiences* (**LM**), *lab assessment* (**LA**) and *other contributions* (**OC**). A short description of each contribution identified as a result of the coding process is shown in each cell.

First, the **UE** is a prominent category related to territorial issues where researchers are providing insights on the process of applying collaborative approaches in the public sector and the digitalization of public practices. The implementation of innovation lab and living lab initiatives is being used to develop capabilities and facilitate sustainable transitions and the digital transformation of territories. Next to this, the **TT** category groups recent studies sharing lessons on technology testing and user validation of new product or service development where the lab approach is used to set up more open and agile prototyping environments.

Similarly, **CA** is a smaller category specifically related to the application of collaborative methods and practices in a broad spectrum of sectors. Practitioners and scholars are using their labs to implement, analyse and explain multi-stakeholder collaborative processes with companies, governments, non-profit organizations and academic institutions. In addition, only three documents are categorized as **OC** where changes in academic profession, intellectual property and personal knowledge management are addressed.

The four categories discussed so far (UE, TT, CA, OC) represent the 62 of the 96 documents in the sample (65%). This means that research on the management of innovation labs is strongly focus on project applications and how the lab initiative contributes to solve specific issues. However, it is also important to underline that the remaining 34 studies (35%) address in some way the understanding of this issue, either their management practices (**LM**) or the assessment of their impacts (**LA**), highlighting a prominent interest in this regard.

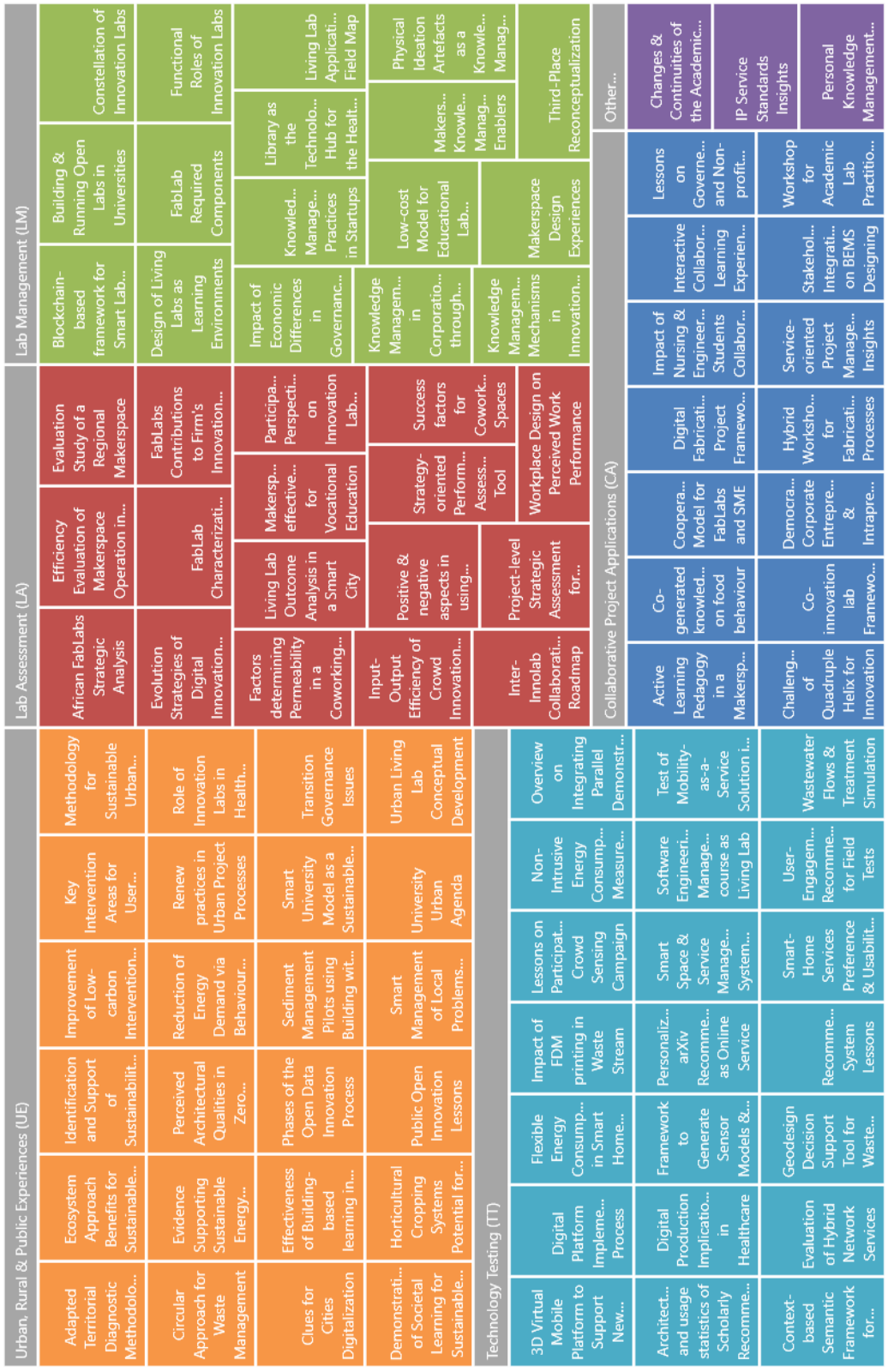


Figure 2-5: Hierarchical chart of scientific contributions

Precisely, the **LM** category comprises a specific set of contributions that focus on the lab management perspective in which insights and lessons are shared mostly in the form of single case studies or self-reported experiences. In this sense, it is possible to find studies that share experiences on knowledge management models, implementation feedback, context comparisons and governance differences. This body of literature shows that understanding the operation of this kind of organizational structures is a matter of current interest, but even so, they all seem to remain exploratory and scarce.

Lastly, the **LA** category gathers the authors addressing the challenge of pinpointing the results and evaluating the performance of innovation labs. As one of the research objectives of this thesis is to contribute to the strategic management of these innovation intermediaries, identifying where research efforts are focusing in is a matter of interest. Efficiency evaluation of makerspaces, strategic analysis of fablabs, outcome analysis of living labs, innovation lab users' perspective and success factors of coworking spaces are some of the scientific contributions that reflect the interest of academics in recent years.

Based on Figure **2-5** and how these categories are composed, a set of axes is proposed here as a research agenda in the management of innovation labs. These axes are explained below:

- **Innovation labs for product development (based on TT contributions):** Traditionally, one of the reasons for the existence of innovation labs has been to support the development, testing and market introduction of new technologies, as products or services. Regardless of the evolution of innovation intermediary structures, this is something that has a strong presence in this bibliometric study. Today, research around innovation labs is leading, for example, to the development of digital platforms, hybrid network services, recommender systems or decision support tools. This is a clear line that scholars should keep in mind as a path for research in innovation labs.
- **Innovation labs for territories (based on UE contributions):** Every day more innovation labs are conceived in order to transform the way in which public management and territorial development carried out. Cities digitalization, public

goods management, crisis response, social innovation and sustainable development are examples of critical research areas where innovation labs have a key role to fulfil.

- **Innovation labs for collaboration (based on CA contributions):** Regardless of how they are embodied, collaborative approaches are inherent to innovation lab practices. Nevertheless, there is also a specific tendency that focuses on studying the application of collaborative methods in a wide scope, such as service-oriented project management, supplier-driven innovation, open innovation engineering or interactive collaborative learning. In this aspect, there is a vast outlook for innovation labs to be studied as mediators of knowledge creation and interinstitutional collaboration.
- **Management of innovation labs (based on LM contributions):** Design and creation processes, framework and management models, as well as component configurations, are being discussed in the literature through case studies that share lab management experiences. Such contributions are valuable inputs for teams seeking inspiration in terms of examples, practices and challenges. Furthermore, lab teams willing to share their experiences will allow future researchers interested in this topic to access more empirical information.
- **Assessment of innovation labs (based on LA contributions):** It is noteworthy that studies dealing with the assessment of innovation labs are already feeding the literature. In this respect, success factors, positive and negative aspects, characterizations, assessment plans or even roadmaps and impacts on firms' innovation capabilities are all issues being explored. The importance of seeing this matter as a research area is founded not only on the possibility of measuring results and appreciating impacts but also on the opportunity to create new knowledge in terms of how to make the most of these dynamic innovation structures. This is an emerging topic of interest that still has a long way to go before establishing itself in the literature.

2.6 Conclusion

This chapter was meant to provide an overview of the notion of innovation labs in the literature, its origins and how has evolved in recent years. Despite of the multiple definitions, innovation labs are recognized because of their positive impact in facilitating innovation processes. This is associated with the concept of innovation intermediaries which means that innovation lab phenomenon has the potential to play a bigger role in reducing the innovation gap within innovation ecosystems. In addition, this chapter helps in the scientific positioning of innovation lab concept. Particularly, it is explained that, compared to other related concepts (such as living labs, fablabs, third places or makerspaces, which are usually oriented to specific communities, territories or technological applications), the innovation lab concept focuses on the organizational perspective of the innovation process facilitation.

Moreover, a scientific outlook of the constellation of innovation labs was presented in this chapter. This was done through a bibliometric study based on co-occurrence analysis of keywords and content analysis. The results provide a network of 8 clusters in which both research affinities and distinctions between the most common concepts often related to innovation labs are described. Lastly, a research agenda on the strategic management and assessment of innovation labs is proposed. Tools and methods were identified, as well as whether they are being used to analyze, characterize or evaluate this phenomenon. On the one hand, research is being focused on studying the role and impact of innovation labs on technology testing, collaboration and territorial issues. On the other hand, a particular research path is emerging towards their strategic management and assessment. This suggests the increasing interest from scholars of the organizational side of innovation labs.

3. Design and management of innovation labs

As organizational forms, innovation labs are more than just the creativity room of a firm or the gathering point of communities. They are a managerial response to the organizational challenges that hinder innovation. Therefore, to think that implementing this type of initiative is simply a matter of setting up an appealing space with technological resources is a perception that is far from reality. This chapter explores in greater depth the theoretical foundations of innovation labs and their organizational effects. On this basis, the multifaceted functions offered by these laboratories are explored, evidencing their contingent and idiosyncratic character. This is followed by an examination of the implications of designing and managing an innovation lab. The chapter ends with a comparison of conceptual frameworks in an effort to identify a common ground of key terms, dimensions and criteria to be taken into account throughout this research.

3.1 The organizational innovation lab

Over the last few decades, organizations of all kinds have been exposed to much more accelerated changes in the introduction of new technologies, changes in markets, new ways of governing, teaching and appreciating the world in which we live. In this context, innovation has become a key strategy for any type of organization seeking to adapt and keep on generating either economic, environmental or social value (Boly et al., 2016; OECD, 2018). Such universality and complexity of the challenges we experience as a society have driven innovation understanding to be much more open and based on knowledge and value generation (OECD, 2018). Also, innovation is associated as much to the implemented result as to the process and activities that lead to it (Blok, 2021; Gregoire, 2016). Based on the most recent version of the Oslo Manual (OECD, 2018), innovation can be defined as:

"An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process). This definition uses the generic term "unit" to describe the actor responsible for innovations. It refers to any institutional unit in any sector, including households and their individual members."

As broad as this definition is, innovation is inherently subjective and context dependent. Yet, its application can be guided, managed and facilitated. According to the *Innovation management system guidance - ISO56002*, once an organization identifies and defines its intent to innovate, a process that brings such intent to life should be established (ISO, 2019). Although innovation processes are flexible, adaptable and can take multiple forms, an organization seeking to implement its own innovation process should generally *identify* opportunities, *create* and *validate* concepts, *develop* and *implement* solutions (see Figure **3-1**). However, successful implementation of these processes requires strong facilitation (Magadley & Birdi, 2009). On top of that, organizations do not always have the capabilities required to innovate, thus motivating them to seek resources elsewhere or to develop new competences (Boly et al., 2016; Moya Sedan, 2021). To this scenario is what the creation of an innovation lab is usually aimed at, as a managerial response to overcome the organizational challenges that limit innovation (M. Lewis & Moultrie, 2005).

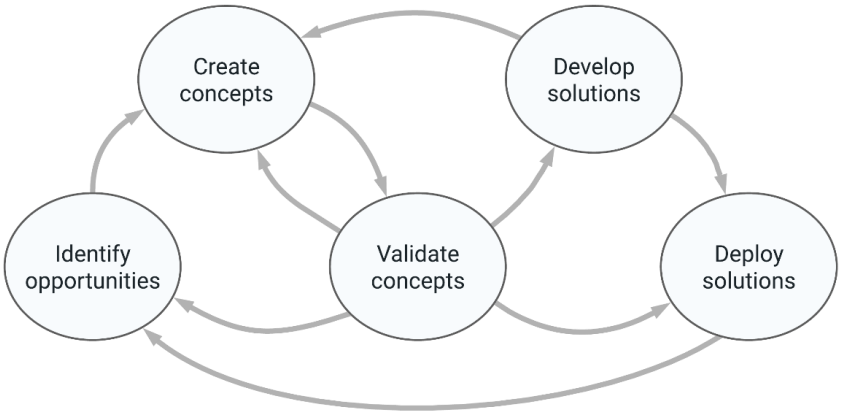


Figure 3-1: Innovation process (ISO, 2019).

While examples of innovation labs date back to the 1970's (see Weick, 1977), Lewis & Moultrie (2005) are perhaps one of the firsts to theorize how they work and offer explanations of their organizational impact. In this sense, they project the innovation lab as the physical and real manifestation of an organization's commitment to innovation (see Figure **3-2**). They argue that the lab operation, in addition to offering a creative, playful environment, conducive to teamwork and access to technologies, has a fundamental effect in terms of stimulating double loop learning dynamics within the organization (Argyris, 1977, 2002).

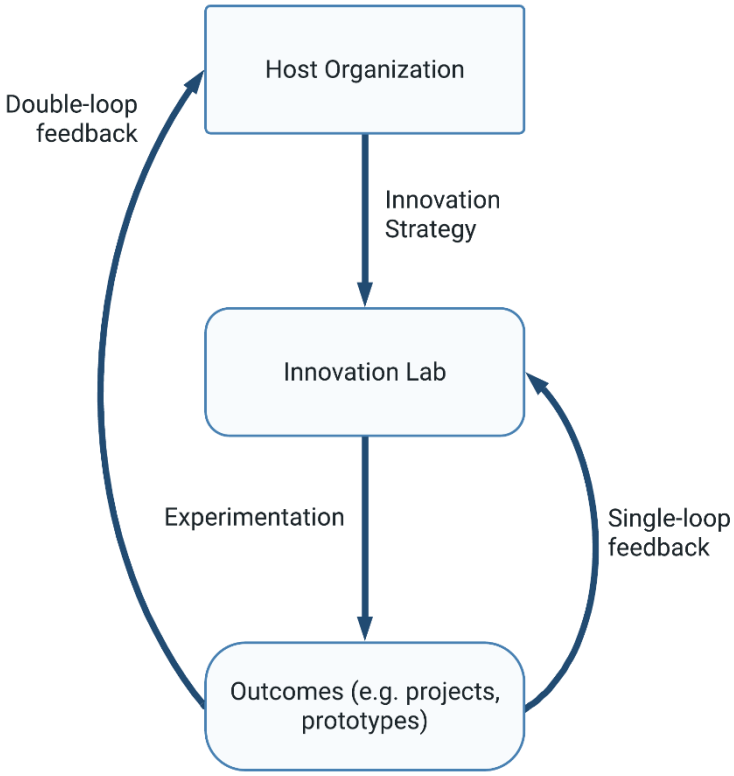


Figure 3-2: Innovation lab as source of double-loop learning. Based on (Lewis & Moultrie, 2005).

On the one hand, the daily operation of an innovation lab usually leads to tangible or intangible results (projects, workshops, validation of solutions, getting closer to people, showcase of results) without necessarily provoking major questions or changes towards its

parent organization. On the other hand, for Lewis & Moultrie, however, this ability to act as demonstrators of new solutions helps prevent an organization from becoming too conservative, which can eventually lead to profound questions and transformations within the organization in terms of culture, policies, core competences, or redefining values. To achieve these changes requires a capacity to question assumptions, reconfigure resources, reframe questions and be sensitive to changes in the context (Agogué et al., 2017; Gryszkiewicz et al., 2016). Hence, implementing an innovation lab means setting up a dedicated environment with resources (human and technological) specifically organized to *facilitate* an organization's drive to innovate and learn.

3.2 Functional roles of innovation labs

Although fostering organizational learning may be part of the expected benefits, the mission of an innovation lab is operationally tied to the support of innovation processes, or in other words in mobilizing technological and methodological resources to identify, design, prototype, implement and/or validate new solutions to specific problems. To do this, innovation labs rely on 3 main aspects (see Figure 3-3). The first is the workplace to foster creative behaviors. Creating conditions to foster creative thinking and behaviors has been a longstanding research topic in the literature (Ekvall, 1997; Woodman et al., 1993). One might even say that the roots of innovation labs stem in good part from this interest (Kristensen, 2004). Therefore, one of the main aspects that make up an innovation lab is the deployment of a physical or virtual space whose architectural design, rooms, configuration and imagery are specifically conceived for the lab's purpose (Klooker et al., 2019; Oksanen & Ståhle, 2013).

The second aspect concerns the technological resources that favor prototyping and testing. Innovation labs are recognized for providing access to new technologies and specialized knowledge that support prototyping, allowing users to materialize their ideas and test them, thereby moving forward in their implementation (Mortara & Parisot, 2018; Moultrie, Nilsson, et al., 2007). Third, there are the people, both the lab team, who are in charge of orchestrating what happens in the lab, and the users, who are the actual beneficiaries of

the lab operation. This is perhaps the most distinctive feature that academics and practitioners point out when they refer to the innovation lab concept, the interplay among all the related actors that make use of the lab (Fecher et al., 2020; Magadley & Birdi, 2009). Combined, these are the main pillars of an innovation lab which are subsequently committed to the innovation process (Gey et al., 2013; Memon & Meyer, 2017).

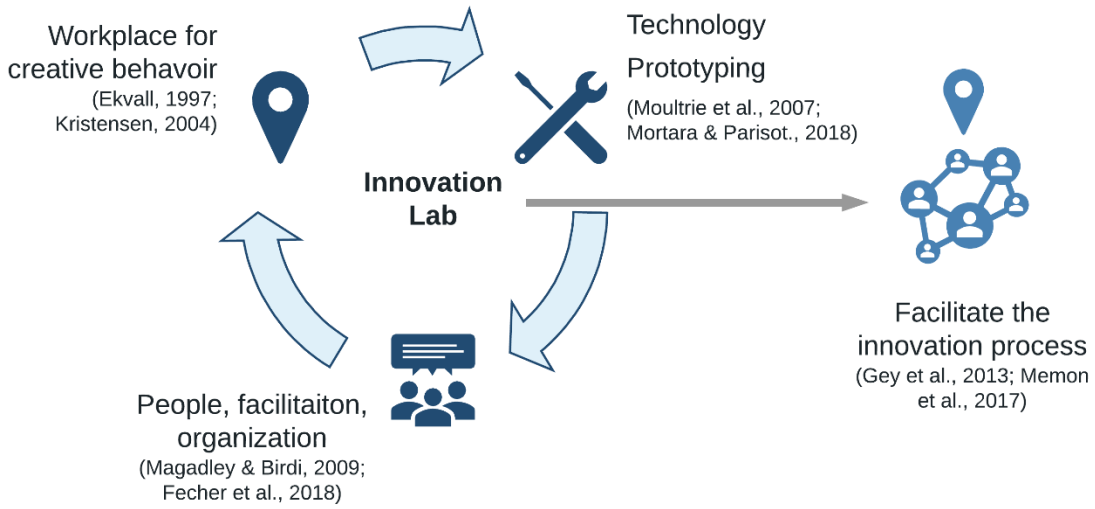


Figure 3-3: Innovation lab composition

Having explained the above, it is worth asking how this facilitation is carried out. Several authors have approached innovation labs to understand “what they do” and “how they do it”. For example, Memon & Meyer (2017) propose a categorization of the functional roles that innovation labs adopt to assist businesses to keep innovating in their products or services. Combining an online survey with 35 responses and 25 semi-structured interviews with representatives from different labs, they identified 8 key functionalities: creativity stimulation, knowledge dissemination, business incubation, networking, resource provisioning, process intermediation, research and development, and market research (see Figure **3-4**). They also revealed that innovation labs offer support that covers the entire innovation process, impacting both the increase of capabilities in creative thinking, know-how or knowledge transfer, as well as the reduction of management barriers, risk factors or lowering the initial costs of innovation projects.

In any case, a noticeable feature for Memon & Meyer (2017) is the fact that a certain lab usually focuses on a specific set of functionalities and will not necessarily be able to (or is intended to) mediate the entire innovation process. This reinforces the contingent characteristic of innovation labs: they are designed to meet specific innovation challenges in their context. Something that is evidenced as one can easily find lab experiences in diverse sectors such as finance (Fecher et al., 2020), corporate (Rieken et al., 2019), health (Sangiorgi et al., 2020) or tourism (Santarsiero et al., 2021).

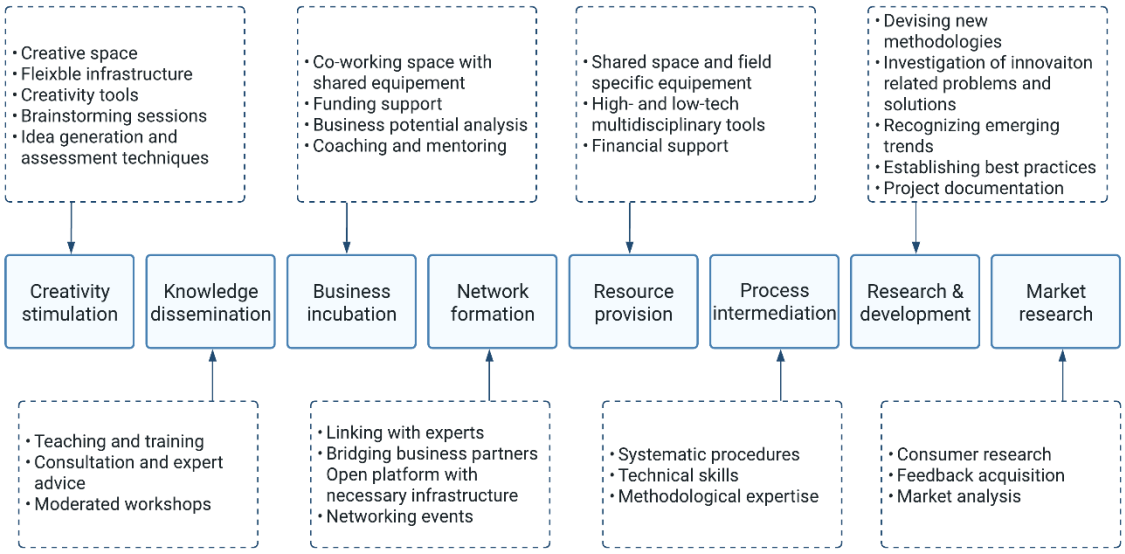


Figure 3-4: Functional roles of innovation labs (Memon et al., 2017)

Yet, innovation lab activity is not limited solely to product/service design, or business support. In fact, as it was shown in the bibliometric analysis (see section **2.4**), they have received particular interest from the public and academic sectors. Over the past few years, governments, civil servants, NGOs and communities have been turning to innovation labs as an alternative way of overcoming internal barriers to innovation in the public sector (Acevedo & Dassen, 2016; Bloom & Faulkner, 2016; Puttick et al., 2014). Public sector is a particular environment that attracts risk adversity, limits experimentation, and where politics and media scrutiny play a major role (Tõnurist et al., 2017). Thus, (public or public sector) innovation labs are envisioned as spaces for empowering citizens, officials, and entrepreneurs in values, skills, and techniques to address social and public challenges,

through experimental and user-centered methods as a means of fostering participatory innovation (Acevedo & Dassen, 2016; Gascó, 2017; McGann et al., 2018). This open and participative perspective, supported by collaborative dynamics, seems to be one of the most prominent results when it comes to public innovation labs (Osorio et al., 2020; Timeus & Gascó, 2018).

Similarly, implementing spaces as meeting points between governments, companies, academics and citizens has become an opportunity for academic institutions to enhance their ability to produce systemic and community-based knowledge, or Mode 3 of knowledge production (Camargo et al., 2021; Mérindol et al., 2018). In this sense, university-hosted innovation labs enable co-design and co-creation between students and professors in conjunction with all actors in society, thus stimulating collaborative learning and whereby lab teams act as the facilitators of synergies and collaboration among all individuals (Caccamo, 2020; Delgado et al., 2020). Moreover, these structures not only become a tool for research and pedagogy, but also contribute to establishing more stable and lasting partnership relations between stakeholders (Camargo et al., 2021).

More recently, a new trend in innovation labs seems to be gaining attention from practitioners and scholars. This refers to *social* innovation labs, an emerging approach to keep up with the increasing changes and accumulating challenges that society faces, where more conventional approaches based on mono-centric thinking are insufficient (Jezierski et al., 2014; Wascher et al., 2019; Westley et al., 2015). Rather than solely pursuing a political agenda, market growth or technology push, authors call for social innovation labs to be used to address complex social problems and enable coherent action among multiple stakeholders in order to develop systemic solutions (Wascher et al., 2018; Zivkovic, 2018). This kind of labs are distinctive because they foster the creation of dialogue, listening and mixing the different voices of the actors involved (see Corsini et al., 2020; Lake et al., 2016; Nilsson et al., 2015; Timmermans et al., 2020). Ultimately, they act as cross-pollinators of co-creation methods, approaches and perspectives between groups, thus stimulating and channeling collective creativity so that grassroot ideas may constantly emerge (Jezierski et al., 2014; Rayna & Striukova, 2019).

Despite how promising innovation labs may seem in general, one should keep in mind that this approach is a response meant to keep up with the increasing and cumulative changes we are experiencing nowadays as society (Rezaee Vessal et al., 2021; Zivkovic, 2018). That is to say, to embark upon such an initiative implies dealing with the uncertainty, ambiguity and tensions that are inherent to addressing such complex and changing conditions (Callon et al., 2001; Kant & Kanda, 2019; Rayna & Striukova, 2019). For this reason, organizations willing to create their own "lab" need to be aware of the challenges and opportunities that this type of initiative entails.

3.3 Designing and managing innovation labs

The design of innovation labs has been discussed in the scientific literature from various perspectives, including the spatial design of a creative space, the characteristics that activate or inhibit the appropriation of users or the managerial factors that should be taken into account to achieve a positive organizational climate for innovation. This section explores those issues in order to highlight what elements should be addressed when designing and managing an innovation lab.

Creative rooms have been a common strategy to help organizations foster creativity and innovation at the workplace (Oksanen & Ståhle, 2013). In this sense, it has been recognized how the design of these spaces should consider dynamism, playfulness and debate as fundamental features toward a creative climate (Ekvall, 1997). This is because the spatial confines where creativity and innovation take place have a direct effect on people by inducing emotions that can alter their well-being, which may ultimately facilitate or reduce creative processes (Kristensen, 2004). This resonates with Olson, Cooper, & Slater (1998) who noted that "environmental design carries the potential of having a direct impact on worker morale and productivity". Also, for Oksanen & Ståhle (2013), spaces conducive to innovation should consider modifiability, smartness, attractiveness, value reflecting and collaboration enabling as key attributes.

But designing an innovation lab extends beyond spatial design. For Lewis & Moultrie (2005), the innovation lab must ensure users find themselves in an environment that reduces hierarchy and encourages participation. Indeed, a successful innovation process is usually driven by the personal experiences of individuals operating within established networks and leveraging personal connections (Dougherty & Hardy, 1996). This allows consideration of how these experiences can be improved and how the workplace may influence them. Design of an innovation lab should consider not only place, time, and technologies that support the innovation process, but also human facilitation (Magadley & Birdi, 2009). This implies managing participants' expectations, fostering team building spirit, as well as inspiring participants to maintain motivation and pass on the results to their daily work environment (Fecher et al., 2020). Therefore, managers of innovation labs face a challenge that goes beyond just managing them. According to Peschl & Fundneider (2014) innovation needs to be enabled rather than controlled. More concretely, they state that, to manage a space intended to foster innovation, managers must "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 the lab environment and organizational climate as part of the enabling context (Peschl & Fundneider, 2012).

On top of that, it is important to notice the more complex, multi-directional and networked nature of how innovation takes place in an innovation lab (Gryszkiewicz et al., 2016). The original propositions made by Lewis and Moultrie (2005) are mainly grounded on the idea that an innovation lab is embedded to a single parent organization dedicating its operation to reinforce the institutional commitment to creativity and innovation. But today's context and the way in which innovation labs have been evolving are much open, collaborative, multistakeholder and social (Morel et al., 2018). Although an innovation lab is probably still promoted by a specific organization, the lab is likely to be co-sponsored by an external institution or serves as a means of connecting with other partners through joint projects (Dupont et al., 2019; McGann et al., 2019; Osorio et al., 2020). In any case, this means that the lab team stands right at the center of multiple institutional interests (see Figure **3-5**). At the same time, and depending on the lab's purpose, lab managers are entrusted with facilitating and coordinating the daily activities with different groups of communities, citizens, entrepreneurs, academics, etc. They find themselves in a conjunction of expertise,

cultures, mindsets, and interests that change depending on the project or activity that takes place (Rayna & Striukova, 2019).

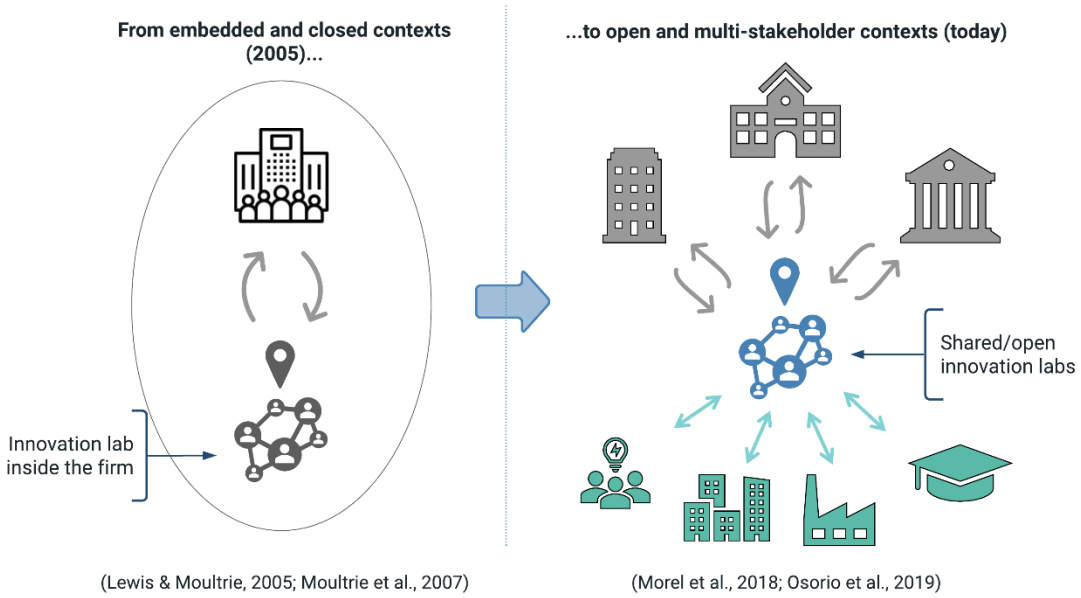


Figure 3-5: From embedded to shared and open innovation labs

In this regard, scholars have already raised concerns on how the lack of a clear thematic focus and a shared intent among its stakeholders undermines the innovation lab purpose (Moultrie, Nilsson, et al., 2007; Osorio, Dupont, Camargo, Palominos, et al., 2019). In fact, past experiences have shown that innovation labs need to adapt rapidly without losing their thematic focus and continuously share and align their strategic intent with all the stakeholders (Veeckman et al., 2013). Innovation lab initiatives that have achieved a certain level of prominence have done so by aligning organizational ambition, culture and people to produce a supportive, enabling design (Wagner & Watch, 2017).

This issue should receive special attention, as innovation labs are exposed to addressing substantial strategic and financial issues that can lead to a shortened lifespan (M. Lewis & Moultrie, 2005). These concerns appear to be driven by misperceptions about “what makes an innovation lab”, resulting in an identity crisis in which, in some cases, the concerned

parties refer to them as “innovation gadgets”, isolated places to do “cool stuff” and measured by “vanity metrics” (Drew, 2017; Innov8rs Team, 2017; Leicher, 2017). This underlines the importance of defining a methodological framework to assist lab managers and stakeholders in strategically defining and guiding innovation lab implementation and operation. In the following section, a review of conceptual frameworks that have addressed this problem is then carried out in order to identify key concepts, criteria and practices.

3.4 A framework comparison for the design of innovation labs

Table **3-1** summarizes the eight frameworks identified in the literature. Here, on the basis of five comparison criteria, the main features as well as the differences between them are discussed. It is important to note that some frameworks comprise a more detailed level of elements by disaggregating specific components for certain constitutive pillars. However, not all of them reach that level of specificity; therefore, only the main pillars are presented. Regarding the comparison, a set of five criteria to identify the comprehensiveness of the current frameworks was established (Osorio Bustamante et al., 2016; Osorio, Dupont, Camargo, Palominos, et al., 2019). These are:

- **Strategy vs. outcomes approach:** To understand innovation lab performance it is necessary to analyze how and why it was initially conceived, and the way the lab is used; it is therefore of interest to identify a framework that contributes to this regard.
- **Space & lab’s embodiment focus:** As the motivation and research questions rely on the role of the innovation lab as an organizational form, we try to compare whether the space or the infrastructure has been considered as one of the main features of analysis.
- **Criteria definition:** Almost all frameworks have a solid theoretical basis, although not all of them define criteria to evaluate their constitutive pillars. Those with a criteria definition are considered a significant input.
- **Operationalization & metrics:** In addition to the criteria, we look at whether instruments and metrics were developed for each framework.

- **Case study:** Finally, we compare which frameworks have been tested and deployed through single- or multi-case studies.

Throughout this section, the identified frameworks will be discussed and the main features and the context in which they were developed will be underlined.

The first framework (Moultrie, Nilsson, et al., 2007) recognizes that the environment itself can be part of the organization's innovation strategy (rather than ad hoc) and can influence performance in innovation. Consequently, *"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"* (Moultrie, Nilsson, et al., 2007, p. 61). A remarkable point of view taken by them is the outcome approach. They used the transformation model (progression from inputs to outputs) by Woodman et al. (1993) as the 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 the physical embodiment of such spaces should be. These elements seem to be a useful tool to examine and compare which kinds of real environments are implemented in different laboratories. In that sense, this framework is comprehensive and detailed, and identifies which elements are involved for each block or process. Although the framework is not operationalized, it is a significant input to advance in this research.

Subsequently, Dupont (2009) presents a physical environment specifically designed to facilitate collaborative work. The author proposes a coherent framework to enable the involvement of the end users 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 in a customized space to accelerate such a process from the sharing of stakeholders' requests to a reached consensus. This framework has been deployed, tested and analyzed (Dupont et al., 2014; Skiba et al., 2012) through the Lorraine Smart Cities Living Lab project. Furthermore, the Lorraine Fab Living Lab platform gives the opportunity for new developments and experiments (Dupont et al., 2016; Roux-Marchand et al., 2020; Ten et

al., 2020). Still, identified points for improvement remain its reproducibility and the definition of key performance indicators to measure the steps of the process and its outcomes.

Table 3-1: Comparison of frameworks (Osorio et al., 2019)

State of the art			***Comparison criteria***				
Author	***Description***	***Constitutive pillars***	***Space focus***	***Strategy vs. Outcomes***	***Criteria Definition***	***Operational & Metrics***	***Case Study***
Moultrie et al., 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 process ▪ Technology (equipment & methods)	X		X		X
Gey et al., 2013	Framework for describing the innovation laboratory phenomenon	▪ Actor of innovation ▪ Methods - Designer ▪ Actions at interface between operator and lab ▪ Operators ▪ Actions of operator ▪ Operations ▪ User ▪ Idea of innovations	X		X		
Schuurman et al., 2013	Living Lab constellation	▪ Infrastructure ▪ Natural setting ▪ Multi-method ▪ Medium- to long-term ▪ User-centric ▪ Multi-stakeholder	X				X
Veeckman et al., 2013	The Living Lab triangle	▪ Innovation outcome ▪ Technical infrastructure ▪ Ecosystem approach ▪ Level of openness ▪ Community ▪ Lifespan ▪ Real-world context ▪ Evaluation ▪ Context research ▪ Co-creation ▪ User role			X	X	X

State of the art			Comparison criteria				
Author	**Description**	**Constitutive pillars**	**Space focus**	**Strategy vs. Outcomes**	**Criteria Definition**	**Operational & Metrics**	**Case Study**
Peschl & Fundneider, 2014	Enabling spaces framework	▪ Architectural and physical space ▪ Social, cultural and organisational space ▪ Cognitive space ▪ Emotional space ▪ Epistemological space ▪ Technological and virtual space	X				X
Kallio et al., 2015	The triangle of physical space, organisational culture and organisational creativity	▪ Location ▪ Spatial organisation ▪ Architectonic details ▪ Openness ▪ Collectivity ▪ Equality ▪ Organisational creativity	X				X
Klooker et al., 2015	3-dimensional model (facilitator, provide and communicator)	▪ Work modes ▪ Mindset ▪ Collaboration ▪ Interaction ▪ Initiative ▪ Product development ▪ Place ▪ Equipment ▪ Advanced technical devices ▪ Space ▪ Curriculum ▪ Experience ▪ Motivation ▪ Identity	X		X		X

Afterwards, Gey et al. (2013) introduced a conceptual framework for the analysis of innovation labs based on structuration theory and a meta-structuring approach proposed by Orlikowski, Yates, Okamura & Fujimoto (1995). They show the influences of different actors (designers, operators and users) on the design and usage of the innovation laboratories. This is presented through eight categories based on roles and tasks which help to define multiple meta-structuring activities to support the operation of a laboratory. While this framework can help compare and characterize different laboratories, this is mainly at an operational level with no associated metrics and without considering strategic relationships.

Schuurman et al. (2013) proposed a framework for “infrastructure driven labs” within the 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 lab imposes some risks, such as the roll-out, which can take longer, and the integration of the external cases into the original intent. All the external cases they had were situated in the media domain, whereas no further eHealth cases were held. This shows the need for a clear thematic focus for a laboratory to easily define which projects it attracts and realizes. The framework proposes that the infrastructure represent the core of the lab and the other five general elements depend on this infrastructure.

Following this, Schuurman, Baccarne, et al. (2013) made another significant contribution in the literature by also defining the scope of the term infrastructure. They propose that a lab can be composed of material infrastructure, such as all the tangible assets that are brought to the space: physical networks, user devices, research equipment. But they also consider the immaterial infrastructure, referring to all the intangible assets that surround a lab, such as the environment, the stakeholders and the end users. Nevertheless, this work does not go into depth about what exactly those elements are and what their contributions to the outcomes are. The living lab constellation (Schuurman, Baccarne, et al., 2013) presents an original approach based on a single-case experience at the generic level but it is also possible to think on 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 of other authors, it validates the emergence of this issue.

On the other hand, 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 (Veeckman et al., 2013). However, the infrastructure aspect is limited to technical matters and does not seem to be considered an influential factor within the framework. Despite this, as part of the conclusions further in this work, the authors realized that infrastructure actually plays a bigger role and needs to be clearly defined as part of the

general strategy of the lab. 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 (Veeckman et al., 2013). Therefore, it represents an important reference to be considered in our path to propose our own adapted framework.

Peschl & Fundneider (2012) have studied the term "enabling spaces" over several years. They have developed a framework based on the premise that innovation should be enabled (facilitated) rather than managed (referred to 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 considered and integrated. Following this work, in (Peschl & Fundneider, 2014) the authors state that each space has to be specifically designed for each organization and its quality relies on 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 presentation, 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.

Kallio, Kallio & Blomberg (2015) conducted a longitudinal study comparing a case organization before and after a change in its physical environment. The longitudinal data illustrates how a change in the spatial environment contributes to the emergence of a culture conducive to organizational creativity. The study is based on an in-depth, longitudinal case study, the aim being to enhance understanding of how a change in physical space, including location, spatial organization and architectonic details, supports cultural change. To do this, it uses a model comprising three concepts, namely: the triangle of physical space, organizational culture and organizational creativity. However, the strategic issue has not been developed in his work.

Finally, as part of the literature review, Klooker et al. (2015), based on the application of a 3-dimensional model for workspaces (Amabile, 1988), introduces a collection of 14 inductive categories defining strategic intent preceding the establishment of innovation labs

within organizations. This work corresponds to a qualitative study of two organizations implementing an innovation lab. While their focus on understanding the underlying intentions for pursuing this type of initiative provides valuable insights, it falls short in contrasting those intentions with the outcomes.

As a result of the comparison of frameworks, the main findings are summarized as follows:

- Regardless of any particular label, it is clear that innovation labs play an active role in open innovation processes and outcomes.
- In general, research efforts to understand their role and contribution remain theoretical and exploratory.
- To diagnose the performance of an innovation lab it is necessary to analyze how it was conceived, materialized and used.
- It is important to establish a common understanding of what composes the embodiment of an innovation lab.
- A framework can work just as a tool or guideline. Each innovation lab must be designed according to its context.

3.5 Conclusion

In this chapter, the theoretical foundations of the innovation lab concept are explained. As the embodiment of an organization's commitment to innovation, innovation labs have the potential to stimulate double loop learning dynamics in their organizations. Further, it is illustrated that a space for creative climate, technological infrastructure for prototyping and human facilitation are the constituent elements of an innovation lab. Such capabilities are put in place to support the desired innovation process for which functional roles vary in terms of the intended extent of the process as well as in purpose and context (technological, business, political or social).

This chapter also emphasizes how the context in which innovation labs are set up has evolved. They have gone from being embedded in a single organization to respond to that single organization's strategy, to being conceived in a more open and shared way, serving

multiple stakeholders. This only increases the complexity of what is at stake in managing these initiatives. Finally, this is further supported by the comparison of eight conceptual frameworks with results pointing out the importance that the authors assign to the strategic component in innovation labs and how the lack of a clear and shared strategic intent can limit their purpose.

4. Strategic Intent

Scholars and practitioners have raised concerns on how the lack of a clear strategic intent undermines innovation labs' purpose. But also, that this kind of organizational settings demand for a high effort in ensuring that such intent is shared by all their stakeholders throughout the lab's operation. However, despite being a popular term in the managerial audience, it is rather unclear what exactly is the role that strategic intent can play and how it relates to the innovation lab context. Therefore, this chapter focuses into understanding of what strategic intent is, where the theoretical foundations lie on and what considerations should be kept in mind of when attempting to build a collective intent. This is followed by an explanation of why it is important in the context of innovation. Lastly, hints on how strategic intent can be applied proactively are found from the literature.

4.1 The concept of strategic intent

As it has been discussed thus far, several authors point to strategic intent as an essential element for the success of innovation labs. Moultrie, Nilsson, et al. (2007) stress that to avoid an innovation lab initiative resulting in a vacuum space, or a single person's compelling cause, there must be an underlying strategic intent. Similarly, Veeckman et al. (2013) analyze in retrospect how a lab initiative should not only ensure that there is strategic intent from the start, but that such alignment translates into a common purpose among its stakeholders. According to them, innovation labs are likely to fail in building shared intent if they do not ensure that the value created by the lab is shared with every stakeholder who supports or joins the initiative. Therefore, it is equally important that the existence of a strategic intent is present from the very beginning of the innovation lab, but also that it aligns

and adapts to the changing needs and expectations of its stakeholders (Kant & Kanda, 2019).

But then what is strategic intent? Despite being a term that is frequently encountered in management terminology, it is a rather under-researched and abstract concept that is difficult to appreciate. Then, this chapter addresses its definition, how it differs from other commonly used terms such as mission, vision and goals, and how authors suggest it could be used proactively in strategy making.

The concept of strategic intent is often understood as a proactive mode of strategizing, symbolizing an organization's will for a desired future (Hamel & Prahalad, 2005). This concept was introduced by Hamel & Prahalad in 1989, and quickly became well-known among management audiences. As a result of studying several cases of Eastern companies, they use the perspective of strategic intent to explain how those companies had managed to become world leaders against all odds and out of proportion in terms of their resources and capabilities. Defined as a goal that cannot be planned for and as a shared obsession to win at all levels (Hamel & Prahalad, 2005), strategic intent emerges as an alternative to rationalistic models of strategic planning, which are commonly based on the organization's resources and the limitations of the context (Mburu & Thuo, 2015; Sheehan Jr., 1999). In Hamel & Prahalad's logic, using strategic intent implies defining the north of an organization based fundamentally on aspirations, ambitions and commitment, even if these may seem irrational or very difficult to achieve (Hamel & Prahalad, 2005).

Often represented as a slogan, a phrase or a statement, strategic intent is in fact a construct associated with the symbolic mode of strategy making (O'Shannassy, 2016; Pitt, 2001). This means that strategic intent relates to the more "intuitive, generative and soft practices" of strategic management (O'Shannassy, 2016). The statement of strategic intent provides a symbolic guide for members of an organization to work together effectively through uncertainties (Hamel & Prahalad, 2005). This ultimately helps to create and maintain a shared meaning of the organization, which helps to organize action, leadership legitimacy, resource allocation, as well as to guide the development of new competences and provide

reassurance and coherence to the members of the organization (Mantere & Sillince, 2007; O'Shannassy, 2016).

Referring to strategic intent can be confusing given its proximity to other strategic management concepts such as mission, vision or goals. It is therefore worth reviewing how they differentiate. The mission statement describes the purpose and scope of an organization's operation in a form that reflects priorities and indicates the main product or service areas, and the key customer or user needs to be satisfied (Pearce II, 1982). In other words, the mission responds to the "what we do". In turn, the vision responds to "what we want to become". The vision is defined as a coherent statement of what the organization can and should be in a certain time frame and what needs to be done to achieve it (El-Namaki, 1992). That is, the vision is partly rational and partly emotional, establishing desired but realistic goals in relation to the context of the organization (Wilson, 1992). And finally, goals specify what is to be accomplished and when. An organizational goal is a desired state to which an organization moves as a whole and is manifested in activities, and although they do not necessarily indicate how they are to be achieved, they should be achievable (Gross, 1969).

Strategic intent then differs from mission in its prospective sense in that it helps to create new paths of operation and modifies the scope by inducing the pursuit of ambitious goals and challenging the status quo of the organization (Pitt, 2001). Although vision and goals are also future-oriented in this regard, they differ from strategic intent in their rational and limiting nature, either in terms of time or resources (Mantere & Sillince, 2007). One could say then that strategic intent is superordinate, symbolic, of high significance and uncertain in its achievability (Hart, 1992; Mantere & Sillince, 2007; Pitt, 2001; Smith, 1994).

The latter is perhaps one of the most challenging aspects that scholars point out about using strategic intent as a driver for strategy definition. Goals defined by aspirations rather than projections are by definition irrational and unlikely to be achieved, which exposes members of the organization to a direct possibility of failure (Sheehan Jr., 1999). According to Sheehan Jr. (1999), organizations that choose to use strategic intent must embrace failure as a trade-off for the possibility of achieving extraordinary returns. This is because an

organization that defines highly ambitious goals and then only partially (or even largely) achieves them will necessarily fail to reach those goals completely. But, by the mere fact of having followed this path, it will probably have a higher return than if only more modest goals are pursued (Hamel & Prahalad, 2005; O'Shannassy, 2016; Sheehan Jr., 1999).

This is probably the reason why the concept of strategic intent has found its place among practitioners and scholars, leading to various applications in different instances. For example, Pitt (2001) explores in his work the metaphorical manifestations of strategic intent, and how they are used by managers to drive change in organizations. Also, Gratton (1994) shows the instrumental role of strategic intent in helping to connect human resource management to the business core. Similarly, a number of studies have discussed, based on empirical evidence and literature, how strategic intent can guide performance in organizations (see Mariadoss et al., 2014; O'Shannassy, 2016; Sheehan Jr., 1999). This diversity of applications has also raised the discussion on how the intent is built.

4.2 Stating or building a strategic intent

When considering strategic intent, one should keep in mind that it is tied to people. The intent is a psychological concept in possession of individuals capable of generating a state of mind associated with an external reality (Searle, 1979). As humans we plan for our futures and such a future-oriented mindset is intentional (Mantere & Sillince, 2007). The same happens at the organizational level when plans are made, and goals are defined. Beyond explaining exactly how they are to be achieved, what is expected is to set an organizational intent with a broad range of interpretation and improvisation in how that intent is realized (Mantere & Sillince, 2007).

The literature can be confusing about who is responsible for or who is the bearer of strategic intent in an organization (see Table **4-1**). In a corporate context, strategic intent is in many cases attributed exclusively to the top management team (see for instance Burgelman & Grove, 1996; Lovas & Ghoshal, 2000; Prahalad & Doz, 1987). However, one of the characteristics that Hamel & Prahalad (2005) stress the most is the motivational and flexible

dimension that encourages individual and team contributions at all levels of the organization. In the same line, Gratton (1994) insists on the importance that a strategic intent should not be left only as rhetoric in the form of slogans or compelling phrases by the top management team, but that it should be communicated, discussed and operationalized with the other areas of the organization. Similarly, Smith (1994) also argues that no matter how much a leader's personal vision of an organization exists, it does not really become a strategic intent until the other members are committed and contribute to it.

Table 4-1: Strategic intent in the literature

Reference	Understanding of intent	Possession of intent	Context
Prahalad & Doz (1987)	Goal for which one cannot plan, long-term goal, long-term orientation	Top management with no mention of employee involvement	Corporate
Hamel & Prahalad (2005) originally published in 1989	Shared obsession to win leaving room for individual and team contributions	From CEO to all members of the organization	Corporate
Hart (1992)	Mission (superior goal) for the organization that inspires higher levels of achievement	Multiple members of the organization	Corporate
Smith (1994)	A sense of direction, discovery and destiny that changes people's beliefs and actions	From CEO to all members of the organization	Corporate
Gratton (1994)	A mission statement beyond rhetoric that ignites change in human resource processes	From CEO to all members of the organization	Corporate
Burgelman & Grove (1996)	A top management decision that stretches current innovative capabilities and market's readiness	CEO	Corporate
Sheehan (1999)	A new strategic framework that creates a chasm between ambition and resources leading to a creative tension to systematically build new advantages	All members of the organization	Nonprofit

Reference	Understanding of intent	Possession of intent	Context
Lovas & Ghosal (2000)	A statement of goals about a preferred future position articulated by the top management	Top management	Corporate
Pitt (2001)	Is synonymous with the means envisioned for achieving favorable outcomes, the path rather than the destination	Top management	Corporate vs University
Mantere & Sillince (2007)	A symbol of the organization's will about the future which energizes all organizational levels for a collective purpose	Coherently distributed in all members of the organization	Organizations in general
Rui & Yip (2008)	The relentless pursuit of long-term objectives, a source of motivation and an active and rational process to focus resources	Top management	Corporate
Mariadoss et al. (2014)	A broad-based strategic posture that involves strategic aggressiveness with a focus on dominance	From CEO to all members of the organization	Corporate
O'Shannassy (2016)	A dynamic capability that gives an intuitive understanding of the future of the organization that helps to confront uncertainty	From CEO to all members of the organization	Corporate
Metzlar (2017)	The misfit between resources and ambitions created by a set of goals that exceeds the current position of the organization provoking a sense of urgency to reach those goals	All members of the organization	Smallholders

While much of the academic discussion has been from the corporate context, there have been authors interested in exploring the influence of strategic intent in other sectors. For example, Sheehan (1999) is perhaps one of the first to apply this concept to a non-profit organization. Despite the vast differences between the corporate and nonprofit worlds, he explores the extent to which strategic intent could be applied to help drive the youth leadership development programs offered by the non-profit. In this case, the intent, rather than focusing on “dominating the competition” or “global positioning”, was to increase the

quality and outreach of those programs driven by the passion and belief of managers and staff in making a positive impact on society (Sheehan Jr., 1999). A similar approach is explained by Pitt (2001) in comparing the behaviors and metaphors of a CEO of a multinational food company with the head of the business administration department of a university. He shows how even in university characteristic situations such as budget deficits, high individuality and strong reputation orientation, strategic intent plays an instrumental role in helping to build relationships in a more productive and broadly cohesive direction (Pitt, 2001).

Another more recent example is the work by Metzlar (2017). In this study, he examines to what extent strategic intent can be a useful tool to understand the performance and foster collective action in a cooperative of smallholders. As part of his conclusions, Metzlar argues that a weak strategic intent in such organizations leads to low member commitment with fragmented ideas mainly due to a lack of clear goals, but also to the diversity of interests and expectations of cooperative members. He further suggests that, to address this, not only a consistent group goal should be developed and communicated, but cooperative members should be trained in both the practices of their work and the relevance, benefits and objectives of the cooperative. In this way farmers could have a better understanding of why join and contribute to improve the cooperative (Metzlar, 2017).

Whether using strategic intent as a top-down directive or as an organization-wide engagement mode, the possibility of recognizing multiple intents in harmony toward a broader direction is scarce in the literature. This is what Mantere & Sillince (2007) draw attention to and call for considering organizational strategic intent as an umbrella for building coherence among multiple individual (or team) intents within the organization. They argue that instead of expecting the strategic intent to be unique and rigid for everyone in the organization, or allowing multiple intentions to exist unconnected, one should put effort into building an organizational strategy that is understandable and recognizable to a wide range of stakeholders (see Figure **4-1**).

Whereas Mantere & Sillince's collective approach invites a symbolic and inspirational way of strategizing and energizing an organization, authors such as O'Shannassy (2016) note

that such an approach will be limited in large organizations and there will be times when goals must be cascaded down to the rest of the organization to avoid potential waste of time and resources. According to O'Shannassy (2016) one must be mindful of the moments to increase discipline and coordination so results can be delivered, and the moments to allow for more “chaotic management processes” that foster innovation and learning.

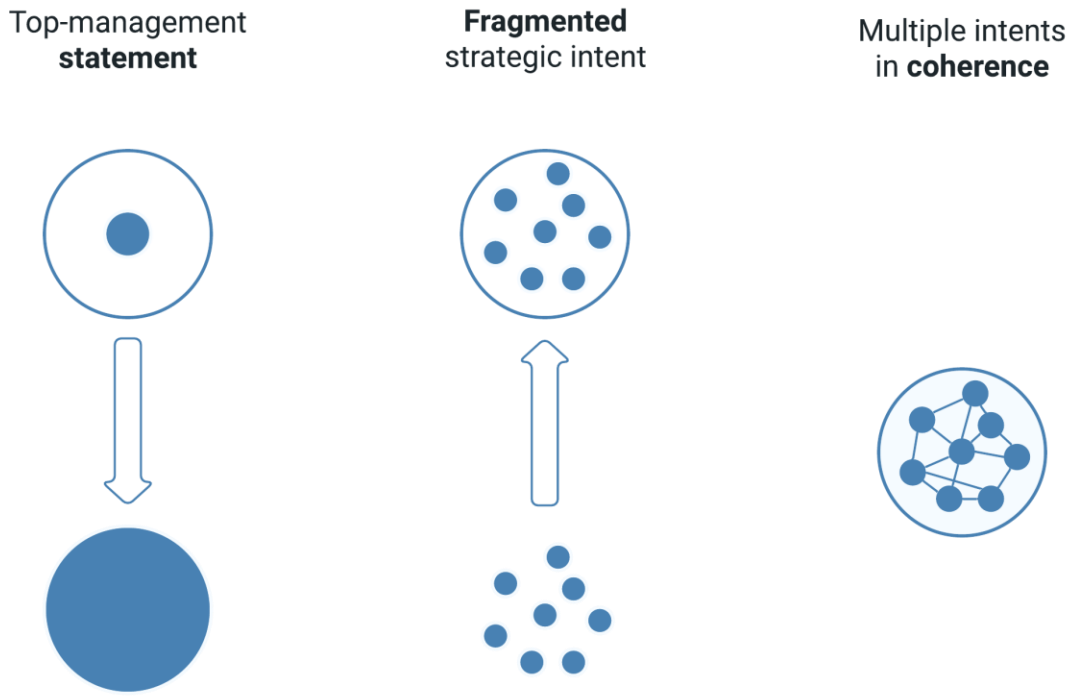


Figure 4-1: Organizational strategic intent (adapted from Mantere & Sillince, 2007)

4.3 Strategic intent, innovation and innovation labs

Strategic intent and innovation are inextricably intertwined. As it has been mentioned, strategic intent invites to change, to pursue a desired future and thus creating a creative tension, triggering the competence development and inciting experimentation. This capability for experimentation and future-oriented reinvention is what Leonard-Barton (1995) underlines as one of the sources of innovative organizations. According to her, the

more uncertain the future becomes, the more important is to generate an environment in which all members of an organization are oriented towards experimentation and learning. In this regard, strategic intent is the spark that triggers the innovation process in an organization (Leonard-Barton, 1995). An innovation intent is the basis that determines an innovation strategy by describing opportunity scenarios under uncertain conditions (ISO, 2019).

The innovation intent needs a supportive and collaborative culture (ISO, 2019). Yet organizations suffer from multiple obstacles to ensure favorable environments to realize their intention to innovate (Boly et al., 2016; Leonard-Barton, 1995). Therefore, it is not surprising to see the degree of popularity that innovation labs have acquired. It is important to keep in mind that innovation labs are an organizational device that helps to materialize the intention to innovate and overcome the barriers to innovation (risk adversity, limited experimentation, organizational climate, lack of openness, etc.). But as innovation labs are increasingly being designed as open spaces or platforms where multiple actors converge around joint innovation projects (see Chapter **3**), this inherently brings about the convergence of multiple innovation intents.

Then a worthy question would be to what extent the intent of an innovation lab can operate as an umbrella that allows multiple innovation intents to coexist? Based on what has been discussed in this chapter, it seems reasonable to think that the strategic intent of an innovation lab can act as an organizational strategic intent that will integrate multiple and different intents throughout its operation (as suggested by Mantere & Sillince, 2007). But this also implies that the lab initiative should be regarded as more than a space or accessory and rather as an organizational form entitled to support the innovation strategy. Accordingly, the lab team will be in charge of conveying and involving all stakeholders (internal and external) under the “innovation lab intent”. Ultimately, strategic intent has the potential for uniting organizational action into a coherent pattern, especially in those situations where organizations need to be sensitive to environmental changes while being able to exploit bottom-up ideas (Gratton, 1994; Mantere & Sillince, 2007; O’Shannassy, 2016).

4.4 Understanding and unfolding strategic intent

So far, a review has been made of what strategic intent consists of, its relevance in strategic management and its potential to help build coherence towards a common north in contexts where multiplicity of intents prevails, such as that of innovation labs. The remaining issue is how the strategic intent can be implemented. In general, it can be said that the effective use of strategic intent lies in making strategic decisions communicable (Gratton, 1994; Metzlar, 2017; O'Shannassy, 2016). However, according to Mantere & Sillince (2007), in order to use strategic intent proactively, efforts should be focused on two aspects: making it *understandable* and following its *unfolding* over time.

Understandable refers to facilitating strategic intent interpretation through some form of representation that helps individuals in the organization to interrelate the main elements of that intent with their personal point of view and the context (Mantere & Sillince, 2007; Sillince, 1999). If that intent is subsequently informed and the beliefs behind it are shared and discussed, then people can make connections between the possible actions the intent entails, how others understand it, and how they project themselves into it (Gratton, 1994; Pitt, 2001; Sheehan Jr., 1999; Smith, 1994).

Unfolding refers to being aware that an organizational strategic intent may be shaped over time and, therefore, care must be taken to ensure that its implementation and transformation is comprehensible (Mantere & Sillince, 2007). A sustainable implementation of strategic intent requires more than a single intervention (Metzlar, 2017). It should be followed and supported by reminding and updating goals, allowing feedback on decisions and results, recognizing milestones and the contributions of the parties, thus making the collective intent more consensual, open and robust (Hamel & Prahalad, 2005; Sillince, 1999). Appreciating the temporal unfolding of strategic intent helps to reorder past experiences and enables retrospective sense-making (Gratton, 1994; Mantere & Sillince, 2007).

The above insights help explain the theoretical foundations and implications of the notion of strategic intent. This helps to clarify the relevance that prior research has placed on the need for innovation labs to have a clear and shared strategic intent, but also reaffirms that

it is something that goes beyond the definition of goals and the allocation of resources. As a result of this literature review, it can be hypothesized that by providing a mechanism to facilitate the depiction of how innovation labs perform, the process of understanding and building a shared strategic intent can be assisted. Therefore, it seems reasonable to propose a tool to help guide the innovation lab intent.

4.5 Conclusion

Throughout this chapter it has been addressed the managerial and theoretical foundations of strategic intent. As an alternative to more rationalistic strategic planning approaches, strategic intent represents a more symbolic and intuitive way of guiding organizational performance in more uncertain contexts. It has been also explained how strategic intent can unite organizational action into a coherent pattern, especially when organizations need to be sensitive to environmental changes while being able to exploit bottom-up ideas. In addition, because it incites the pursue of ambitions goals, permeates the organizational culture and triggers experimentation, strategic intent is strongly linked with sparking innovation processes.

Moreover, the literature discussion in this chapter suggests that the strategic intent of an innovation lab should be conceived as an organizational intent that will integrate multiple and different intents from internal and external stakeholders. This further implies that innovation lab initiatives should be organizational forms entitled to support the innovation strategy instead of being just accessory. Lastly, an emphasis has been made in acknowledging that strategic intent needs to be understandable, and its unfolding supported over time.

5. Understanding innovation lab intent: toward a performance assessment tool

The literature review presented in the preceding chapters has shown there is still a gap in understanding how strategic intent is built within innovation labs and what are the actual capabilities that are mobilized to realize such intent. Therefore, in this chapter, the focus turns to identifying which set of concepts and criteria is useful to examine in order to understand what the common practices among innovation labs are. The objective is to propose a method to assess the way in which innovation labs operate, looking to provide a tool for strategically designing and conceiving spaces to support innovation processes. To achieve that, we build upon the eight frameworks identified and compared in Chapter **3**, whereby Moultrie, Nilsson et al. (2007)'s is selected as the most comprehensive and suitable for the objective of this research. From there, an updated framework is introduced as the basis for the construction of a maturity grid-based assessment tool tested in an exploratory study among managers of 27 different innovation labs around the world.

In the following, the methodological approach is presented in which the main stages of this part of the study are described. Next, the updated conceptual framework is proposed, followed by the proposition of a strategy-oriented maturity grid and finally the design of the assessment tool (questionnaire). Then, the main empirical results of its application are discussed by means of a cross-case analysis. At last, a discussion of the validation and its practical implications is addressed, before proposing a conclusion and discussing further steps.

The contributions made in this chapter were originally published in the *Journal of Creativity and Innovation Management* (Osorio, Dupont, Camargo, Palominos, et al., 2019).

5.1 Setting up an exploratory study

This part of the research was conducted through a five-stage process, as shown in Figure **5-1**. First, building upon the literature review presented in Section **3.4**, eight frameworks were already selected due to their comprehensiveness, giving relevance to both strategic and operational aspects as part of the innovation lab. Next, a comparison between the eight frameworks was performed, remarking on the positive aspects or the disadvantages of each of them. As none of the frameworks seemed to be totally oriented towards the objective of this research, and some of them remain theoretical works, we attempt to propose a conceptual framework adjusted to the conditions of this research. Therefore, it was aimed to operationalize the updated framework by building a maturity grid and designing a collection tool.

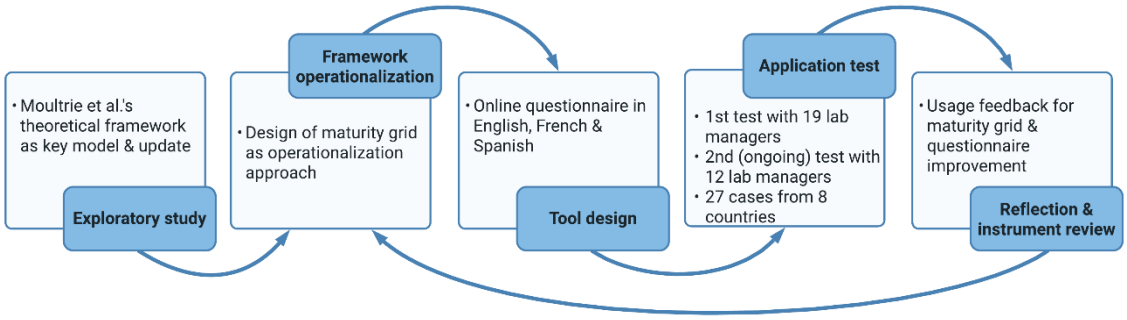


Figure 5-1: Tool design and international study process

Given the relative novelty of this phenomenon as a research field, relying solely on the existing body of literature may be insufficient. As addressed before, innovation labs are exposed to deal with substantial strategic matters and possibly short useful lifespans, their challenge is to adapt rapidly without losing their thematic focus and continuously share and align their strategic intent with all the stakeholders. This has led to significant diversity in laboratories, managing practices and unpredictable outcomes. Also, this underlines the importance of defining a methodological framework to assist lab managers and stakeholders in strategically understanding and guiding innovation lab implementation and operation. Thus, the idea of capturing good practical knowledge through a process maturity

approach to assess organizational performance and support improvement initiatives, as applied by Moultrie, Clarkson, et al. (2007), appears to match in this case.
Due to the exploratory nature of this research, we opted for building a maturity grid as an alternative to capturing practices and outcomes of innovation labs. A collection tool was designed to include directors and managers from laboratories in this process. Then, an international survey is conducted in two periods as an application test. Answers from 27 lab managers were collected from which insights and usage feedback were progressively used to strengthen the maturity grid and improve the questionnaire.

5.2 Defining an innovation lab conceptual framework

In the previous bibliographic discussion (Chapters **3** & **4**), a close relation has been observed between strategic intent with innovation lab performance. Thus, it is possible to think that, if at the project stage of an emerging innovation lab, it is possible to have a way of assessing and analyzing the proper environment for intended goals, the outcomes of such an intention could be better oriented. In addition, if during that process we contribute to understanding the way that the innovation lab is materialized and resources are used, it could be possible to establish some guidelines for those laboratories that are already in operation to redirect or adapt their strategy.

Considering this and the results of the comparison, we believe that Moultrie, Nilsson, et al. (2007) provide the most fitting framework for the purpose of this research. They comprise the process of creation of the innovation environment (physical space) to satisfy strategic and symbolic goals (strategic intent), and the process by which such space is used and the degree to which the strategic goals are met (realized intent). Additionally, elements that compose each pillar and process are theoretically described. However, as addressed in Chapter **3**, this framework was developed in a specific context. Since 2007, several societal evolutions have generated a new context and it seems relevant to improve Moultrie, Nilsson, et al.'s framework with new inputs and knowledge:

- First, although Moultrie, Nilsson, et al. (2007) consider the context, it was addressed as an innovation space within a company. Today, this dimension takes even more importance because the large diffusion of innovation lab involving open and virtual communities, the public etc. Hence, this type of project must be more resilient regarding its global, regional and local context. Furthermore, such a project always makes part of a particular ecosystem (whether a university, city or industry) take into account the stakeholders' expectations and needs as well as the nature of and culture of the community that allows it to exist.
- Second, an innovation lab must help stakeholders connect with the reality of each other, i.e., the real-world lives of the different stakeholders, to better understand context and anticipate concrete issues. Moreover, some projects require the implementation of real-size demonstrators in the real situation of use (Dupont et al., 2015; Roux-Marchand et al., 2020; Ten et al., 2020).
- Third, innovation labs are open spaces where various cultures intersect. Studies show that we can view stakeholders as a "community of interest" or "community of practices" (Dupont et al., 2017; Morel et al., 2018). According to the stakeholders' motivation and practices, it is necessary to adapt the physical environment and the technologies.
- Also, the collaborative aspects must be integrated as these behaviors around the innovation lab generate profitable opportunities for innovation (del Vecchio et al., 2017; Dupont et al., 2019). Furthermore, the user is a specific key stakeholder for whom methods of involvement have largely been designed and implemented (Dupont et al., 2016).

In addition to updating the framework in a new context (e.g., more open, more virtually distributed etc.), there is the need to operationalize it, through a structured hierarchy and the possibility of evaluating each element of the pillars. Figure **5-2** proposes an updated framework based on the experience of the projects described in literature discussion presented earlier in this work.

As has been shown, establishing a clear strategic intent at the early stage of the project is fundamental, and the literature has actively evolved in that regard during the last few years. Among the other frameworks studied in this work, it is possible to identify common elements that define which aspects should be considered to set up the strategy for an innovation lab supported and shared by several stakeholders, such as companies, academics, open labs, factories etc. To be precise, the contributions to this updated framework rely on the consideration of the previous mentioned elements, where only strategic goals and teamwork elements are retained from the original framework, as five new ones are proposed:

- **Ecosystem approach:** To generate added value for all the stakeholders involved, creating long-term engagement and sense of belonging with the lab.
- **Real-world context:** To capture or resemble real-life environments (through space, equipment or methodologies) and enable stakeholders to understand how others understand the context.
- **User-centric innovation:** To adopt a user's point of view and involve them in the different phases of the innovation cycle, in which they can test, evaluate, contribute and co-create. The user is not necessarily the direct customer. He or she can benefit from a use without having bought it directly.
- **Culture and community:** To build an identity and to grow a community of users or partners engaged and motivated with access to the lab.
- **Lifespan:** To estimate the length of the lab project as a whole (short-, medium- or long-term).

Ultimately, we also believe that "realized intent" should be seen as innovation outcomes with tangible and intangible results that allow us to assess impact and determine how the lab performed. With these results, decisions can be made either to make early modifications to the functioning and the space (adaptation) or to deeply address the strategic intent (evaluation).

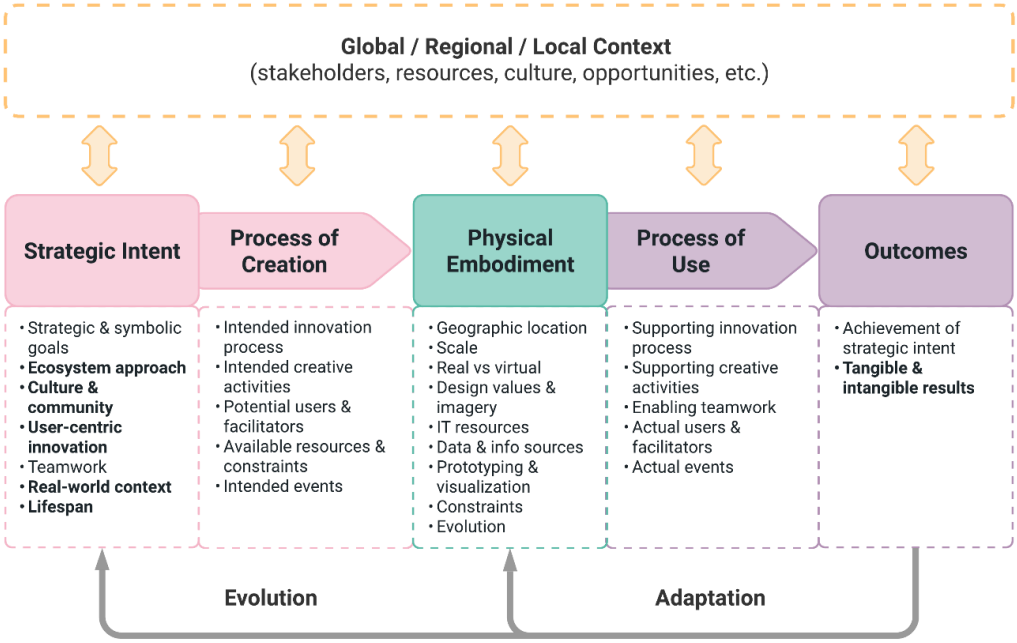


Figure 5-2: Updated framework proposition based on Moultrie, Nilsson, et al., (2007).

On balance, we argue that this framework aims to facilitate the design of a new lab (or the adaptation of an existing one) according to the reasons for creating it, the type of lab that is envisaged, the resources needed for its implementation, how it is or should be used and the results that are expected or are being obtained. To address these aspects, the framework is composed of 30 criteria grouped into 5 pillars: strategic intent, process of creation, physical embodiment, process of use and innovation outcomes. Additionally, through this framework, it is encouraged that any innovation lab must be aligned with the innovation strategies of its allies and according to its context. Likewise, the results of its operation should be observed and evaluated to determine the level of achievement of the innovation lab intent and eventually to determine its adaptation or strategic rethinking.

5.3 Framework operationalization: proposition of a strategy-oriented maturity grid

As the aim of this work is to go deep into the operationalization of the framework, the next step in the methodology was to have a clear definition of each indicator proposed in the framework. In addition, a first approximation to a maturity grid was made based on the literature review as well as the experience of the authors and a group of experts. Here, the concept of maturity is taken into consideration as a measure to quantify the organizational capabilities (Maier et al., 2012). This concept is helpful for determining standard practices or processes, and their classification by degree of expertise (Claire et al., 2014). One way to do this is by looking at what people are doing operationally and analyzing behaviors, attitudes and competences (Maier et al., 2012). This is usually visualized in a set of cumulative stages, where higher stages build on the requirements of the lower ones. This evolution towards maturity can be made using a ladder representation (Andersen & Jessen, 2003). These representations can vary from Likert-type scales to maturity scales with multiple anchor phrases and detailed performance descriptions (Moultrie, Clarkson, et al., 2007).

In this case, the maturity grid is used as a methodological representation of our framework. Based on the definition of each criterion, we built a set of four levels of maturity using anchored phrases to describe performance at each end of the scale. Then, from Level 1 to Level 4 we have a transition from low to high performance. However, most of these levels were identified from the literature but in some cases, it was necessary to appeal to our own experience and discussions with some experts to determine the levels of maturity for certain criteria (see Figure **5-3**). Even though, this maturity grid has proven instrumental for the collection of evidence and practices as shared in (Osorio, Dupont, Camargo, Palominos, et al., 2019), it is undeniably that it needs to be further developed and completed based on the actual experience and actions undertaken within the innovation lab, so behaviors, attitudes and competences can be better understood (Maier et al., 2012).

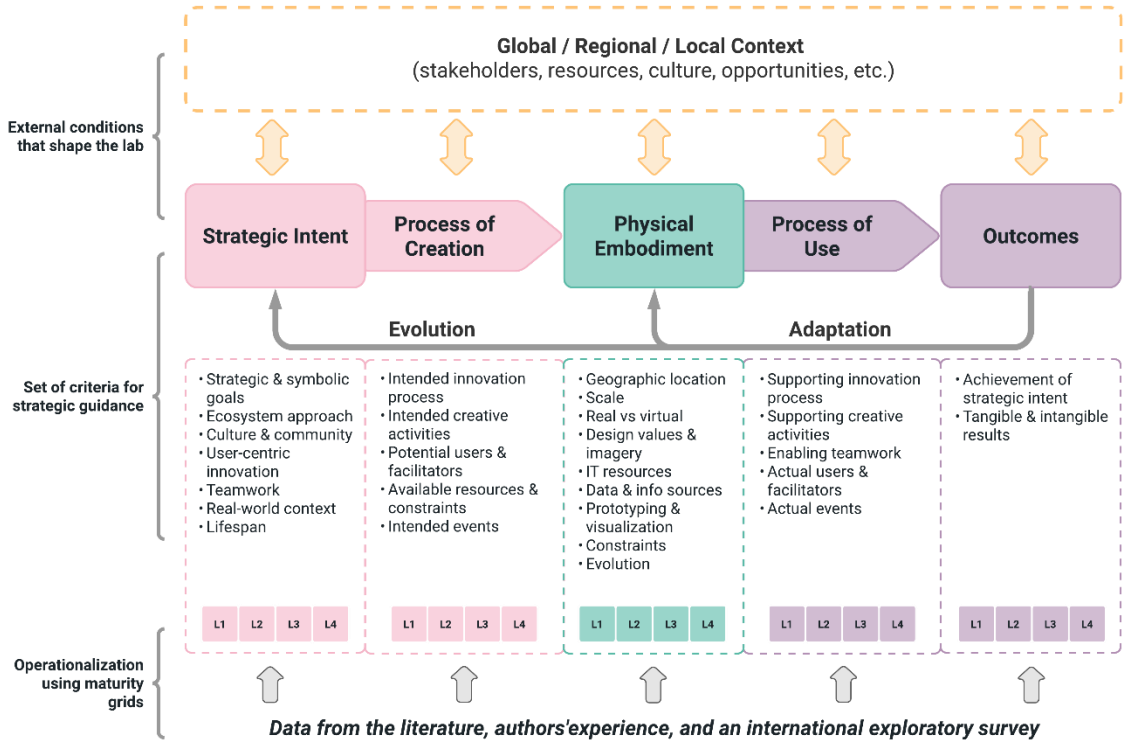


Figure 5-3: Framework operationalization using maturity grid approach (Osorio et al., 2019)

5.3.1 Strategic Intent

The first process to be considered is the strategic intent. As an example, Table **5-1** shows the detailed maturity grid for the strategic intent block. The detailed maturity grids for the rest of the blocks are shown in Appendix **B**. As discussed before, the strategic intent concept symbolizes the organization's will about a desired future and gives a common target to which intraorganizational evolution processes are oriented and the necessary competences accumulated (see Chapter **4**). This is why Moultrie, Nilsson, et al. (2007) assign a fundamental role to the existence of an underpinning strategic intent, so a desired innovation environment does not become a vacuous space with a superficial focus. The design of an innovation lab enables the development of unique capabilities, their reconfiguration to changing demands, and supports synergies between complementary assets (M. Lewis & Moultrie, 2005). Hence, it is determinant to be conscious of which kind

of capabilities and assets are important to enable and how the innovation lab is strategically conceived around its context.

Table 5-1: Maturity grid for the strategic intent block (updated from Osorio et al., 2019)

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
Strategic & Symbolic Goals	To support the mission of the organization or association and its innovation strategy.	There was no clear perspective on the objectives	As short-term goals	As mid-term goals	As long-term goals	Lewis & Moultrie, 2005; Moultrie, Nilsson et al., 2007
Ecosystem Approach	To generate added value for all the stakeholders involved, to create long-term engagement and identification with the laboratory.	There was no plan to generate value for the lab's stakeholders	Value generation for the lab's stakeholders was limited to contractual commitments	Value generation was planned to foster stakeholders' involvement in the lab	Value generation for all stakeholders was envisaged to create long-term engagement and identification with the lab	Veeckman et al., 2013; Dupont et al., 2014; Dupont et al., 2017
Real-World Context	To capture or resemble real life environments (through space, equipment or methodologies).	The lab was never planned to capture or resemble real-life environments	The lab was conceived as an isolated testbed	The lab was thought so it could emulate some real-life conditions	The lab was designed to capture and/or resemble real-life environments	Schuurman et al., 2013; Veeckman et al., 2013; Roux-Marchand et al., 2020
User Centric Innovation	To involve users in the different phases of innovation cycle in which they can test, evaluate, contribute and co-create.	There was never considered to involve users in the lab's activities	Users were seen as passive actors mainly for testing purposes	Users were seen as contributors whose inputs may lead to pivots in the innovation process	Users were considered as co-creators who should be an active part of the whole innovation process	Veeckman et al., 2013; Fecher et al., 2020; Ten et al., 2020
Culture and Community	To build an identity and to grow a community of users engaged and motivated with access to the laboratory.	There was not a clear intention to build a community around the lab	Interested people could access to lab facilities to conduct specific activities under demand	The lab was viewed as meeting point for groups of people and existing communities to gather and shared knowledge	The lab sought to create a broader sense of community by bringing together multiple groups of people with whom to co-organize activities, events, and knowledge sharing	Moultrie, Nilsson et al., 2007; Oksanen & Ståhle, 2013; Dupont et al., 2017
Teamwork	To enhance teamwork in innovation, encouraging better communication (physical or virtual), encourage formal and informal	There was not an intention to stimulate teamwork	Teamwork and social interaction were seen as limited, formal, and hierarchical	There was an expectation that the lab would foster teamwork through physical or virtual mechanisms, while allowing	There was a clear desire to stimulate teamwork through the design of the lab, enabling people to constantly interact under	Moultrie, Nilsson et al., 2007; Nicolai et al., 2016 and authors' experience

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
	social interaction and motivate staff			for dynamic interaction between people	formal or informal circumstances	
Lifespan	To estimate the length of the project as a whole (short, mid or long-term).	Short-term (less than a year)	Mid-term (from 1 to 2 years)	Long-term (from 2 to 3 years)	Very long-term (more than 3 years or permanent)	Veeckman et al., 2013 and authors' experience

5.3.2 Process of creation

Beyond strategic reflection, it is necessary to understand the types of people who will use the space and their needs, including the degree to which independent facilitation is required and how the space will be linked to the whole innovation process (Magadley & Birdi, 2009). After all, the innovation lab will support the organization's existing innovation process or stimulate the development of a new one (Moultrie, Nilsson, et al., 2007). Likewise, during the *process of creation* one should be aware that, in practice, any work environment will evolve from the original intentions and will manifest the real work undertaken there.

5.3.3 Physical Embodiment

The innovation lab itself encompasses all the characteristics and forms of its *physical embodiment* (real and virtual). The design of the space varies significantly, with different design values and degrees of flexibility (Oksanen & Ståhle, 2013); also, the way the space evolves should be contemplated. Different laboratories contain diverse levels of physical and virtual resources, from the IT infrastructure and support of prototyping and visualization to the furniture. Each configuration is realized based on specific constraints such as resources, space, skills, and time.

5.3.4 Process of use

Innovation labs are forced to adapt to the changing conditions, and this may lead to *new or adapted uses* of the space (Osorio et al., 2020). The way innovation is actually supported,

which creative activities are done within the lab, or to what degree the space really enables teamwork are some of the elements to take into consideration, but more important is to compare how much this has changed in comparison to the original intent and the process of creation. This could lead to helpful insights to understand the actual role the lab has and the services that are provided.

5.3.5 Outcomes

As innovation intermediaries, innovation labs are expected that their activity will result in some kind of innovation outcome. However, based on the literature review, there is no clear understanding of which type of results are the ones to determine whether a laboratory is successful or not. Beyond this, it is clear that the activity of innovation labs triggers a set of creative and innovative processes with involvement of the community that eventually lead to some positive testimonials and compelling stories. Therefore, it is necessary to examine what possible indicators could help to assess their performance. For the purpose of this work, *innovation outcomes* are considered to be those tangible and intangible results which can be duplicable, new and useful in their context (Quintane et al., 2011).

Moving forward through the path to operationalization, an international exploratory study is proposed. As was shown before, the international proliferation of claimed innovation labs around the world has been significant. Thus, designing an instrument to gather and analyze the experiences of multiple cases fits with the need to complete and ameliorate the grid. This instrument is a questionnaire intended to reach multiple networks of labs, such as fablabs, living labs, makerspaces, vivelabs, design factories among others.

5.4 Testing the assessment tool

Due to the exploratory nature of this research, we opted for building a maturity grid as an alternative to capturing practices and outcomes of innovation labs. A collection tool was designed to include lab managers and directors in this process. An international survey was then conducted among 27 innovation labs to test the tool, from which insights and

comments on its use are collected and discussed. Finally, this analysis will be used to strengthen the maturity grid as well as to improve the questionnaire.

5.4.1 Design of the instrument and data gathering

Based on the comprehensive set of criteria developed in the previous section, an instrument (online questionnaire) to collect qualitative and quantitative data based on multiple cases was designed. It was co-designed with directors and managers from several innovation labs. This questionnaire is based on the 30 criteria defined in the framework and the grid of indicators previously presented. The instrument is composed of multiple-choice questions as well as checkboxes and open questions. In the first case, we aim to assess the maturity level of the lab in the correspondent criteria according to the literature. On the other side, the checkboxes and open questions are used to gather data and identify which practices are performed within the surveyed cases in order to enrich the knowledge on the different setups that composes the innovation labs.

The collection tool was applied in two separate periods and two versions were developed. The first version builds on the master's project of this author (Osorio Bustamante, 2015). It was composed of 56 questions directly related to the framework plus 14 general questions for classification and feedback purposes for a total of 70. During the first data collection period 19 responses from 18 labs were gathered from 2015 to 2019. Then, based on the results, usage feedback and advances in this research, it was deemed necessary to iterate on the instrument in order to improve multiple aspects.

Several actions were made in this sense: (1) question refinement in terms of pertinence, structure and wording, (2) maturity concepts and descriptions have been updated based on new literature and the empirical data obtained, and (3) migration of the online questionnaire from Google Forms to LimeSurvey (Université de Lorraine official online survey platform), which offers a more customized experience, improved security and data management, and multilingual features. A prototype for each version was applied with preliminary cases to verify the functioning of the questionnaire, which resulted in the stable

version that was used for the following tests with subsequent cases. As a result, the composition of the second version was optimized to 50 framework-related questions plus 10 profiling and feedback questions for a total of 60. The second collection window was launched in mid-2020, which allowed us to collect 12 additional responses and 9 new cases.

The questionnaire can be accessed in the three languages:

- English: https://enquetes.univ-lorraine.fr/index.php/238264?lang=en
- French: https://enquetes.univ-lorraine.fr/index.php/238264?lang=fr
- Spanish: https://enquetes.univ-lorraine.fr/index.php/238264?lang=es

5.4.2 General characterization of surveyed labs

The instrument was applied in 27 cases on a diverse sample of laboratories from 18 cities and eight countries (see Figure **5-4**). Among the respondents there are representatives from living labs, vivelabs, makerspaces, design factories and fablabs (Figure **5-5**), represented mostly by their lab managers or directors (22 out of 27); this fact guarantees that the information collected is accurate and as close as possible to the reality of the labs. Regarding the type of host organizations to which the laboratories belong, there are public and private universities, governmental institutions, private associations and international agencies (Figure **5-6**). A summary of general characteristics is presented in Table **5-2**. The questionnaire captured responses describing functioning details of innovation labs, though they also provide valuable insight into the utility and the potential to assess each part of the process. Based on this, it is intended to understand the degree to which the instrument could be used as an assessment tool.

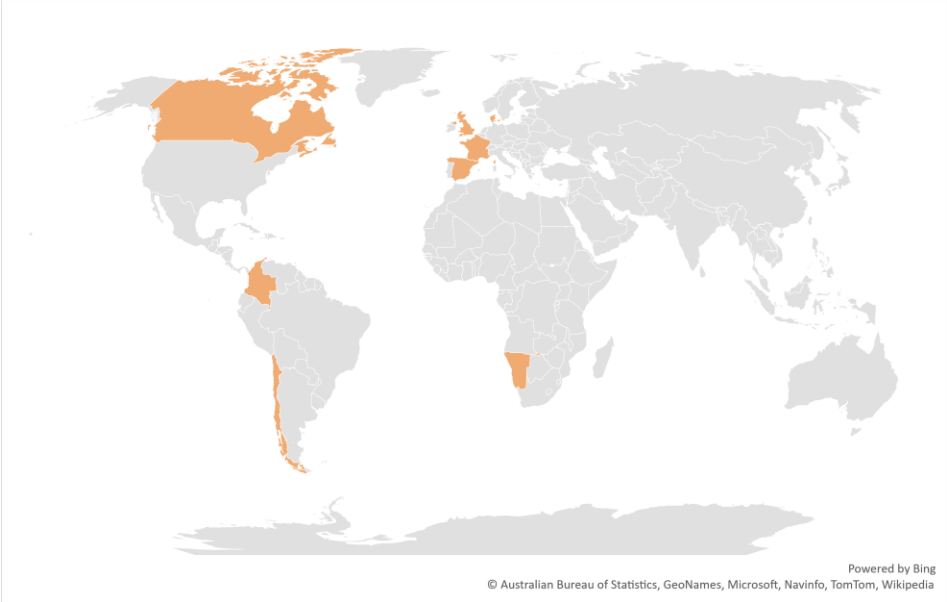


Figure 5-4: Country representation

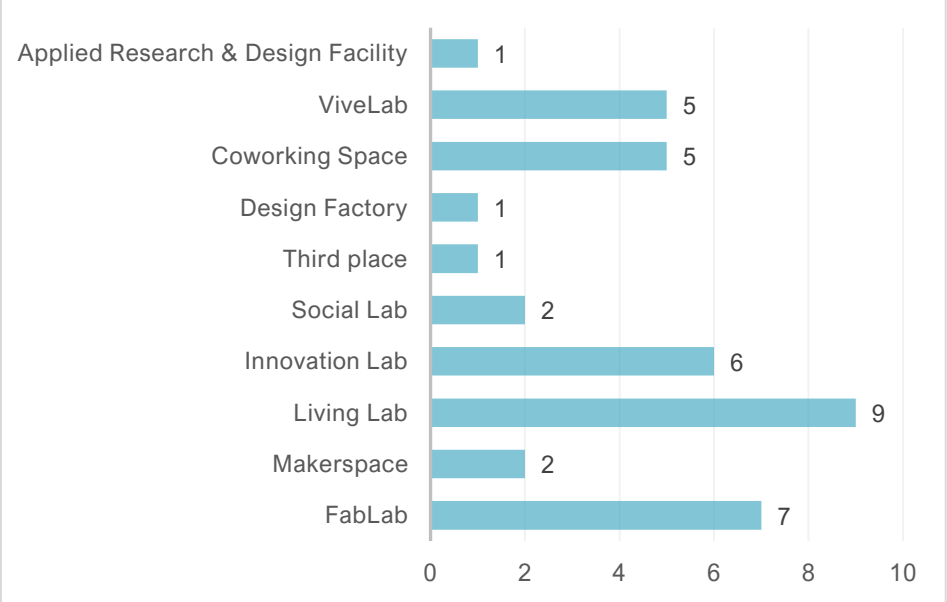


Figure 5-5: Type of surveyed labs

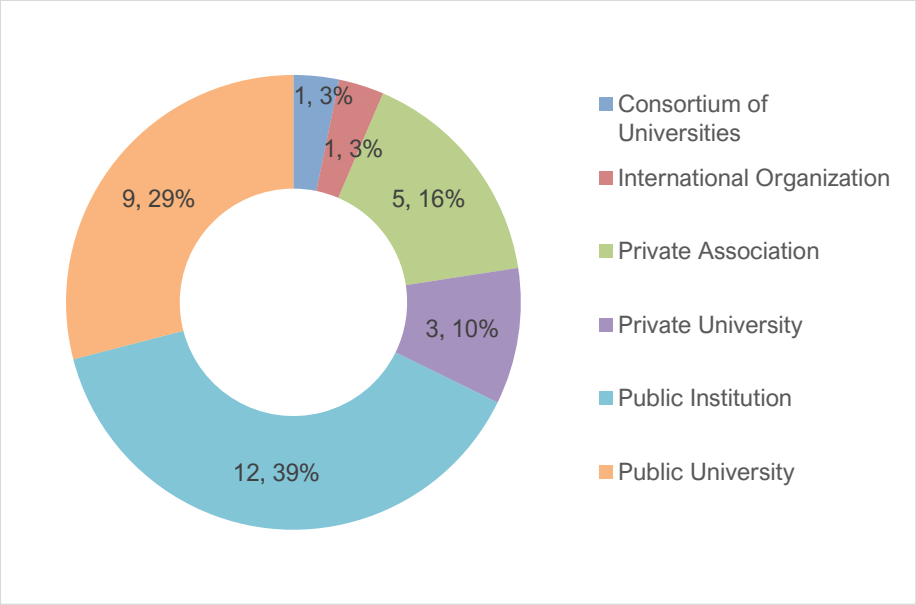


Figure 5-6: Types of lab host organizations

Table 5-2: Complete list of characterized labs that participated in the study

Tool version	Case	Date of creation (months of operation when answered)	Lab type	Lab staff	Users / month	Thematic focus
1	I	1-Dec-10 (56)	Living Lab	14	32	R&D in AAL and e-Health
1	**II**	**13-Nov-12 (32)**	**Design Factory**	**7**	**40**	**Design factory training program**
1	III	2-Sep-14 (10)	FabLab	1	80	Education, inclusion & disability
1	IV	25-Sep-12 (34)	ViveLab	4	70	Visual design training & research
1	V	29-Apr-13 (27)	ViveLab	12	546	Digital art entrepreneurship
1	VI	**1-Jan-14 (19)**	**FabLab, Living Lab**	**3**	**150**	**Fab Living Lab**
1	VII	21-Jul-15 (0)	Living Lab	3	10	Innovation
1	VIII	3-Nov-14 (9)	Coworking space	3	20	Social Innovation
1	IX	**28-Oct-13 (21)**	**ViveLab**	**18**	**160**	**Digital Content**
1	X	**1-Sep-07 (96)**	**Combined applied research and design facility**	**20**	**50**	**Digital Media**
1	XI	1-Nov-13 (21)	ViveLab	3	80	Mobile apps & Animation
1	XII	1-Aug-05 (122)	Living Lab	8	400	ICT in Education
1	XIII	1-Sep-15 (2)	Living Lab	1	20	Chain care of Nervous System Diseases
1	XIV	30-Nov-14 (31)	Coworking space	3	50	Science & technology-based entrepreneurship
1	XV	2-Jan-12 (66)	Makerspace	4	80	Digital Fabrication
1	XVI	12-Dec-15 (38)	Living Lab, Coworking space	2	20	3D Printing, Creativity & Innovation
1	IX	28-Oct-13 (72)	ViveLab	30	70	Digital content training and co-creation

Tool version	Case	Date of creation (months of operation when answered)	Lab type	Lab staff	Users / month	Thematic focus
1	XVII	23-May-18 (21)	Makerspace, Coworking space	6	300	Technology use awareness in educational institutions
1	XVIII	4-Apr-17 (35)	Innovation Lab	1	15	Innovation processes
2	VI	1-Jan-14 (80)	FabLab, Living Lab, Third Place	8	80	Innovation continuum in urban & territorial-based applications
2	VI	5-Jan-14 (81)	FabLab, Living Lab	6	100	Innovation & product development in urban & territorial-based applications
2	XIX	1-Mar-12 (104)	FabLab, Innovation Lab	9	3	ICT-based project development
2	XX	17-Aug-18 (26)	Innovation Lab	5	20	Social innovation for vulnerable aging population
2	XXI	6-Oct-13 (86)	Innovation Lab, Coworking space	7	14	Social innovation and regional collaboration
2	XXII	12-Mar-20 (8)	FabLab, Living Lab, Innovation Lab	2	15	Digital processes
2	XXIII	1-Jan-19 (23)	Innovation Lab, Research Platform	2	30	Robotics, cyber-physical systems and 3D printing
2	XXIV	1-Jan-20 (11)	Living Lab, Innovation Lab, Social Lab	3	50	Global learning network for scaling up local solutions
2	XXV	9-Dec-17 (37)	Social Lab	2	200	Entrepreneurship
2	XXVI	1-Jun-20 (7)	FabLab	7	0	Participatory Media
2	IX	28-Oct-13 (87)	Public Innovation Lab	10	40	Digital Content
2	XXVII	22-Dec-17 (37)	Living Lab	10	100	Innovation in energy

5.4.3 Application of the instrument: a cross case analysis

The purpose of this work is primarily exploratory and seeks to increase the understanding of the phenomenon rather than pursuing generalizable results or external validation. The focus is therefore mainly on analyzing the potential use of this tool as a methodological framework to understand the intent behind the creation of an innovation lab initiative and to represent the elements that can help to appreciate and guide its operation. It is important to also mention that, although at the time of writing this document the number of cases reached 27, this was not considered to be a representative sample to pursue statistical analysis and validation (Morse et al., 2002). Nonetheless, this will be a perspective to be pursued in this research as the tool evolves and new cases are collected. Finally, Appendix **C** includes an infographic as a descriptive summary of all the responses.

Then, results from the application of the instrument are discussed in detail in this section following a cross-case analysis. This method is useful in qualitative research to deepen the understanding and explanation of a phenomenon (Miles et al., 2015). We look at how the cases responded to the maturity grid, the contributions to the open-ended questions and the feedback to the tool. This process is illustrated below with four cases, each one chosen for their different stages of development and for the richness of their answers. Figure **5-7** shows the profile of each case based on the responses obtained. Next, valuable observations are discussed for each section into which the instrument is divided.

Case II. This laboratory belongs to the Design Factory network. It belongs to a private professional institute and was funded by the national government. It has seven employees, received 40 users per month and is focused on sharing and replicating the Design Factory Training Program among the students at their institute. The respondent for this case is the lab manager.

Case VI. This corresponds to a living lab that combines the fablab vision. It belongs to a public university and is the result of a joint effort with the city government and companies (network of SMEs and energy companies). In this case, the lab manager responded to the questionnaire. The staff is composed of three people and they receive more than 150 people per month. Their thematic focus is Fab Living Lab combining ideation, prototyping and evaluation.

Case IX. The innovation lab was created from a public alliance between the national and regional governments, operated by a public university. They have 18 employees while they welcome about 160 users per month. This laboratory belongs to the ViveLab network and is oriented towards strengthening the digital content industry in their context.

Case X. This is a combined graduate program and (applied) research and design facility. It belongs to a consortium of universities and their thematic focus is Digital Media. They have a staff of 20 people and have approximately 50 users per month.

From now on, main insights and learnings from the application of the instrument are discussed. Based on a cross case analysis, usage feedback and learnings are examined as well as instrument shortcomings to be improved.

- **Strategic Intent**

Looking to understand the degree of consciousness in which an innovation lab is conceived, several questions were grouped in this section according to our initial maturity grid. Some questions were presented according to the levels of the grid to determine how managers reflect on specific criteria from a strategic perspective. As for the strategic goals, we found that the question seems understandable to respondents reflecting on how they have foreseen the operation of their lab. Given that our four cases are strongly related to university environments, it is natural to see that in every case, their objectives aim to provide some kind of service or benefit to their closest communities (students, researchers and professors). However, *cases VI* and *X* are not limited to their university communities and show the intention to link their operation to companies' projects by charging for them to make a sustainable innovation lab.

Regarding the possibility that the innovation lab could create added value for its partners and the mechanisms to do so, respondents appear to be familiar with it. In this point, *Case X* shared a clear intention based on intellectual property strategies to make sure that any sponsor company keeps or receives the IP rights and they do not remain exclusively with the university; dedicated staff is in charge of managing relations with the companies; a faculty member is assigned for each project, acting as a facilitator and arranging schedules and deliverables at the beginning of each project. On the other hand, *cases II, VI* and *IX* considered that actions were mostly providing access to the space and equipment, offering free activities and services, or organizing joint events for dissemination. Based on these examples, it would be possible to feed the maturity grid with enough descriptions for each level.

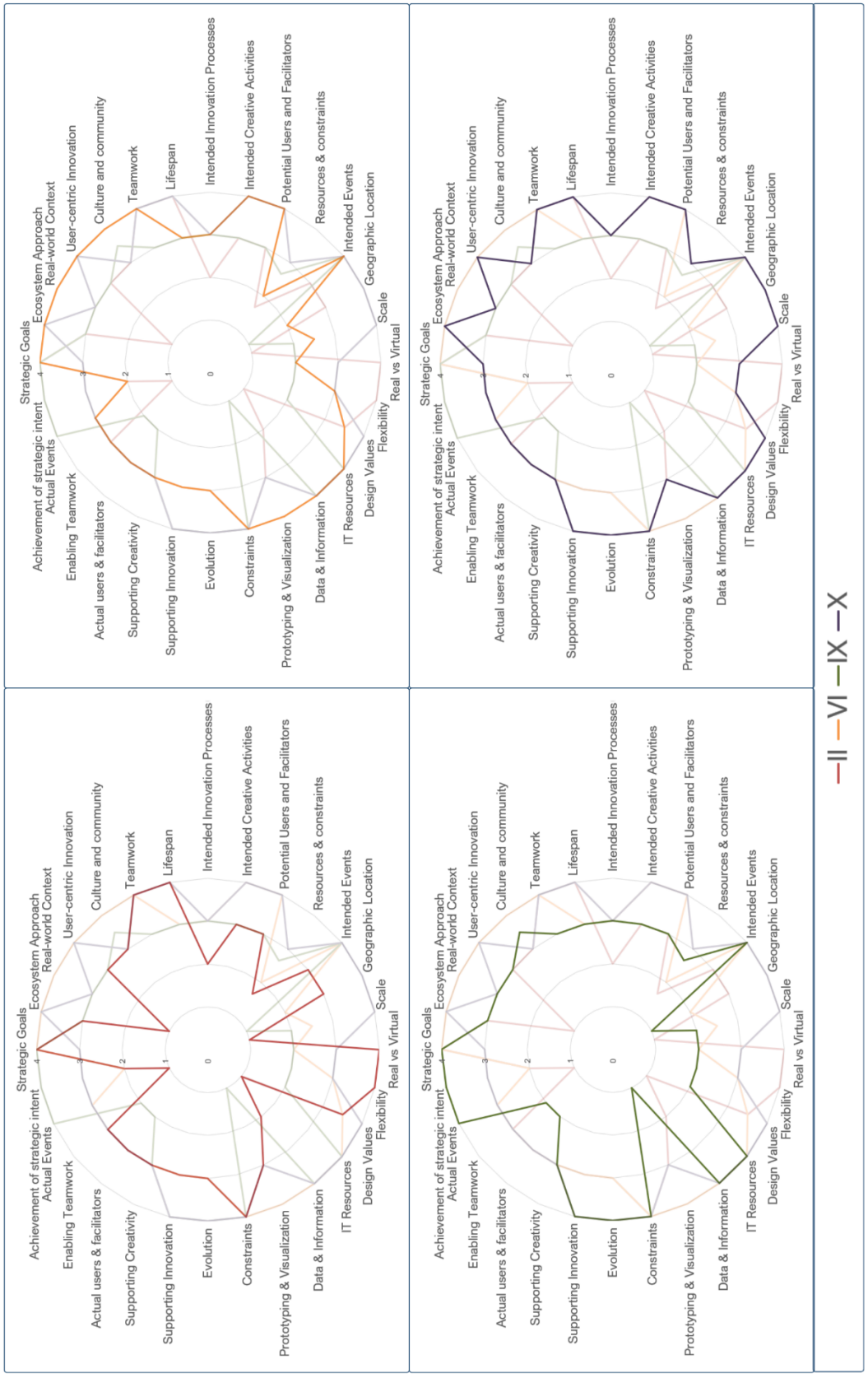


Figure 5-7: Profile of cases II, VI, IX and X

From the application of the instrument also emerges the necessity to make some adjustments. In this section, for example, the intention for the innovation lab to resemble real-life environments was also asked about. These environments are understood as the actions to simulate or recreate specific real-life situations through the space, special equipment or methodologies. According to the obtained answers, in some cases the respondents did not fully understand the question as some of them only focused on whether they considered themselves to have specialized equipment or areas for this purpose. However, this could also be supported by other means, such as particular methodologies, protocols or intended activities. Thus, the levels of maturity should provide a more detailed description to enable better understanding.

From theory (see Section **5.2**), building a community of users is a strong element to consider for designing an innovation lab strategy linked to its local context. Through this study we wanted to explore how lab managers consider this aspect and gather what the actions were that they intended to implement around this criterion. *Cases II, VI* and *IX* stated they were open to welcoming users not only from their main institutions but from other organizations, whilst for *Case X* it was clear that their community will be composed mostly of their registered students and faculty members. Nevertheless, when questions were asked about what types of strategies they expected to employ, a wide variety of actions were presented, including use of the space during specific hours at no cost, an invitation to be part of ideation or prototyping activities, organizing social tech activities (meetups), recognition of their participation through the publication of project results (presentations, reports, online descriptions or blogs). Although *Case II* asserts that, despite their intention, they have been very limited in implementing those actions due to lack of resources, this is a matter they are willing to improve. This raises the question of how feasible innovation labs are and whether they are coherent to their actual capacity and the expected outcomes.

On the perspective of applying the questionnaire to an extensive sample, these kinds of questions would probably contribute to identifying patterns and correlations that would help to better address innovation labs' strategies. As we found in this testing sample, even though c*ases VI* and *IX* aimed at long-term objectives, they also noted that, due to resource

allocation constraints, the initial estimation time for their laboratories was two or three years initially. Despite the desire to make the lab sustainable and permanent, at that moment they were constrained to contractual terms they could not avoid. The ability to identify these sorts of limitations and challenges for innovation labs is what we believe to be the value of the instrument, so that practices and experiences can be shared and enriched.

- **Process of creation**

Hereafter, the strategic intent begins to be materialized in what ultimately will be the innovation lab's embodiment. Still, to reach this phase it is necessary to look over the creation process to assess how the strategy was interpreted towards the implementation of the lab. The questionnaire inquiries about the intended innovation processes to be carried out, in which respondents were invited to choose from opportunity identification (research), concept creation or validation (design), solution development (implementation) or deployment (exploitation). During the test campaign they also had the opportunity to include any specific process that they considered was not covered by the options, but this was not the case. All the four cases exhibited a design orientation, while some of them also aimed to include implementation or research processes. In any of the selected cases, deployment or exploitation processes were contemplated, even in those cases in which lifespan and objectives were defined as mid-term or permanent.

For example, *Case X* explained that implementation and deployment processes were intended to be carried out by their clients (mostly companies) and only their lab was involved in these processes when students created their own projects and subsequently wished to commercialize the results. In this case, the innovation lab provides support for preliminary development/deployment activities. From this, we agree that an innovation laboratory is not meant to commercialize or to mass distribute products; instead, they should favor the promising new solutions to rapidly reach implementation and transfer status. Therefore, it needs to be considered that innovation processes are composed of several activities, not all of which need to be performed within the lab (e.g., deployment may include selling, promoting and demonstrating) but if they were somehow considered it would provide valuable support to the transition of the innovation lab's outcomes to the real

context as they are supposed to. Based on this, we observe that it would be necessary to include additional descriptions in the maturity grid to clarify the possibilities.

Likewise, respondents were also asked about the kind of users they expected to welcome and the frequency. Students, professors, researchers and entrepreneurs appear to be common in the sample. Moreover, depending on the innovation lab thematic focus, diverse types of users could be linked, such as officials, non-profit organizations, hospitals, mothers, makers etc. From the answers it seems that users' descriptions can be very general, almost superficial, whereas an innovation lab is supposed to exceptionally know its users and how to work with them. For this reason, questions in this regard need to be revised to motivate managers to refer to users as individuals describing their behaviors, pains and desires. Subsequently, this also applies to facilitators for which we believe they have a significant role that needs to be carefully chosen and designed to correspond to lab users' profiles.

Additionally, the assessment of the creation process was fulfilled, reviewing available resources inquiring about the budget, personnel and intended activities. With this in mind, managers can have a glimpse of how far they are going from the intended strategy even before advancing to implementation. Our reference cases show that investment can vary from less than 500 thousand euros to more than 5 million euros where infrastructure (space and technical resources) represents at least 25% but can go up to 75%. Therefore, a forecast of the extent to which the lab will sporadically receive users or co-located team projects, the required size of the staff to operate the space and what kind of events they must be prepared for seems to be a reasonable task to perform before going through the physical embodiment.

- **Physical embodiment**

The possibility to gather complementary information about infrastructure, equipment and any special features that could compose an innovation lab is also envisioned through this questionnaire. In that sense, the questions for that purpose showed they worked accordingly, as in this test we can observe diverse possibilities for lab embodiment from single rooms with a high level of flexibility with almost no IT resources or fabrication

technologies (*Case II*) to multiple fixed areas, moderate levels of flexibility and vast technology options for experimentation (*Cases VI* and *IX*) to a whole new building specifically designed for the lab's purpose with almost every sort of area, resources and technology at their disposal (*Case X*). It is important to note that these elements based on a bigger sample could be categorized but that does not necessarily mean that an innovation lab equipped with much more technological resources could perform better than others with more "elemental" features. Actually, if an intended projection of the innovation lab is not strategically designed and consistently realized it will probably lead to its misuse or to outrunning its capacity.

Indeed, advancing from design to implementation is not an easy task. Constraints and limitations are part of every project thus adapting and evolving become the alternative to overcome these challenges. Based on our reference cases, we perceive that failing to establish a common vision for the lab among stakeholders, operating in heavily bureaucratic environments, and facing a refusal of cultural change seem to be common issues. Therefore, it should be necessary to look back and evaluate if there were elements that could be foreseen and then move forward by proposing the appropriate actions to address the situation. For example, *Case II* manifested they were facing strong refusals to collaborate and share resources from other units in their institution, being interpreted as lack of will even for inviting their communities to participate in the lab. This corresponds to the difficulties they explained during the strategic intent section, where they were unable to foster the sense of community around the innovation lab as well as the traditional academic environment in where the lab was installed. Although, at this moment it is not possible to provide defining alternatives to address these kinds of situations, the instrument contributes to creating awareness among managers and possible correlations between what was intended and the current implementation.

Subsequently, being prepared to adapt the innovation lab in response to emergent needs, technologies or business strategies should be on the radar of innovation labs; after all, they are even conceived to lead these changes. The questionnaire also inquiries into the degree to which this evolution is planned and in what elements it is mainly thought. Because of this test, ideas, requirements or proposals from new strategies for required technologies were

gathered from respondents. Resuming the previous example from *Case II*, specific actions to improve community engagement and to create a sense of belonging were proposed. Moreover, *Case IX* highlights the necessity to have their own space, not only to satisfy the increasing demand but also to lighten bureaucratic obstacles, while *Case VI* is focused on the redistribution of the space and *Case X* on providing additional technologies. Regarding the questionnaire, we believe this section provides valuable inputs although minor changes are required.

- **Process of use**

At this point in the questionnaire, the objective was to inquire into what the actual use of the lab is, from a managerial perspective, to determine how far from the intended use it is and what the main changes are which have been adopted. In this regard, *Case IX* has begun to include research processes to strengthen their operation with more systematic and rigorous processes. Furthermore, they continue to perform all the intended creative activities but now evaluation has become a strategic activity due to quality data that has been gathered through carefully designed protocols, which they are even considering offering as a lab service to the public. Similarly, *Case X* manifested that most of the intended processes are supported and that they are even partially supporting exploitation. For them, there was a perceived need of their users and therefore supporting final commercialization seemed to be a good fit for them, although the lab does not have suitable testing facilities and they must be done on an ad hoc basis. In contrast, *Case II* explained that they discarded the possibility to include more complex processes, such as research and exploitation, mainly because they are limited by the space and the objectives they defined for the lab, whereas *Case VI* has been primarily focused on improving the coordination among their processes, activities and related technological devices.

Additionally, data related to their capacity, the actual demand and use of the space, as well as the real users they are receiving was also collected. This data will help us to identify where the common changes are, as well as the adoption strategies that were used in each case. Nevertheless, as valuable as it is, the managerial perspective of this exploratory test campaign lacks user feedback. This is one of the main challenges for future steps in this

research, to actually assess the use of the innovation lab from the user's perspective. This would certainly contribute not just to balancing the assessment but would represent a significant source of feedback for managers of innovation labs. Regarding the current instrument, there are several questions that need to be revised to capture better insights from managers, but the assessment of the process of use definitely needs to be complemented by other means and scenarios primarily focused on the actual users of each innovation lab.

- **Outcomes**

Hereafter, the questionnaire was aimed at identifying the set of indicators that could help us determine whether an innovation lab is successful or not. The first step was getting to know what sorts of results are in the minds of those who oversee their operation. Then, for the testing purpose we look to examine whether the questions and their respective answers provide enough data to potentially define the corresponding levels of maturity for these criteria. The degree of realized intentions, tangible outcomes, intangible outcomes, level of satisfaction and suggestions for improvement were the aspects that we went through from which relevant insights were obtained.

As for tangible results, *Cases II* and *IX* manifested their outcomes as the number of training sessions, workshops and hackathons or design contests performed, as well as the number of communities and the total users that have been received within the lab (from visiting to participating). In addition, both laboratories also presented the number of projects supported or incubated in an approximately two-year span. Besides these indicators, *Case VI* also denoted the level of diffusion through the media as well as the scientific recognition due to their research efforts, both forming part of the dissemination strategy of the lab. They also referred to the success of one of their partners who benefited from the lab's operation as a tangible representation of their impacts. On top of that, *Case X* seems to have reached a superior level of maturity in this regard, presenting indicators such as the contribution to better prepared companies for product development; sources of new products or product lines ready to commercialize; student-led companies and the enrichment of the local labor pool. These results constitute a worthy example of the use of the instrument and the valuable data that can be gathered to capture not only practices but also possible desired

outcomes. This could even be used to distinguish types of realized intent among a bigger sample.

Regarding intangible outcomes, the managers from our reference cases assert innovation labs as producing effects over their context and their users that are not necessarily quantifiable. That is to say, change of mindset, attitude and motivation from users towards the activities to be carried out under the lab seemed to be a positive influence shared by four cases. Likewise, it seems the lab itself can trigger people's curiosity, and a sense of belonging and shared learning is created through large-scale events (e.g., hackathons). More than that, the managers believe that the space itself seems to become an iconic place, attracting communities and favoring brand recognition. Thus, evidence indeed shows that intangible results are something that innovation lab managers appear to perceive and something on which they could eventually rely, and therefore they should also be considered in further steps of this research.

5.5 Innovation lab framework and assessment tool implications

This chapter studied what the actual capabilities of innovation labs are and to which degree of expertise their practices and processes could be determined by proposing a maturity grid-based assessment tool. The main contributions of this work are: (1) an updated framework adapted to address innovation labs' strategic intent and capabilities involving stakeholders and communities; (2) a strategy-oriented maturity grid; (3) a multilingual gathering instrument; (4) together, the grid and the instrument envision a prototype of a maturity grid-based design and assessment tool.

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 intent. Based on an existing and mostly theoretical framework, an updated version was proposed and operationalized. According to the literature review, it is an original contribution to the recent research efforts to understand the behavior and

performance of innovation labs. This conceptual basis enabled us to construct an instrument (questionnaire) that allows a particular innovation lab to self-assess its degree of maturity thereby serving as a strategic feedback tool that invites lab managers to reflect on the degree of achievement of their intention. This work evidences the concern to understand the influence of a dedicated organizational form to support the innovation processes and through the application cases it glimpses a guidance tool for those who want to start a new project aimed at creation of an innovation lab.

The main contribution of this work is the basic construction for a maturity grid-based assessment tool for those who want to address and understand the capabilities of an innovation lab. Through this, we aim to build a tool whereby researchers and practitioners can find a comprehensive set of practices and experiences in the way that innovation labs have been implemented to build their own strategy. Furthermore, we hope this research strengthens the collaborative innovation process. Innovation labs are indeed places of knowledge exchange and interaction between communities.

In general, it has been seen that the questionnaire (instrument) itself works as a guidance tool to help managers evaluate the outcomes of an innovation lab and potentially carry out the planning of a new innovation lab project in a more comprehensive way. As part of the feedback, some respondents underlined that in the early stages of their projects they had not taken into consideration several criteria or elements that are strategic for the success of innovation labs. The same instrument also serves for self-testing of the labs on the degree of maturity reached, which supports decision-making regarding the direction to follow in a strategic context. In any case, it should not be expected that maturity-based approaches or tools as the one proposed in this study to be reliable for doing benchmarking or suggesting to all innovation labs exhibit “lead performance”. Instead, they are useful to incite discussion and create awareness on organizational performance to define improvement strategies (Moultrie et al., 2006).

Since this is an exploratory study, future research the efforts will focus on increasing the number of laboratories surveyed, with the aim of improving the results presented in this work. Action-oriented approaches tend to be limited in terms of generalizability given the

focus on small number of cases. Equally, the methodology needs to be improved by considering additional elements from users' perceptions and the context in which the innovation lab operates. Feedback from respondents suggests the methodology should include some interviews that are held directly in the laboratory to acquire more data. Some other comments suggest that the questionnaire must also consider, for example: social software, percentage of use of each room or area (and why), other spaces that are not work-related, co-creation methodologies, the community's point of view, and innovation techniques.

5.6 Conclusion

This chapter sought to increase the understanding of the strategic intent of innovation labs and the capabilities that are mobilized to support such intent. To this end, a maturity-based assessment tool was proposed as an alternative to understand innovation lab performance. The methodology, based on an international survey with a self-administered questionnaire translated into three languages, emphasizes the evaluation of the strategic intent and process of creation versus the physical embodiment and the actual usage and outcomes of the lab. In application, it makes possible the capture of practices and experiences that ultimately will contribute to consolidating the assessment tool.

6. Unfolding Innovation Lab Intent: a multi-case process perspective

In the precedent chapter a contribution to the strategic management of innovation labs has been made by proposing a maturity-based assessment approach as a basis for building guidelines for the design and management of innovation labs. The work developed so far suggests that by looking at how an innovation lab is conceived (strategic intent), designed (process of creation), implemented (physical embodiment), operated (process of use) and valued (outcomes), lab managers and teams can reflect on the journey they have made and potentially envision new strategies to get the best out of their labs.

While the selected approach for the previous work (an international survey with an online questionnaire) has been useful for understanding innovation lab performance, it has yet to be extended and validated in greater detail and depth. How innovation labs develop its strategic intent, what kind of factors influence their evolution or adaptation, and how they manage to do so are some of the questions that need to be studied further in order to attend this research objective. Moreover, as literature on the management of innovation labs is still incipient, to continue this exploratory study through a more qualitative approach seems relevant. The interest of this chapter then lies in deepening this research by applying the framework already established through a complementary approach to study how the strategic intent of an innovation lab develops over time.

To this end, a multiple case study design is proposed to focus on three innovation lab cases from our previous sample in the preceding chapter in order to deepen the analysis. This study was conducted iteratively following a replication strategy that made possible to observe the labs' evolution from a management point of view, while providing useful insights to address the research question. This chapter then first presents the research design by

providing more details on the research method, the case selection and data collection. Next, the results of the application of the framework are presented individually for each case, followed by a discussion that elicits a proposal for the evolutionary stages of the strategic intent of an innovation lab. Finally, this chapter ends with a discussion of the results and implications, as well as concluding remarks.

6.1 Multi-case study research design

6.1.1 Research method

This part of the study was conducted using a multiple case study design (Eisenhardt, 2021; Yin, 2009). This approach fits this research given the limited theoretical and empirical evidence on the subject of study and the research question (Eisenhardt & Graebner, 2007). Also, as the interest at this point in the research focuses on exploring in depth how the strategic intent of an innovation lab is implemented and sustained (or not), a research method sensitive to the evolution of a phenomenon over time and fit to address "how" and "why" questions is required (Eisenhardt, 2021; Gehman et al., 2018).

We used a replication strategy to guide the implementation of this study (Yin, 2009). Thus, the theoretical framework developed in the previous chapter was used as a reference to conduct each case in a sequential and iterative basis. Each case was studied individually with results allowing to refine and adapt each time both our theoretical assumptions (capacity of the framework to elucidate innovation lab intent and performance) and the data collection protocol (sources of information, questions, number of interviews, etc.). Subsequently, based on the results from the three cases, a cross-case analysis was made leading to our propositions and discussion. Figure **6-1** illustrates the research design, followed by an explanation on the selection of the cases, the data collection and how the analysis was carried out.

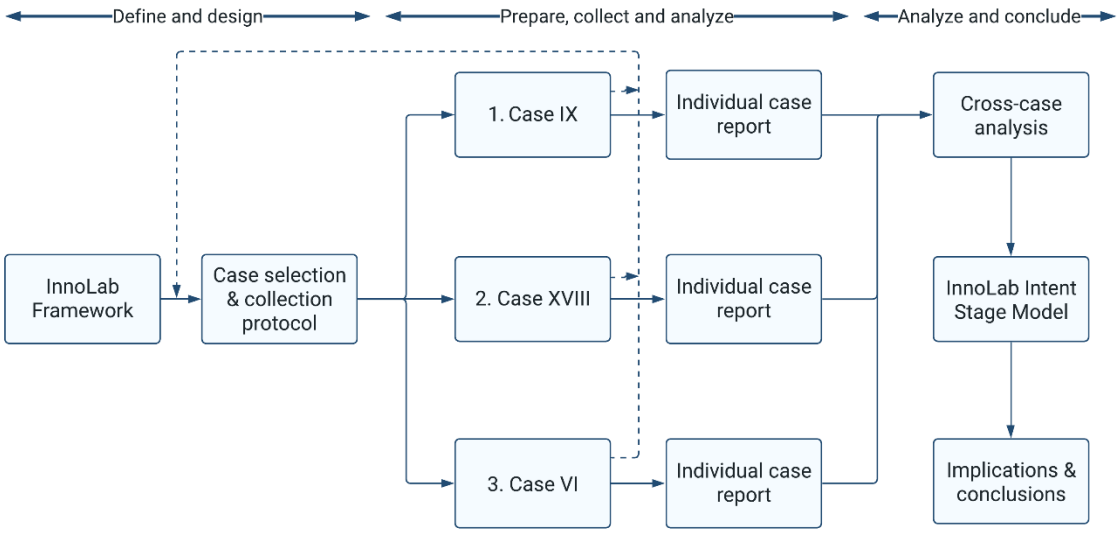


Figure 6-1: Multi-case study design using replication approach (based on Yin, 2009)

6.1.2 The cases

- **Case IX**

The first case is about an innovation lab located in the city of Bogota in Colombia. It was created in 2013 under a public alliance between three important institutions from the public sector in Colombia: a public university (school of engineering), the district government, and a ministry from the national government. This lab is hosted by the university, and it was initially conceived as a digital content lab meant to promote the digital content industry in the country. After six years of operations, this case has consolidated itself as one of the digital innovation labs in the city. Over these years, this innovation lab has acted as a source of practical knowledge and new technologies for citizens, entrepreneurs, companies and government institutions, which has allowed it to conduct several innovation activities and projects in the city, such as the design and implementation of digital public services, citizen empowerment and participation programs, and prototyping and mentoring cycles for entrepreneurs.

- **Case XVIII**

The second case study corresponds to an innovation lab situated in the south of Denmark. It belongs to a public university (engineering institute) and is sponsored by a collaboration with a private foundation. This innovation lab was inaugurated in 2017 as a hub for the

interplay of education, commercial collaboration with industry and academic research projects. Since then, it has been used to facilitate service agreements with both industry and public organizations. These activities span from product development projects co-financed by the university and other stakeholders to the support of pedagogical processes and large workshops for students. In general, the operation of the lab was seen to contribute to fostering the way the institute engage with society by stimulating academy-industry collaboration.

- **Case VI**

The third case is based on the experience of a collaborative innovation space located in Greater East region in France. This lab is the result of a joint effort between the innovation engineering school and the innovation research institute of one of the region's public universities, the city government and companies (network of SMEs and energy companies). Originally conceived to provide a platform for evaluating uses and innovation acceptability, this case is today a reference in the region's innovation ecosystem. The lab was founded in 2014 and throughout more than six years of operation has served as a demonstrator of innovation and product development for urban and territorial based applications from which pedagogical and research capabilities are mobilized for students, researchers and professors to collaborate with the different stakeholders in their territory.

6.1.3 Case selection

Case selection was emergent and iterative, seeking to obtain settings that allow us to explore different perspectives of the phenomenon and thus increase the validity of the results. Theoretical sampling was used for this purpose (Eisenhardt & Graebner, 2007). The theoretical background has shown that innovation labs are increasingly implemented in multistakeholder configurations as one of the drivers of potential strategic problems (see chapter **3**), so this aspect was taken into account in the selection of the cases. Another aspect involved the time in operation of the labs. Since we intended to go deeper into the unfolding over time of the innovation labs, each case had to be at a relatively advanced

stage. In this sense, it was considered that the cases should have been operating for at least three years.

With the latter in mind, the first case (*IX)* was selected as the first case since its history is characterized by a highly volatile context. Despite having been promoted by three important institutions of the Colombian public sector, the operating conditions of this laboratory have been constantly changing and uncertain. This is reflected in a highly volatile activity in terms of short-term hiring, high staff turnover and project diversity. Furthermore, we consider valuable to provide experiences and practices from a Latin American setting in a field mainly studied in European and North American contexts. Results from the first case provided a much more detailed perspective not only on the implementation and management of an innovation lab, but also on its evolutionary stages (Osorio et al., 2020).

The approximation to the second case was then made with the intention of deepening the application of the framework while continuing to unveil the evolutionary character of the phenomenon. The second case (*XVIII*) is similar to the first since the lab is sponsored by a public university in alliance with another entity, which in this case is a private foundation. However, what made case *XVIII* valuable for this study were the shifts and tensions around the purpose of the lab, which, despite the activities undertaken and the results obtained, there was a sense of unrealized intent. This case ultimately helped to evidence the pitfalls and tensions associated with defining the strategic intent of an innovation lab and establishing a dedicated lab team.

Finally, with the lessons learned up to this point, the interest turned to obtaining a more stable perspective. As with the previous two cases, the third case (*VI)* takes place in a public university context. Similarly, this lab was created as a result of a public-private partnership. Besides having a highly dynamic activity in terms of events, projects and human talent, this case offered us a complementary perspective to the other two. This is because at the time of data collection, case *VI* was initiating a quality certification process to become part of the research and innovation infrastructure network of its university. In a field where the discussion about innovation labs has mainly focused on their instability and possible short

periods of operation, this case offered a different view that shed light on other stages in the development of an innovation lab.

Table 6-1: Characterization of cases and data collection window

Case	Thematic focus	Context	Data collection window	Time in operation (years)
IX	Public digital innovation	Public University	May-Sep 2019	6
XVIII	Academy-industry interplay hub	Public University	Feb-2020	3
VI	Innovation continuum in urban & territorial-based applications	Public University	May-Jul-2020	6.5

6.1.4 Data collection and analysis

Following a replication strategy means having a well-defined theoretical framework that will be successively tested in each case. This also implies developing a data collection protocol. For this study, the innovation lab framework developed in Chapter **5** is our theoretical input. Although in earlier stages of this research we opted for an operationalization and application of the framework through an international survey, for a case study approach broadening the sources of information is essential to enable triangulation of results (Yin, 2017). Overall, four sources of information were prioritized (see Figure **6-2**): (1) archival data such as reports, agreements, presentations or publications; (2) the lab manager and team members point of view; (3) this researcher's participant observation; and (4) the lab manager's response to the assessment tool.

Similar to how the insights from each iteration help determine case selection, in a multiple case study by replication it is important to acknowledge that the data collection protocol is also subject to modification and improvement as experience and learning occur with each iteration (Yin, 2009). This was mainly reflected in this study in adjustments to the interview protocol, the number of interviewees and the inclusion of a prospective workshop for the third case. On the one hand, in relation to case *IX*, the main priority was to conduct an in-

depth semi-structured interview with the lab manager. A detailed navigation of the full framework was carried out to obtain an enriched managerial point of view. On the other hand, for case *XVIII*, the protocol was adjusted to include semi-structured interviews with representatives of the section of the institute to which the lab is attached as well as with those in charge of its operation. And finally, for case *VI*, in addition to the semi-structured interviews, it was decided to include a prospective workshop (see Appendix **D**) with all the participants of the study to capture further elements about the future of the lab and the main challenges to overcome. A master student assisted in the data collection for case *VI*.

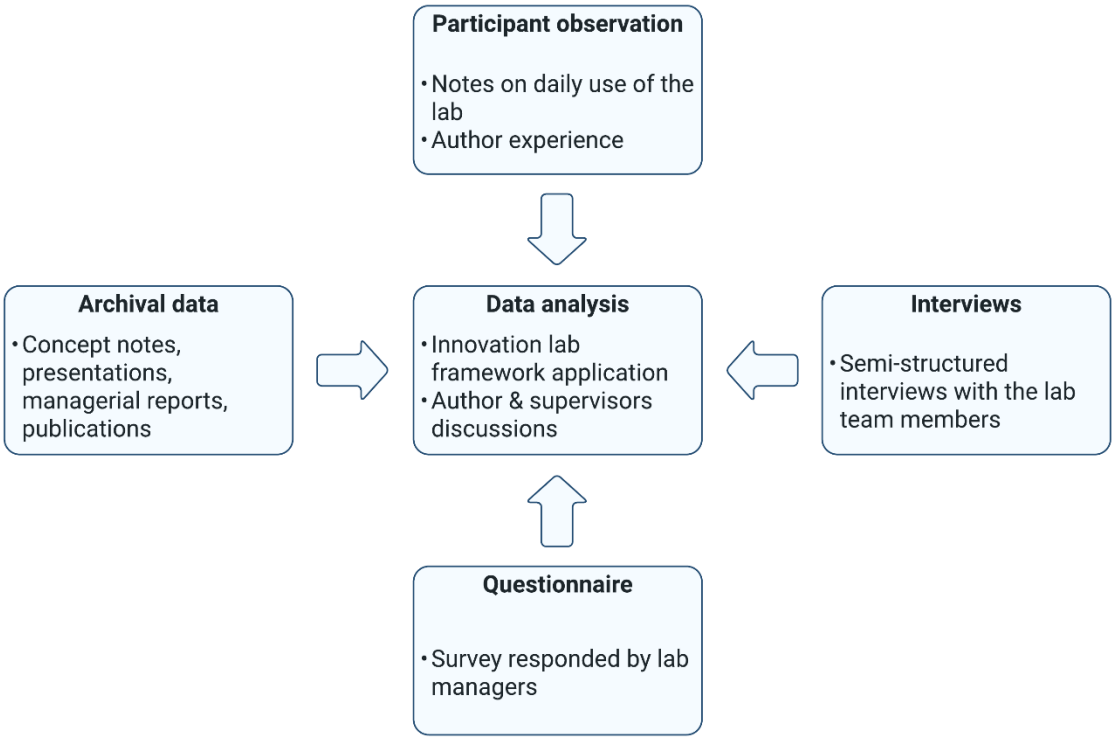


Figure 6-2: Generic type of data sources for all three cases

A total of 22 interviews were conducted across the three cases lasting on average 47 minutes and for a total of 19 hours of interviewing approximately. The semi-structured interview guideline and the full list of interviews are provided in Appendices **Appendix E** and **Appendix F**. In all three cases, a compilation of available archival data concerning the lab functioning was done and lab managers were also invited to answer the questionnaire. Finally, the observations and experience of this researcher played a key role in the analysis

of the information given his involvement in each case study. In the first as co-founder and former lab manager in the periods from 2013 to 2014 and from 2016 to 2018. In the second case, as a visiting researcher and observer for one month at the lab facilities. And finally, in the third case as a former intern between 2014 to 2015 and as a PhD student since 2018. Table **6-2** provides a synthesis of collected data for each case study.

Table 6-2: Data sources for each case study

Case	Interviews	Archival data	Questionnaire	Participant observation	Workshop
IX	Three-session semi-structured interview with lab manager	Contract documents, annual management reports, executive presentations, technical project reports & scientific publications	Responded by lab managers in 2015 & 2019	As co-founder, former lab manager and researcher	N/A
XVIII	9 semi-structured interviews including former lab manager, lab consultant and members of the university section hosting the lab	Concept notes & sketches, institutional presentations & annual reports	Responded by lab consultant in 2020	As visiting researcher	N/A
VI	12 semi-structured interviews with lab team and members of the research institute and engineering school	Concept notes & sketches, institutional presentations, management reports & scientific publications	Responded by lab manager in 2015 & 2020	As PhD student & researcher	Prospective workshop with all interviewees & additional guests

As for analysis, recommendations for multi-case studies and data analysis techniques according to Eisenhardt (1989) and Yin (2009) were followed. A within-case analysis was completed first and then we proceeded to a cross-case analysis seeking to identify patterns and increase robustness in our analysis. In the within-case analysis, the initial focus was on further exploring the potential of our theoretical framework to understand innovation lab intent and performance. Archival data was instrumental to establish the lab's timeline, identifying important milestones such as dates of agreements, events, services and result indicators. Also, institutional presentations and outreach materials were analyzed to identify how the lab's intent was communicated to the public and at what points in time it changed. Subsequently, interview analysis enabled us to enrich the timeline for each of the framework

dimensions as well as to appreciate underlying motivations, landmark events, obstacles and the sense of accomplishment around the lab. Detailed responses to the questionnaire then helped to complement the observations and corroborate specific criteria.

As each case was examined, patterns began to be identified among them, suggesting changes in how strategic intent is perceived and implemented in innovation labs. The focus then turned to revisiting the three cases globally by making a cross-case comparison. This step required referring to complementary literature that would allow deeper comprehension of the phenomenon and refine results. This also required extensive discussions among the research team (this author and supervisors), as well as with other fellow researchers. Finally, based on this work, the findings were consolidated into an evolutionary stages proposition.

6.2 Results and main observations

This section shares the results of the multi-case study. They are presented individually for each case. The first two cases are organized according to the framework and its five dimensions to illustrate its methodological relevance. As the results of each case led us to elucidate an evolutionary behavior, the third case is presented stage by stage in order to provide a complementary perspective to our analysis.

Part of the results of the within-case analysis have been published in the *Journal of Innovation Economics & Management* (see Osorio et al., 2020) and presented at the *R&D Management Conference* (see Osorio et al., 2021).

6.2.1 Case IX

Table **6-3** provides a summary of the main elements retrieved from case *IX* in almost six years of operation. This is followed by the within-case analysis according to our theoretical framework.

Table 6-3: Case *IX* - Summarized results of framework application (Osorio et al., 2020)

	CASE IX	
	2012-2015	**2016-2019**
CONTEXT	- National policy: Development of the Digital Ecosystem - City policy: Bogota, towards a smart city Cooperation agreement between: - Ministry, district government & public university	- National policy: Digital future for everyone - City policy: Bogota, a digital city Separate inter-administrative agreements between: - Ministry & district government - District government & public university
STRATEGIC INTENT	From a digital content lab To a citizen lab	From a citizen lab To a lab of innovation, creativity, and new technologies
PROCESS OF CREATION	Innovation & creativity activities set up around four strands: - Learn - Do - Connect - Create Staff composition: Professors, lab manager, professionals, and students	Innovation & creativity set up through services portfolio: - Digital solutions - Innovation processes - User experience - Digital accessibility - Learning by doing - Emerging Technologies Staff composition: Professors, managing team, scrum master, product owners, and project teams
PHYSICAL EMBODIMENT	Lab facilities as the main place of operation	Lab facilities as headquarters with projects & activities distributed throughout the city
PROCESS OF USE	Operations based on technology- and entrepreneurship-led activities Variation in staff from 8 to 18 persons	Operations based on public service and community empowerment-oriented projects Variation in staff from 6 to 53 persons
OUTCOMES	- Workshops & marathons, training courses, and mentorship cycles - Digital content development (mobile/web apps & videogames) - Community building	- Number of services and projects executed - Financial performance - Public recognition of the lab and allies - Number of citizens, communities or entrepreneurs reached

- **Context**

In the course of its operation, case *IX* has gone through significant changes in both its objectives and its relationship with its stakeholders. The lab was created as part of national network of digital content labs, as part of the national digital program in effect between 2010 and 2014. This initiative was launched by the ICT Ministry through a public call for projects with the purpose promoting the development of the regional digital ecosystem by supporting science, technology, innovation and ICT entrepreneurship to boost the digital

content and mobile apps industry. Within this policy framework, the cooperation agreement for case *IX* was set in motion, with the ministry overseeing the financing of infrastructure investment and initial activities, while the university was responsible for managing the lab with the support from the ICT advisory office of the district government.

- **Strategic Intent**

While the original project goals set out by ministry were aimed at quantifying the number of people trained, entrepreneurs supported or events held, it was important for the university to be aware of the long-term vision. The original intention for the innovation lab was never to remain as a mere digital content production lab, but on the contrary, it was inspired by the practices of living labs and innovation labs as novel ways of "doing things" (Camargo et al., 2012; Carstensen, Bason, 2012). The intended purpose was to be a place with a unique experience for the people of Bogota, where citizens and entrepreneurs could learn, make, connect and create solutions to problems in their context. Early results in terms of people's engagement in workshops, courses and networking activities provided evidence that a sense of community was being established around the lab. Eventually, this would also lead the city government to invest in the lab by the end of 2014 and again in 2015, expanding the scope of the innovation lab activities not only to promote digital entrepreneurship, but also to provide mechanisms for citizens and officials to participate, collaborate and innovate in order to address the city's challenges.

For case *IX*, 2016 was a crucial year in which a rethinking strategy was necessary. The end of the cooperation agreement coincided with local elections taking place, leading to the operations of the lab being halted for more than eight months. Ultimately, because of the significant results achieved by that time and a common desire to pursue this work, a new agreement was signed. This time, the operation of the lab was structured around a new objective and shared vision as the space of experimentation of the city, where the district government, the university, and the citizens join together to foster processes of innovation and entrepreneurship, technological development and applied research, in order to create collaborative solutions of high social and economic impact in the best possible way through exponential technologies. Subsequently, the innovation lab was opened up strategically to

work with other departments of the district government, such as social integration, citizen participation, habitat, among others.

This also implied the possibility of working with other institutions outside the city level, such as the national government or even the private sector. This meant new opportunities but also new challenges, given the different areas of knowledge involved, the social issues that needed to be addressed and adding new stakeholders. Despite this, *"the lab continues to work as a place of transformation of academic knowledge to bring it closer to people and solve problems"* as stated by Interviewee 1. And moreover, for this reason, she explains *"the lab always keeps changing and also adjusting to technological trends in order to remain as a lab to innovate with"*.

- **Process of Creation**

One of the strengths of case *IX* is its institutional position, in the heart of the most important public university of Colombia, which provides human support through multidisciplinary teams and adequate infrastructure. This was a differentiating element in the creation process and continues to be so today. For the execution of projects and activities, the innovation lab brings together professors, students and practitioners in design, digital technologies, social sciences and innovation. Additionally, it relies on the capabilities and knowledge of the university's research groups, which are integrated according to the needs of each project that the lab develops. While the lab's expertise focuses on digital technologies and innovation, being part of the university allows it to deal with challenges in different areas of knowledge by collaborating with other research groups.

It is precisely the excitement, quality and interdisciplinarity of the human talent behind the lab, which prompted, from the beginning, the definition of conceptual and methodological models that would give shape and meaning to its operation. A clear thematic focus, a user-centered approach, the definition of what kind of innovation activities and processes are sought, and the methods to carry them out, are key aspects in the daily life of the lab. The lab's methodology is thus based on the Scrum principles in order to facilitate agile project development (Schwaber, Sutherland, 2017). Based on these principles, four strands have

been integrated: applied research, user experience, sustainability, and technological development. In this way, the lab establishes an operational framework to address complex problems, meet needs under real contexts and generate high-value solutions for those who decide to participate in the lab's experience. This has been an important success factor for this case, as this dynamic causes that *"public entities see our innovation lab as the space that helps them materialize their idea of innovation and consolidate it into a product, document or policy"* as explained by Interviewee 1.

Above all, the operation of the lab faces several administrative barriers. For instance, the innovation lab does not have independent legal status and is part of the administrative functioning of university. This means operating under the administrative rules of the public sector, which often go against the dynamics of innovation projects. The notion of uncertainty and flexibility implicit in each innovation project is something that is difficult to translate into the rigid and deterministic logic of the public sector (Tõnurist et al., 2017). Furthermore, the hiring of personnel is carried out exclusively for each project and most of them are contractors. Apart from the university professors and students who devote certain hours to the lab (as classes are their priority), managers, researchers, and professionals are brought in on an ad hoc basis according to each project. This generates a high turnover of human talent that requires the processes of training and adaptation to internal practices to be repeated constantly.

- **Physical Embodiment**

Once the innovation lab was operational, it quickly became a meeting point for the communities and a landmark in the city. The physical area of the laboratory is 180 square meters, which are divided between a training room, a development room, a creativity room, a usability lab, three offices, a technical room, and bathrooms. The partitions between its areas are in glass, which means that almost all the lab is visible from any point, which gives a sensation of transparency and depth. In general terms, its equipment consists of computers, mobile devices, and accessories (of different ranges depending on their use), specialized software for the development of digital contents and basic material for prototyping on paper. Located near the city center, with a fresh and informal design and

imagery, the physical space certainly offered an alternative for eager citizens who found in the lab an inspiring place and began to develop a sense of belonging.

The innovation lab has been used in different ways and the purpose of each area or office changes depending on the activity or project. Generally, the lab is primarily intended to support ongoing projects by providing space and resources for ideation or prototyping sessions, team meetings or usability tests. This also includes activities aimed at the public (e.g., training workshops or meet-ups). However, because the area layout and workstations are fixed, reconfiguring the space sometimes requires a lot of effort, or in some cases causes discomfort (e.g., not being able to move the tables because they are fixed to the floor). An interesting fact is that due to the nature of recent projects, the innovation lab has begun to have a presence elsewhere in the territory. This means that certain activities are carried out outside the lab, in some cases requiring the mobilization of both staff and equipment. On the one hand, this opens up the option of a "mobile version" of the lab, but on the other hand, it also involves risks of damage or loss of equipment. As part of this same process, the lab also takes advantage of its relationships with allies to use other spaces in the city (e.g., auditoriums, libraries, community halls) when holding public events or sessions with citizens.

In any case, several limitations have determined the way in which the lab was designed. From the beginning, the ministry laid down certain conditions for the innovation lab. In addition, the university's infrastructure technical parameters prevented the acquisition of more modern and flexible furniture. In addition to this, another important challenge is the renovation of the technological infrastructure. Although the lab team has been able to progressively renew some of the technological equipment, there has not been a significant investment in this area since its inauguration. In general, bureaucratic complications imply a significant barrier in this process, which can divert attention from other processes of greater value generation.

- **Process of Use**

Today, the innovation lab offers a portfolio of services ranging from training and mentoring, the facilitation of creative and innovative processes, user experience assessment of digital content, to the design and development of digital solutions. This shows an important shift from those initially offered, which focused mainly on training talent and mentoring entrepreneurs. These changes, besides being consistent with the maturity and capabilities of the laboratory, are also seen as a reflection of a financial model that is being built.

Furthermore, the changes in activities also reflect changes in the types of users and clients. While initially, the innovation lab focused quite naturally on carrying out activities from its physical facilities, the users were mostly technology enthusiasts and entrepreneurs of digital content. However, as the goals were redefined and a closer alliance was established with the city government, the lab began to target a more diverse audience that included seniors, high school students and minorities. This required that activities were to be held in a distributed way around the city. Over time, as collaborations were extended with other institutions, such as the Citizen Participation Institute and the Secretary of Housing, a more territorial approach emerged to foster innovation among communities across the different districts of the city. Or as Interviewee describes *"this is an experience that makes us look like nomads of innovation, where the lab team adapts to each situation, as a walker with the backpack of tricks to assemble the solution with the community"*.

One element that has continuously fed the innovation lab with new ideas and experimentation is the steady generation of knowledge, driven mainly by the curiosity and desire to learn among students, researchers, and practitioners linked to the lab. In this sense, the lab focuses on providing the proper conditions for these dynamics to happen. First, a global Objective and Key Results (OKR) are set for the innovation lab by quarter, then team members are invited to build their own OKR based on something new they would like to learn, but it has to contribute in some way to the ultimate goal. From there, during the following weeks, follow-up is conducted through katas (managerial routines designed to develop staff skills), retrospectives or kudos (recognizing someone else's work) that are usually facilitated by the more experienced members. In this way, while the lab fosters the generation of new knowledge, it also encourages professional and human development among the team, enhancing the work environment within it (Appelo, 2011).

- **Outcomes**

As the intent and objectives of case *IX* changed, so did the type of outputs. The transition from a digital content lab to an innovation lab for the city has been reflected not only in the discourse, but also in the range of experiences, products, and beneficiaries of the lab's activities. Thus, the scope of its results extends to different levels that in one way, or another have contributed to the achievement of its strategic intent. These outcomes vary tangibly from the number of projects, the number of beneficiaries per year or the amount of investment received. However, there are other aspects, such as the recognition of the laboratory and its allies, the inspiring and changing mentality, and the transfer of knowledge to individuals and organizations, which are not quantifiable but always seem to be present.

In terms of project types, the innovation lab has covered different areas of knowledge, technologies and social problems, such as the preservation of indigenous culture, pedagogical tools about the Colombian peace process, the implementation of the Bogota open data strategy, or explorations of new technologies such as blockchain and IoT with high school students. One of the most interesting results in this sense is perhaps the contribution to the innovation strategies of the different institutions that the lab has worked with. In general, it can be said that the innovation lab has performed four roles (Osorio et al., 2020): (1) as a technological ally for the design and development of new digital services for citizens, with a focus on ensuring an optimal user experience and digital accessibility; (2) as a facilitator in the implementation of strategies for the management of digital innovation, creativity, and agility within organizations; (3) as an enabler of joint action and collaboration between communities, citizens, civil servants, and entrepreneurs; and (4) as the place of research and experimentation in the use of new technologies.

Also, as a result of the collaborative approach of the lab, there is an implicit objective of facilitating the adoption of the different methods, techniques or technologies used, by involving beneficiaries and stakeholders in the activities. As explained by Interviewee 1 *"the organizations we reach begin to question how they handle their internal processes and are open to exploring how they could shift ways of getting things done"*. While this is something

that is not necessarily easy to achieve, it is an outcome that definitely nurtures the motivation of the lab team as Interviewee 1 states *"it is very gratifying to see how the lab's discourse permeates people and organizations, and then you see other experiences that show new cases that were not necessarily made with us, but that followed the lessons learned with our lab"*.

Lastly, when it comes to the lab's results, financial performance is perceived as a fundamental aspect, as expressed by Interviewee 1, *"there is an indicator that is inevitable and that is the cash flow. It is not the essence or the purpose of the lab, but it is required"*. In terms of revenue, between 2016 and 2019, the innovation lab operation has managed to almost triple the original investment received by ministry and district government in the early years of the lab, which is perceived as a positive result in terms of the continuity of the lab. Yet, despite income sources now coming from different institutions, the nature of funding remains largely public.

6.2.2 Case XVIII

Results of case XVIII are summarized in Table **6-4** offering the perspective of three years of operation since 2017.

Table 6-4: Case XVIII - Summarized results of framework application

	CASE XVIII		
	2014-2016 (PLANNED)	**2017-2018**	**2019-2020**
CONTEXT	Funding from private foundation (ending on Sep 2020); Changes in head of section in 2016 & 2018; University policy towards contract research		
STRATEGIC INTENT	Lab as access point to the engineering institute and foster: - Attractiveness for Students - Income from Consultancy - Research Collaboration	An innovation lab for the section as four-stage process to support: - Interplay for Education - Commercial Collaboration - Academic Research Projects	From a four-stage innovation lab to a dynamic innovation platform as a smart learning factory
PROCESS OF CREATION	Lab set up for: Ideation / Product Development /	Lab set up for: Ideation / Product Development / Process	Lab set up for: Industry 4.0 / Smart Factory / Simulation and Modelling /

	CASE XVIII		
	2014-2016 (PLANNED)	**2017-2018**	**2019-2020**
	Process Development / Commercialization Staff composition: Lab manager, Lab consultant and PhD Student	Development / Commercialization Staff composition: Lab manager, Lab consultant, Professors & PhD Students	Digital Twin / Hackathons & Entrepreneurship Contests Staff composition: Lab consultant (part time) & professors as facilitators
PHYSICAL EMBODIMENT	Space representing innovation process: Creativity / Prototyping / Manufacturing / Business	Space representing innovation process + Digital Twin Lab	Space redistributed to provide more support to operations/manufacturing From 4 step innovation process set up to a dynamic innovation stage
PROCESS OF USE	Projected as single point of access for articulating engineering institute research labs & centers	Operations based on Teaching, Workshops & Research	Operations based on service agreements, co-financed projects, education activities, development projects
OUTCOMES	Graduate programs with tailored content; International Recognition; Financial self-sustainability; Member of a lab network; Outreach strategy	Innovation consultancy as commercialization strategy; Research Projects on TEE & TT; Six Courses Running in the Lab	Revised Master Program; Commercialized services; Service portfolio; PhD Thesis; Publications

- **Context**

In the midst of a university policy aimed at opening up to society and increasing collaboration with industry, this innovation lab was created with the financial support of a private foundation owned by one of the most important economic groups in the region. In this sense, the laboratory has been funded for the first three years (2017-2020) with the expectation of generating a revenue model for services that would allow the lab to be self-sustainable. Another important feature of the context of case XVIII is the host organization. From an operational point of view, the innovation lab is tied to a section of technology, entrepreneurship and innovation within an engineering institute. Also, throughout the design and implementation process there have been three different section heads that would influence the vision of the lab.

- **Strategic Intent**

Case XVIII was conceived as the access point to the institute for the articulation with society (i.e., industry). The intention was that, through a dedicated space for innovation processes, and industry-oriented, the innovation lab could serve as an entry point for stakeholders in the territory to connect the institute's capabilities (research labs and centers). Building since 2014, this initiative was intended to increase the attractiveness of the section and the institute to students, generate consulting income, and increase collaboration on research projects. Once it became operational, the purpose of the innovation lab began to be shaped. One of the biggest changes from the initial design is perhaps that, in practice, the lab was much more at the service of the section rather than the entire institute. In the absence of a proper prototyping and experimentation space in the section, unlike other areas of the institute, the innovation lab would be consolidated as a space for interplay for education, commercial collaboration and research projects.

By the time the data collection for this case was conducted, there was serious questioning among the section staff about the purpose of the lab. This seemed to be driven by two concerns. First, due to perceived lack of activity in the lab, which was not as much as expected. And second, there was a debate as to what should be the thematic focus to follow. The head of the section and a number of the members of the section believed that, instead of focusing on the innovation process in a broad sense, efforts and resources should be focused on thematic areas such as smart factories, digitalization or automation. However, according to other members, this new path and the actions that were being taken in the transformation were not entirely clear and lacked an integrating narrative, as expressed by Interviewee 6 *"that made it a bit more difficult for me, I have to say, because I think now it might be like furniture or equipment wise… a bit more technical use or building type of use, but for me, it was a bit difficult to see to still see our storyline"*.

- **Process of Creation**

Supporting innovation process stages was a premise since the early days of the XVIII case. It was clear in the project submitted to the foundation for funding that the innovation lab methodological approach should be structured to support ideation, product development, process development and commercialization. *"We wanted to have a physical space that represents what we do in terms of research in a way that we can make it tangible to industry*

and other societal actors also" (Interviewee 9). While this idea has been guiding the discourse and activities undertaken in the lab since its inauguration in 2017, recently the operation has begun to be packaged into thematic service lines such as smart factory, simulation and modeling, digital twins and entrepreneurship challenges.

In organizational terms, it was planned that the lab should have dedicated staff in charge of its operation from the very beginning. The lab team was initially composed of (1) a lab manager responsible for the coordination of activities, dissemination and report preparation, (2) an innovation consultant responsible for analyzing the institute's areas of expertise and sections to create the portfolio of services, as well as assisting in matchmaking between companies and the institute's capabilities, and (3) a PhD student with the mission to study the underlying concept of the lab and help find ways to improve it. This configuration, however, changed over time. Eventually the lab manager position disappeared, leaving the lab consultant as the only person in charge on a part-time basis. Consequently, the consultant's role focused on matchmaking with companies interested in collaborating and specific capabilities of the section associated with its different professors who would implement the activities directly.

- **Physical Embodiment**

The design and implementation of the innovation lab was closely tied to the idea of representing the innovation process tangibly. A total of 147 square meters were distributed in creative, prototyping, manufacturing and business areas. It is equipped with a variety of high-tech and soft features such as VR and AR devices, 3D printing, computers, modeling software, collaborative robot cells, mobile boards, ideation space and a presentation room (in the form of an igloo). In addition, shortly after its inauguration, an additional room dedicated to digital twins was set up. In general, as the laboratory advanced in its operation, its use and distribution changed. As the intention went from being a space to support innovation in a broad sense to focus on thematic lines (smart factory), so the space was redistributed prioritizing simulation and manufacturing areas. This implied, among other things, merging the ideation and group work areas.

For the most part, the space has been useful for hosting different types of activities while transmitting a novel atmosphere to the visitors. On several occasions, however, its capacity to hold a large number of people has been a limiting factor (up to 25 people). One example is the courses offered by the section, which began to be held inside the innovation lab as soon as it was inaugurated. However, this has not been the case recently given to the increasing number of students. This situation has led to the fact that the laboratory has been used mainly for workshops with industry and research in the most recent period.

- **Process of Use**

Consistent with the innovation lab's initial objectives, activities such as teaching, research, creative meetings and outreach have guided its use. Although the lab's operation was initially based on courses, workshops and research, this was later consolidated into a service portfolio structured in services by agreements, co-financed projects, development projects and educational activities under six main themes: strategic and corporate entrepreneurship, innovation management, virtual intelligent prototyping, digital twins, industry 4.0 and women in entrepreneurship. This was considered a step forward in the innovation lab transformation from a 4-step process to a dynamic innovation platform.

- **Outcomes**

The performance of Case XVIII has been marked by a variety of results throughout the three years of operation. In this regard, it is acknowledged that the lab has been key in supporting research projects in entrepreneurship, technology transfer, digitalization and automation. The innovation lab has also enabled commercialization strategy via consultancy, which has resulted in workshops sold to the industry, ranging from trainings in simulation and user interface to entrepreneurship hackathons as well as training in innovation for teachers. Moreover, the new capabilities created as a result of the lab, both in terms of infrastructure and new knowledge, have contributed to the updating of the master's degree program offered by the section.

Yet, despite such results, a sense of underachievement remains, as Interviewee 8 points out *"it has also been a bit difficult to meet these expectations of what the lab should be… because very often not much goes on in this lab, but on the other hand, a lot of cool things*

actually do happen in the lab, it is just not often that you see it. So, that has been a bit challenging, and it is still challenging". On the one hand, this seems to be because there is a general perception that the original vision of the lab as a demonstrator of the innovation process in its four coordinated stages has not been fully realized. And, on the other hand, absence of a dedicated lab team also limits the ability to get the best out of it. Precisely as Interviewee 3 points out, one of the main challenges in the new stage in this case is to *"get the full commitment from all the researchers, and that is not necessarily a must, but of course, we would like to use it as a common playground"*.

6.2.3 Case VI

Results of this case are presented according to the four main periods identified and taking into consideration the five dimensions of our theoretical framework. In Table **6-5** a summary of the main elements that characterize each stage is provided.

Table 6-5: Case VI - Summarized results of framework application

	CASE VI			
	2005-2013	**2014-2017**	**2017-2020**	**2020-…**
CONTEXT	From polytechnic institute to university model Close relationship Engineering school – Research Institute Strategic relationship University – Metropolitan Government	Strategic Alliance through public private partnership (University – Metropolitan Government – French Energy Firms)	Strategic relationship University – Metropolitan Government Collaboration with companies	Continued institutional commitment Changes in metropolitan government Facilities agreement renewal Quality certification process
STRATEGIC INTENT	-Demonstrate tangible innovation approaches to boost pedagogic and research processes -Foster links with territory -Increase engineering school and research institute visibility and recognition	-From parallel initiatives to a unified platform to support research and pedagogic processes -Concept implementation -Facilitate interaction with stakeholders in the territory	-From concept implementation to scaling-up -Convergence space for School, Institute & Stakeholders -Support of pedagogic and research processes -The place to "faire vivre l'innovation"	-From scaling-up to sustain -Keep convergence dynamic -Institutionalize the platform -Focus on societal issues

	CASE VI			
	2005-2013	**2014-2017**	**2017-2020**	**2020-…**
		-Showcase school & institute competencies		
PROCESS OF CREATION	-FabLab and Living Lab as parallel approaches -Prototyping to support pedagogical activities -Co-design to support citizen workshops	-Fab Living Lab approach -Innovation process structured in 2D – 3D – 4D stages -Lab Team composition: scientific coordinator, fab manager & research assistant	-Fab Living Lab 4D Model -Green FabLab -Immersive collaborative environment -Reconfiguration of Lab Team competences -Lab Team composition: scientific coordinator, fab manager, research associates and technical assistant	-Fab Living Lab 4D Integrated Innovation Model -Green FabLab -Immersive collaborative environment - -Lab Team competency inventory -Strengthen digital & facilitation skills
PHYSICAL EMBODIMENT	-Prototyping room as FabLab within the school building (50m2) -User innovation platform as facilities for developing living lab approach (250m2)	-Innovation lab as single space hosting FabLab and Living Lab setups (400m2) -Implementation of a FabLab mobile	-Same facilities -Continuous technological upgrades -3D printing and recycling technologies -Immersive technologies and biometric sensors	-Scenario building to explore possibilities to: -Facilities Reconfiguration -New facilities -Facilities expansion
PROCESS OF USE	-Prototyping room: Creativity and prototyping support for pedagogy -User innovation platform: Urban innovation workshops	-Support of pedagogic and research activities through: -CAD & prototyping to support pedagogy -Co-design & immersive environments -Collaboration with communities of practice through open days	-Formalization of pedagogic and research support services: -Experimentation protocol design -Experimentation setups -Facilitation of innovation workshops	-Improvement of welcome experience -Strengthening of pedagogic and scientific services -Diversification industrial partnerships
INNOVATION OUTCOMES	-Conceptualization of methodological approach on collaborative spaces -Student projects & innovation workshops Labels: Fab Foundation, ENoLL, France Living Labs	-Industrial & Territorial Partnerships -Student & research projects -Scientific publications -Fablab mobile deployments in the territory	-Industrial & Territorial Partnerships -National & European Funded Projects -Participation at annual metropolitan fair	-Keep developing new strategic partnerships -Financial performance -Reenforce visibility of parent institutions -Sustain Lab Team competencies

CASE VI				
	2005-2013	2014-2017	2017-2020	2020-…
			-Scientific publications & press articles	

- **Stage 1: 2005-2013**

Although case *VI* officially started to operate in 2014, it was only the result of a discovery and conceptualization process that began several years before. Back in the time, professors from both the engineering school and research institute were seeking to develop novel mechanisms to help materialize the innovation knowledge that was being created. Therefore, this period was mostly characterized by a strong conceptualization and development of emerging approaches such as (1) digital fabrication to stimulate prototyping and implementation, and (2) living lab methodologies to facilitate collaboration and user validation.

This intent was manifested by two parallel initiatives. On the one hand, there was the implementation of a prototyping room in 2005 conceived to support student projects located within the school building. The allocation of these resources and the dynamic created there will eventually lead to creation of a fablab association in 2011 as one of the first fablabs in France. On the other hand, there was a user innovation platform created in 2009 to foster territorial innovation open to public servants, citizens and companies. This initiative will be the carrier of the living lab project officially recognized by the European Network of Living Labs (ENOLL).

The simultaneous functioning of both structures naturally sparked complementary interactions as explained by Interviewee 18 *"the fablab side helped me to make mock-ups to model mobility stations so that we could have other ways of getting users to work with more representative or novel objects to bring another form of creativity to the citizen workshops"*. The development of this dynamic is perhaps one of the most important outcomes of this period, since it was this reciprocity between initially independent approaches that will establish the methodological basis for the future operation of the innovation lab.

- **Stage 2: 2014-2016**

A remarkable aspect of the context around this case is the strategic alignment between engineering school and the research institute. Both organizations have clearly coincided in their common interest in jointly promoting the necessary actions and resources to support and foster their scientific and pedagogical processes. A key strategy in this regard has been their determination to interact and collaborate with the different actors in their territory to constantly bring new projects so students from all levels and young researchers have a real milieu to work in.

As result of this dynamic, in 2013 a public private partnership between the university, metropolitan government and two energy firms to reinforce their actions for sustainable urban transformations started operations. The public focus and scale of the project, the favorable political environment, in addition to methodological knowledge developed in the preceding years were the conditions that led to the implementation of the innovation lab in 2014 in a new dedicated facility to host both, the collaborative space along with the fabrication lab. Although the context was determined by a specific project, the vision of the research institute and the engineering school was to establish an integrated environment with a triple purpose: (1) support research and pedagogy through collaborative innovation processes; (2) facilitate interface with the territory; (3) be a showcase of their expertise.

While this new vision followed the same line as before, its materialization represented a major change in perspective due to the reorganization of resources and competencies: going from two independent sites with different ways of operating to assembling everything into a single one. Something that helped to give meaning to the new organization was the construction of a unified methodological model that reflected the learning and aspirations sought for this new stage. A Fab Living Lab approach was then presented as an innovation continuum composed of the stages 2D (co-create) - 3D (prototype) - 4D (evaluate). This was conceived as a methodological depiction of the desired way of working around which the different activities and human and technological resources would begin to be guided.

Another important characteristic of this period was the conformation of the lab team composed by a scientific coordinator, a fab manager and a research assistant. Even though case *VI* was designed to function as a support platform for the research institute and the engineering school, undoubtedly the management of the space itself and the intended activities required a dedicated team. Support for modeling and prototyping activities, facilitation of co-design workshops and access to immersive environments were some of the main activities that the platform offered to its users in order to provide an experience under the 4D model. All these activities rapidly allowed the development of an active use of the space, measured mainly by the number of events with citizens and the number of student projects supported. In addition, capitalizing on the experience acquired through scientific publications derived from the lab's activity was a key result that would help disseminate and gain legitimacy in the region's ecosystem.

- **Stage 3: 2017-2020**

The positioning of the case *VI* in the city, as well as the sustained growth of the research institute and the engineering triggered a virtuous circle where new projects were increasingly housed in the innovation lab, professors and students were using the space for their undergraduate and master courses, and doctoral thesis were being conducted. In this way, the innovation lab was becoming the place where the work of the institute and the school *"converge as a place to bring innovation to life"* as expressed by Interviewee 21.

Moving from implementing the innovation lab as a novel concept to scaling up was what characterized this period. This was evidenced by the increase in the number of personnel installed on the platform from 3 to 5 people along with the formalization of functions. While in the early days the lab team members felt that *"because one was here you had to do everything"* as explained by Interviewee 10, over time the operational needs became clearer and more defined roles started to be defined. This reorganization did not only involve a redistribution of functions, but also the building of new competencies in areas such as plastic recycling, circular economy, virtual and augmented reality, biometric sensors, etc.

Under this new configuration, a service-based operation began to be more explicitly defined, mainly around the reservation of spaces and technological resources, design of experimentation environments, design of testing protocols, and the facilitation of innovation workshops. As a result of all these conditions, case *VI* today plays an essential role as a support platform for research and pedagogy. On the one hand, it supports the institute in the implementation of research projects with regional, national and European funding. On the other hand, it provides a place and complementary resources for the academic activities offered by the engineering school, including the hosting of master's and doctoral students in need of an experimental environment.

- **Stage 4: 2020-Future**

The history of case *VI* has been marked by continuous institutional support and ownership by its parent institutions. Although throughout these years there have been changes in the leadership of both institutions, the professors recognize the strategic role that this has for their ecosystem. However, 2020 was a year with important changes in the political, social and regulatory context. At the local level, it was an election year that would call into question whether the agreement for the use of the space where the innovation lab is installed could be renewed. In addition, a quality certification process for the different platforms offering research and pedagogical services was beginning to gain momentum within the university. These conditions, together with the health and social crisis caused by Covid19, triggered a phase of institutionalization of processes and activities that until then had taken place organically.

The purpose of innovation lab has never been in doubt, however issues at this new stage are focused on how to move from growing to sustaining, how to preserve the dynamics of a convergence space for all stakeholders, ensure an increasingly social thematic focus, and institutionalize all these capabilities within the university. Hence, the concerns for the future of case *VI* seem to be oriented towards how to formalize the operation of the lab within the structure of the university and to what extent the administrative conditions allow or not to maintain the competencies acquired so far. Questions such as what the organizational boundaries between the innovation lab, the research institute and the engineering school are (if any); to what extent the platform should be measured by its financial performance or

not; or even how the positioning of innovation lab in the local ecosystem should be better oriented to reinforce the visibility of its parent institutions, appear as some of the key aspects to work on for the future.

6.3 Unfolding the strategic intent of innovation labs

The individual case analyses have shown how the intention of establishing an innovation lab is conceived, materialized and sustained. Using the 5 dimensions of our theoretical framework, we have been able to characterize the development of the three cases by stages. As we completed each case study a pattern began to emerge regarding how the organizational strategic intent of an innovation lab develops, but also how it changes depending significantly on the tangible and intangible manifestations of the surrounding environment. At this point it was then necessary to turn to the literature to find new insights that would enable us to make sense of these findings.

The literature review conducted in Chapter **4** showed the importance of not only communicating a strategic intent but also ensuring its development over time so that it can be understandable and recognizable by the members of the organization. Mantere & Sillince (2007) theorized on how strategic intent can be used to build coherence between multiple stakeholders by helping in creating purpose, offering a different perspective, emphasizing context or creating consistency. They suggest that strategic intent can be actively used to guide organizational performance by focusing people's minds on a big picture (purpose), relativizing opinions and allowing alternative means to achieve objectives (switching perspective), providing meaning and freedom to people to use intent from their own point of view (emphasizing context), and eradicating uncertainty while strengthening future commitments (consistency). This seems to correspond to what has been observed in terms of the different moments identified in the cases. We therefore use in this section Mantere and Sillince (2007) propositions to explain our multi-case intent evolution.

6.3.1 Stage 1: Finding purpose

The first stage, finding purpose, describes the genesis of the innovation lab's intention. This is the moment of discovering why the innovation lab is needed, what is it intended to achieve and what capabilities are needed. But more importantly, this is when the narrative about the wish to innovate and how to do it is created. The ambition and nobility under which the innovation lab is designed will serve as a beacon for people and stakeholders to identify with. The three cases in our study show a strategic intent defined through ambitious objectives aimed at contributing to the creation of new capabilities for their universities and partners. Interestingly, unveiling the purpose of an innovation lab takes time. In cases *IX* and *XVIII* it took about two years but in case *VI* it was a much longer process in which the present version of the innovation lab is the result of prior developments.

6.3.2 Stage 2: Switching perspective

There is no doubt that having the will to create the right conditions to foster some form of innovation is the basis for innovation lab initiatives. However, from having a purpose to putting it into practice is not an easy task. Switching perspective is the stage where the innovation lab intent is tested. Implementation of the lab involves the installation of new capabilities or the reorganization of existing ones. This triggers a phase of discovery and adaptation of what the innovation lab can really offer. While the new perspective offered by the lab may strengthen the will to innovate, the lab team and stakeholders must be ready to deal with differing opinions and unmet expectations, as well as abrupt changes in their environment. This can be seen in case *IX* which has been highly dependent on the political context leading to a redefinition of objectives and capabilities as the government changes. Or with case *XVIII* in the midst of a redefinition of its objectives as a result of the vision of the current head of section.

6.3.3 Stage 3: Emphasizing context

The third stage, emphasizing context, marks a period of increasing awareness of the potential of the innovation lab. Reaching this stage means that the innovation lab intent is

used so that more and more people and partners make use of the space, develop projects and benefit from its services. This can consequently lead to diversification and increase in the volume of activities, reallocation of resources and reorganization of the lab operating model. Case *IX* for instance was seemingly experiencing this stage in recent years due to the high volume of activities occurring outside the lab facilities, as well as the increase of simultaneous projects. Or similarly in case *VI* whose growth in projects and number of students have generated an increase in space use requiring, among other things, the hiring of new personnel and the formalization of roles and functions.

6.3.4 Stage 4: Building consistency

Finally, the fourth stage of building consistency represents the strengthening of commitment to sustain the innovation lab intent. Disturbances and contradictions are bound to arise along the way of managing an innovation lab. This is where innovation lab initiatives tend to have difficulties in maintaining strategic alignment with their stakeholders. Consequently, one must be aware of when dissonances need to be collectively addressed in order to strengthen engagement around the lab. Of our three cases, case *VI* is the sole one to exhibit this stage. Despite the positive results and perceived impact, case *VI* is entering a stage where external conditions are adding pressure to a so far mostly organic dynamic. Organizational boundaries, institutionalization of competencies and financial performance are some of the issues driving the debate on the future of the platform.

6.4 Discussion

This multi-case study explored, from a managerial point of view, the way in which an innovation lab is designed, implemented, and sustained. It expands from the work presented in Chapter **5** not only by adding insights to the evolutionary process of the management of an innovation lab but also to the way in which its strategic intent is built. An emphasis has been made in how the constitutive pillars of the theoretical framework (strategic intent, process of creation, physical embodiment, process of use and outcomes) help to represent

the innovation lab intent that emerge among the lab team members and ultimately give shape to the lab strategy. This led to the identification of four stages through which an innovation lab strategic intent is unfolded.

Results allows us to depict the different manifestations of strategic intent that led to the reorganization of their existing capabilities under the original idea that gave life to our three cases, drove the experimentation and adaptation stages that shaped them and favored the institutionalization of the practices and routines resulting from the labs to their ecosystems. Results also show the chosen approach is useful to understand the sensemaking process that is carried out within an innovation lab, by looking at the collective intent from team members, how resources and competences are configured, and the subsequent conducted actions. This suggests the potential use of the framework to be applied as a coherence-building tool from which strategic intents could be made recognizable and operational (see **Figure 6-3**).

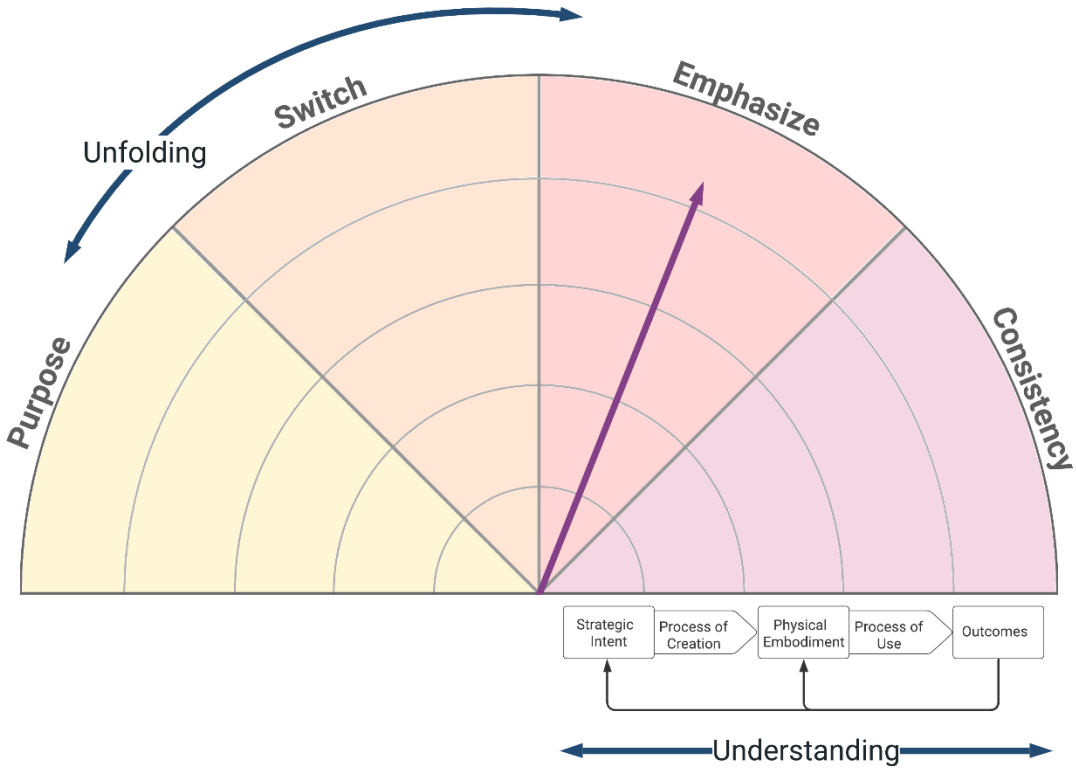


Figure 6-3: Innovation lab intent stage model

Through this work we seek to draw attention to the different issues that influence an innovation lab performance beyond infrastructural and operational ones. Public and private practitioners and policy makers will therefore find a framework that, in practice, constitutes a methodological approach from which innovation lab performance assessments can be tailored. Furthermore, we explore the potential of this approach to become a proactive strategy-making tool to help an innovation lab team and its stakeholders find common ground for building a collective intent.

In any case, it is important to clarify that the purpose of this chapter is not to produce generalizable results on the performance of an innovation lab but, on the contrary, to provide insights into how the application of the selected framework could help to understand the evolutive process that entails its management, thereby shedding light on the strategic orientation of these organizational forms. We therefore believe that having opted for a multiple case study and focusing on the lab management point of view, make findings worthwhile in terms of inspiring others with experiences and practices that they can ultimately adapt to their own context.

We acknowledge the importance of innovation labs in fostering collaborative innovation and social transformation. However, we also realize the complex and uncertain conditions in which these structures develop often leading to tensions and bottlenecks. While research focus has been mostly set on the outcomes and impacts that they may have on their users and ecosystems, we believe that understanding innovation lab intra-organizational processes is fundamental for ensuring their success and continuity.

6.5 Conclusion

In this chapter a multi-case study was developed seeking an in-depth analysis of how the strategic intent of innovation labs develops over time. For this purpose, three cases were analyzed using the theoretical framework previously defined. As a result of observations together with a check with the theory, a 4-stage model was proposed to depict the evolution

of innovation lab intent. Both the model and the framework constitute a methodological approach to assist in guiding innovation lab intention and performance.

7. Exploring team roles and competences for innovation labs

Throughout this document, it has been evidenced that there is widespread interest in the development of innovation labs as intermediary organizational forms to facilitate innovation processes in multi-stakeholder contexts. Likewise, it has also been discussed the issue of how to build and maintain a shared organizational strategic intent enabling lab teams and their stakeholders to navigate the different instances that these innovation endeavors entail. Yet, one aspect worth addressing that has received little attention is precisely the conformation of innovation lab teams.

This is an issue of paramount importance given the fact it is ultimately people who are the bearers of the innovation lab intent. This means that lab teams, who are in charge of ensuring the functioning of such places, find themselves in a conjunction of expertise, cultures, mindsets and interests that change with each project or activity that takes place. That is, these teams need to be able to deal with recurring conditions of uncertainty and complexity. Accordingly, the last contribution of this dissertation focuses on exploring how innovation lab teams are composed, including the underlying competences and main roles needed in managing these organizational forms.

To this end, this chapter first elaborates on the importance of innovation lab teams, the notion of competence for innovation lab teams and innovation roles. Next, a role-based model is developed by comparing seven existing frameworks drawn from the literature on innovation teams and innovation labs. Then, the proposed model is operationalized through a competence-based assessment tool (online questionnaire), from which a self-assessment methodology is designed.

This approach is subsequently tested within the setting of the Climate Labs project, an Erasmus+ initiative which aims to strengthen the applied research and innovation capacities of 10 Latin American Higher Education Institutions in Mexico, Brazil and Colombia, through the design and implementation of social innovation labs for mitigation and adaptation to Climate Change. Results from this exploratory study show that the approach chosen is instrumental in characterizing the teams during the early stages of the implementation of an innovation lab project within Higher Education Institutions, enabling them to elicit improvement strategies. Lastly, we present our conclusions with a discussion around the main implications of this work and suggested avenues for future research.

7.1 Innovation lab management teams

The changing and permeable nature of the lab phenomenon entails a complex working environment which often leads to conditions of uncertainty. This is something regarding which authors have raised concerns, suggesting that teams in charge of leading an innovation lab should be able to deal with ambiguities, integrate multiple perspectives and facilitate cross-disciplinary work (McGann et al., 2019; Osorio et al., 2020; Rose et al., 2021). As discussed before, there is a growing interest in how innovation labs can be used to address societal problems; governments, companies, universities, and even communities are increasingly turning to implementing their own lab as vectors for fostering collaborative learning, inclusive entrepreneurial thinking, systemic change and the transfer of innovation capabilities (Camargo et al., 2021; Delgado et al., 2020; Rayna & Striukova, 2021; Rezaee Vessal et al., 2021). However, several questions arise when considering the composition and organization of the teams managing these initiatives (J. M. Lewis, 2020; Zivkovic, 2018). This aspect is of paramount importance, especially at the early designing phase, to foster the future development and consolidation of such initiatives.

In fact, the assembling of innovation teams has been a matter of interest for long time. Practitioners and scholars from both the public and the private sector have addressed and shared their experiences of the nature and characteristics of innovation teams across time. This is a vision that has known a constant evolution, referring, for instance, to the 80’s and

corporate-style innovation teams, whose nature depended mainly on the emergence of "champions" capable of overcoming any obstacle, while additional roles were organized towards supporting them (Jenssen & Jørgensen, 2004; Roberts & Fusfeld, 1982). Then, as open innovation practices became widespread, the idea of innovation teams progressively became more agile and adaptive, opening the door to the integration of multiple disciplines, and inspiring new ways of working and collaborating (Gemünden et al., 2007; Hellström et al., 2002; Hering & Phillips, 2005). While the perception of lone innovators and isolated teams still seems to persist today, the increasing interconnection and complexity of the problems that we face as a society, the amount of information and knowledge that is continuously created, and the challenging task of making critical decisions with unforeseeable repercussions, explain why today's innovation teams are called upon to efficiently collaborate across multiple perspectives, disciplines and cultures (Björklund et al., 2017; Puttick et al., 2014).

This is not a minor issue, as the success of every innovation process of an organization lies in people (Leonard-Barton, 1995). Thus, understanding the dynamics of group work and team performance has been a topic of interest for the scientific community. In this regard, previous studies have tackled the issue from several perspectives. In terms of team theory for instance, Belbin (2010) gathers extensive research in her book to summarize her proposition of the nine key team roles at work. In this work, originally published in 1993, Belbin explains why, in fact, team roles encompass multiple factors such as personal traits, knowledge, skills, experience and even situations that will determine a person's behavior in group work or in a specific job. More specifically, studies on innovation teams such as the ones led by (Kratzer et al., 2004, 2006a, 2006b) focus on examining the way factors such as team communication, conflicts or virtuality influence creative performance. Likewise, DeCusatis (2008) points out how team performance varies according to generational preferences, habits and the nature of the intended innovation. Specifically, the changing nature of the innovation process across time has opened the door not only for defining the required roles, but also the competences necessary to building successful innovation teams.

In this sense for example, the research work of Chatenier et al. (2010) and Podmetina et al. (2018), propose specific competence profiles for open innovation teams, detailing the main tasks they cover, the main challenges they face and their underlying competencies. Chatenier et al. (2010) point out that competence profiles are instrumental for the creation and development of innovation teams. However, besides the comprehensive and detailed model put forth, they also suggest that a single competence profile falls short of expectations when it comes to assembling effective innovation teams, specifically when determining which competences are required for each team member and for which role.

Despite existing research, the literature remains scarce when it comes to which competences are key to guiding the conformation of innovation lab teams and what specific roles are required in this instance. This is a major issue for the successful implementation of an innovation lab initiative, since beyond physical and technological resources, human facilitation is a fundamental pillar in this regard (Magadley & Birdi, 2009). Furthermore, how these aspects are weighed early on during a lab setup, and the lab's implementation context (i.e., private, community or university) determines the type of challenges a lab team will have to face (Rayna & Striukova, 2019). More importantly, the strategies to overcome these challenges could either be driven or undermined, depending on the competences of the lab team, which would also reflect how effectively they could achieve the intended social impact (Rayna & Striukova, 2021). Therefore, the main focus of this chapter lies in the identification of the key competences and roles that could help in the process of building better teams meant to be the bearers of the innovation processes. Our goal is to put forth a methodological approach for the early designing stage of innovation teams. By means of a self-assessment tool, we intend to provide practical guidance for creating resilient lab teams while continuing to create awareness on the management of such organizational structures.

7.1.1 Competence and Innovation Labs

From an organizational and managerial perspective, the development of human competences is a fundamental task in the path to innovation and successful organizations

(Leonard-Barton, 1995) . Understanding individual competences is key to enabling the performance and adaptation of teams and organizations in rapidly changing conditions (Sandberg, 2000). In general, the concept of *competence* is understood as the capability of an individual to deliver sustainable and effective performance in a specific domain, job, role, organizational context or situation (Mulder, 2014). A *competence* consists of various competencies that coherently cluster a set of knowledge, skills, attitudes and experience (Mulder, 2014). In that sense, competence profiles are often used to represent the functional and behavioral competencies that are required to successfully meet complex demands in a particular context (Chatenier et al., 2010).

In the context of open innovation for instance, the work of Chatenier et al. (2010) proposes a competence profile for open innovation teams based on 20 semi-structured interviews and 2 focus groups with professionals who had participated in open innovation projects in the agribusiness sector. Based on their empirical findings, they build a profile composed of 4 main competence categories and 34 key competencies to accomplish three main tasks of an open innovation team: (1) managing the inter-organizational collaboration process, (2) managing the overall innovation process and (3) creating new knowledge collaboratively. They consider that a team which is competent in self-management, interpersonal management, project management and content management should be better prepared to deal with the challenges behind those main tasks.

In a similar way, Podmetina et al. (2015) propose an open innovation specialist profile based on a large-scale survey with 528 European companies. By inquiring on the required and desired competencies for an employee to be able to implement open innovation, the authors build a profile consisting of six categories of competencies: collaboration skills, interdisciplinary skills, methodic skills, explorative skills, transformational skills and exploitative skills. This work will subsequently lead to the proposition of a competence model for open innovation in which direct links between competencies, key activities and roles are made at the organizational level (Podmetina et al., 2018). This holistic understanding of what is constitutive of a person's key aspects to perform a determined task or role is instrumental when assembling teams and training professionals (Mulder, 2014). Furthermore, competence profiles can also be used as an assessment tool of teams

at work, in order to spark reflection processes (Sandberg, 2000). This ultimately allows managers to identify whether there is room for improvement and decide which type of actions are worth pursuing in order to enhance a team's performance, especially in complex and uncertain circumstances such as facilitating innovation processes (Chatenier et al., 2010). Nevertheless, although the studies conducted by Chatenier et al. (2010) and Podmetina et al. (2018) are presented as specific but not unique to the open innovation context, little has been studied in terms of innovation labs.

While the existing literature on innovation labs constantly highlights the importance of the lab team and the selection of the staff, most of today's experiences and insights rely on generic statements such as the need for people with mixed profiles and backgrounds to reflect social reality, with both traditional skills such as project management and communications and innovation skills to get things done, or with networking skills to gather participants and build connections (Jezierski et al., 2014; Kieboom et al., 2015; Puttick et al., 2014). Acknowledging the importance of this issue, Wascher et al. (2018) @Wascher2018 gathered from the literature a set of 14 key competences for an innovation lab team (see Table **7-1**). They consider that the combination of all of these competences should help a lab team to successfully manage and facilitate cross-sector collaborations. Furthermore, these teams tend to be relatively small, usually composed of a lab manager, an administrative staff and members dedicated to lab process facilitation (Wascher et al., 2018). Yet, there is no theoretical or empirical evidence that suggests what the required roles for an innovation lab are and further, which competences are needed to effectively perform such roles.

Table 7-1: List of competences for innovation lab teams. Source: Wascher et al. (2018)

Competence	Description
Project management	Competence in planning and implementing innovative projects; meeting legal requirements as well as financial expertise, contracts and agreements on the use of space
Moderation	Competence for integrating emerging ideas and orient projects
Mediation	Competence for helping project parties understand and focus on the important issues needed to reach a conflict resolution

Networking	Competence for building connections and relationships with local organizations
Participation	Competence in fostering mechanisms for the involvement of the parties in the project's decision-making processes
Communication	Competence for empathy, change of perspective and use of media in a clear, positive, conversational fashion
Self-organization	Competence for ambiguity and frustration tolerance, confidence and self-esteem
Intercultural	Competence in ensuring inclusivity throughout the project
Evaluation	Competence in the design of mechanisms for monitoring strategies and results
Research methods and interdisciplinary work	Competence for working in interdisciplinary environments using diverse research methods such as critical thinking, data analytics, social research, anthropology, etc.
Design methods and creative thinking	Competence in applying design methods such as design thinking, theory of change planning, etc.
Information and telecommunication techniques	Competence in technological techniques that provide support for project development
Entrepreneurial thinking	Competence in project incubation processes and ventures
Systems thinking	Competence in addressing challenges in a holistic way and being able to examine the links and interactions between all constitutive elements

7.1.2 Innovation teams and roles

Reflecting on what roles or behaviors are required to facilitate innovation processes within an organization is not at all a new idea. One can refer to the notion of “champion” back in the 60’s where the success of the innovation process was attributed to the one single person who was willing to fail for a dubious idea but capable of reaching success (Jenssen & Jørgensen, 2004; Roberts & Fusfeld, 1982). However, nowadays the aim of reflecting on innovation roles is no longer to create heroes that prevail against all odds. Instead, it relies on building strong teams that are aware of their strengths and weaknesses, helping them find ways to overcome the barriers paving the way to the implementation of the intended innovation process (Gemünden et al., 2007). Indeed, innovation does not originate and sustain itself, rather, it happens thanks to the people who make it possible through

teamwork that push the boundaries of their imagination, resilience and perseverance (Kelley & Littman, 2005).

In this sense in particular, the literature on innovation teams and roles has evolved, as innovation processes have become more open, collaborative and social. This has also been the case for the roles needed to facilitate such processes. By delving into the literature on innovation teams we intend to illustrate the diversity of roles that members of an innovation team may play, and which could subsequently inspire the configuration of lab teams. Hence, seven models of innovation roles emerge from the literature (see Table **7-2**), models which are now discussed.

One of the earliest innovation role models is the one proposed by (Roberts & Fusfeld, 1982). This model consists of five roles that are needed to fulfil the critical functions in a technology-based innovation process. These are the *idea generator*, the *entrepreneur* or *champion*, the *project leader*, the *gatekeeper* and the *coach*. The intention was to highlight the key functions that were not always explicit in formal job structures. This also acknowledges the fact that, depending on the size of the team or the organization, some roles need to be filled by more than one person, while some individuals can perform more than one role, and that ultimately, the roles a person fills will change over the course of their career. More importantly, beyond considering a role as purely functional, one should consider a person's behavior within a team. Under the premise that people's useful behaviors can be grouped into a set of related clusters, in her book (originally published in 1993) (Belbin, 2010) condenses the nine team roles which are an effective contribution to team performance: *plant, resource investigator, coordinator, shaper, monitor evaluator, teamworker, implementer, completer finisher* and *specialist*. Even though the Belbin team roles are not exclusive to innovation teams, they represent an important part of team theory that should be taken into consideration.

More recently, Hering & Philips (2005) present eight innovation roles, placing emphasis on the ones required for a generic innovation process. The authors detailed the features of what can be expected of these roles, rather than just titles or job descriptions. According to

them, *connector, librarian, framer, judge, prototyper, monitor* and *storyteller* are the roles that should be sought when putting together an innovation team. The organization's commitment and a belief system are also deemed critical to creating the time and the resources necessary for innovation teams to deal with the uncertainty pertaining to any innovation process. Alternatively, Kelley & Littman (2005) published *Ten Faces of Innovation* based on their experiences at IDEO. The book presents ten descriptions of condensed persona meant to inspire which roles members of an organization should play to foster creativity and innovation. They consider that each role or persona helps bring specific values, tools, skills to the table, and therefore that it is important to ensure they are present in any innovation team. These ten roles are grouped by *learners* (anthropologist, experimenter and cross-pollinator), *organizers* (hurdler, collaborator and director) and *builders* (experience architect, set designer, caregiver and storyteller).

Based on 104 interviews with representatives of German companies and 42 cases from questionnaires, Gemünden et al. (2007) propose a model to determine whether certain innovation roles are influential in adding to the success of new product development in the context of increasingly open innovation. They point out that not only innovation and technological experts are required (*expert promoter* and *process promoter*), but strong leadership (*project leader*) as well as good external relationships (*technology and market relationships promoters*). Moreover, they emphasize the importance of institutional support in the form of power promoters. Recently, Goduscheit (2014) endeavored to build on the work initiated by (Gemünden et al., 2007). There, he seeks to further develop the concept of innovation promoters. This notion is based on the idea that innovation teams are meant to overcome the barriers and difficulties to successful innovations. His aim is to explore the interorganizational dimension between the innovation roles proposed by (Gemünden et al., 2007) by analyzing how they interact/perform with/within multiple organizations. As a result, he further develops the innovation promoter model by moving from the original six roles to a proposition with nine roles: *seniority, top-level representative, technological expert, methodology expert, intra-organizational process, inter-organizational process, project process, technology relationship* and *market relationship*.

Table 7-2: Role models of innovation teams over the years

Reference	Innovation team roles studied over the years							
Roberts & Fusfeld, 1982	**Idea Generator**	**Entrepreneur or Champion**	**Project Leader**	**Gatekeeper**	**Sponsor or Coach**			
	Analyze and synthesize; Markets, techs, approaches, procedures	Recognizes, proposes, pushes and demonstrates technical ideas	Plan and coordinate; pragmatical	Collects and channels info; markets, manufacturing and tech	Big brother (support); protects and advocates; orients based on experience			
Belbin, 2010 (Originally published in 1993)	**Plant**	**Resource investigator**	**Co-ordinator**	**Shaper**	**Monitor Evaluator**	**Teamworker**	**Implementer**	**Completer Finisher**
	Creative, imaginative, unorthodox. Solves difficult problems.	Extrovert, enthusiastic, communicative. Explores opportunities. Develops contacts.	Mature, confident, a good chairperson. Clarifies goals, promotes decision-making, delegates well.	Challenging, dynamic, thrives on pressure. Has the drive and courage to overcome obstacles.	Sober, strategic, discerning. Sees all options. Judges accurately.	Co-operative, mild, perceptive, diplomatic. Listens, builds, averts frictions, calms the waters.	Disciplined, reliable, conservative, efficient. Turns ideas into practical actions.	Painstaking, conscientious, anxious. Searches out errors and omissions. Delivers on time.
Hering & Phillips, 2005	**Connectors**	**Librarian**	**Framer**	**Judge**	**Prototyper**	**Metric Monitor**	**Storyteller**	**Scout**
	Wide knowledge; knows everyone; build networks; jump the tracks; top management contacts	Idea collectors; define the "meta-data"; search & find info	Understands the organization; Builds evaluation frameworks; Focus on consistency and transparency	Evaluates ideas; Provides verdicts; Keep track of decisions	Mockups and "strawmen"; Comfortable with iteration; Good listeners; Knows where to stop	Focus on achievable goals; define metrics'; detects patterns; create new patterns	Communication that matters; Reinforce corporate culture; Emotional connection with abstract process	Voraciously reader; Stays up to date; Analyze trends
Kelley & Littman, 2005	**Anthropologist**	**Experimenter**	**Cross-Pollinator**	**Hurdler**	**Collaborator**	**Director**		
	Human behavior; Physical emotional interactions with products, services and spaces	Prototypes ideas; Trial and error; Calculated risks	Explores industries and cultures; Translates findings in revelations	Overcomes innovation obstacles	Brings people together; lead the way combine and create multidisciplinary solutions	Organize people and sparks creative talents		

Reference	Innovation team roles studied over the years							
Gemunden, Salomo & Holzle, 2007	**Experience Architect**	**Set Designer**	**Caregiver**	**Storyteller**				
	Designs compelling experiences	Transforms physical environments to influence behavior and attitude	Anticipates and look for customer needs	Builds internal moral and external awareness; Compelling narratives; reinforce a cultural trait				
	Power promoter	**Expert promoter**	**Process promoter**	**Technology-related relationship promoter**	**Market-related relationship promoter**	**Leadership experience of the project leader**		
	Supports from higher hierarchical position	High technological know-how	Organization processes savvy; Links experts and decision-makers	Relations with external cooperation partners; Searches for information exchange and collaboration	Market-related know-how	Project management and leading experience		
Nystrõm et al., 2014	**Webber**	**Instigator**	**Gatekeeper**	**Advocate**	**Producer**	**Planner**	**Accessory provider**	**Coordinator**
	Initiator; decides on potential actors	Influences decision-making process	Possesses resources	Distributes information externally	Development process	Supports development process; input from intangible resources	Promoter of products, services and experience	Coordinates participants
Goduscheit, 2014	**Messenger**	**Facilitator**	**Orchestrator**	**Integrator**	**Informant**	**Tester**	**Contributor**	**Co-creator**
	Disseminates information to the network	Offers resources for the use	Guides activities, foster trust and collaboration	Integrates heterogenous knowledge	Brings knowledge and opinions to the lab	Tests innovation in real-life environments	Collaborates with other actors in the network	The users who co-design
	Seniority promoter	**Top-level representative promoter**	**Technological expert promoter**	**Methodology expert promoter**	**Intra-organizational process promoter**	**Inter-organizational process promoter**	**Project process promoter**	**Technology relationship promoters**
	Overcomes barriers through authority	Overcomes barriers through top/level support	Technological insights	Innovation methods insights	Knowledge of the organization	Knowledge on external organizations	Innovation project management	Knows actors with tech know-how

Finally, we refer to the very interesting work conducted by (Nyström et al., 2014). These authors also build on the research work of (Gemünden et al., 2007) by analyzing the roles needed in the context of open innovations. However, they center their research on the possible influence of such roles on innovation networks. For this, they studied 26 living labs and came up with a final proposition of 17 roles that network actors can adopt or create for an innovation project. The new roles identified are mostly related to users and the facilitators (e.g., *co-creator*, *orchestrator*, *contributor*), which correspond to living lab approaches encouraging multi-stakeholder engagement. They also state the importance of innovation roles to combine multiple perspectives, due to the increasing complexity of innovation projects.

Throughout this review of the literature, one may observe that despite the diversity of perspectives, processes or names, authors agree that imbalanced teams and frequent changes can disrupt the way an innovation team performs. This is a challenge that should definitely be taken into consideration when setting up an innovation lab. However, none of the role models establish a direct link between the proposed roles and the relevant competences needed for a person to adequately fill these roles. Nor are any of the identified studies have developed in the lab management perspective. These elements are considered in the next section dealing with the proposition of this article.

7.2 Toward a Competence-based Role Model for Innovation Lab Teams

7.2.1 Methodological approach

Throughout this document and the theoretical background presented above, we have explored the principles behind the notion of innovation labs, along with the dynamics that lab teams must deal with in the context of such organizational forms. Several questions arose as to which roles would allow an innovation lab team to be better prepared to accomplish their mission, as well as what set of competences would be necessary for these teams to thrive under such conditions. Accordingly, seven innovation role models were retrieved from the literature on innovation teams, as well as a set of 14 key competences

for innovation lab teams. However, because of the lack of research work on the performance of innovation lab managerial teams, through this study we aim to establish a connection between innovation competence theory and actual innovation teams in order to hypothesize the essential elements that should be considered when putting together an innovation lab team. To this end, we designed a four-stage process, as shown in Figure **7-1**.

First, based on the literature, we proposed an adapted role model. Because none of the previous role models for innovation teams are rooted in innovation labs, our aim was to use the 14 identified competences to establish a model proposition adapted to the context of our research. Following this, the proposed model was defined operationally as an assessment tool (online questionnaire) that was ultimately applied using a self-assessment approach. Given the practical motivation behind this exploratory study, which is to assist 10 Latin American university teams in setting up their own SI lab team in the framework of the Erasmus+ Climate Labs project, we opted for a two-way self-assessment approach. The first goal was to use this approach to trigger reflection processes that would allow the university teams to increase their awareness of their actual position with respect to the expected roles. And the second goal was to have a comprehensive role characterization at the early stage of the project, for every lab team and according to their perception of the degree of mastery of the identified competences.

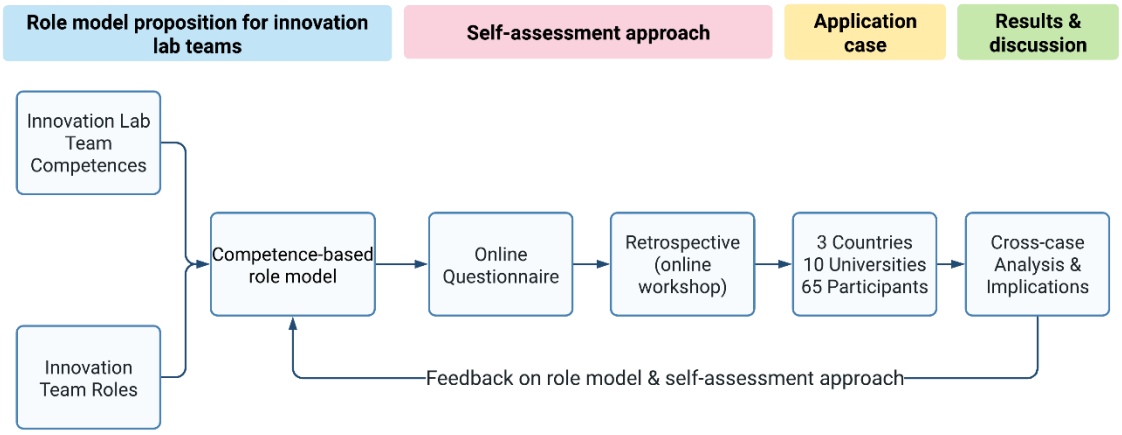


Figure 7-1: Methodological approach to the proposition of the role model

Due to the transcontinental nature of the Climate Labs project, the self-assessment approach was applied virtually by means of the online questionnaire and an online workshop. The proposed approach was designed so that each lab team member (including professors, researchers, students, and administrative staff) could be part of the process. We received a total of 65 answers along with the workshop results for each team. We then analyzed and discussed the results and insights in order to draw conclusions that could be used to provide guidelines for the future of the Climate Labs project but also to further develop this study.

7.2.2 Proposition of a Competence-based Role Model

Despite several insights from empirical studies and different statements regarding which functions or behaviors are possibly found in an innovation team, propositions and explanations fall short of expectations when it comes to the specificity of innovation lab teams. Therefore, we have reason to believe that by establishing a clearer connection between competences for innovation labs and innovation team theory a model can be proposed. First, drawing from the 14 competences proposed by (Wascher et al., 2018), we established a categorization according to the main functions that could be set forth. Based on the literature and according to the authors' knowledge and experience, four competence categories were identified, as illustrated in Table **7-3**. This was done in consideration of the competences that most contribute to one of the following functions: (1) innovation process orchestration, (2) materialize systemic solutions, (3) spark connections and new ideas, and those that contribute to (4) organizing and measuring results.

Table 7-3: Categorization of innovation lab team competences

Competence	Orchestrate Innovation Process	Materialize Systemic Solutions	Spark Connections & Ideas	Organize And Measure Results
Project management				X
Moderation	X			
Mediation	X			
Networking			X	

Competence	Orchestrate Innovation Process	Materialize Systemic Solutions	Spark Connections & Ideas	Organize And Measure Results
Participation	X			
Communication			X	
Self-organization				X
Intercultural	X			
Evaluation				X
Research methods and interdisciplinary work		X		
Design methods and creative thinking		X		
Information and telecommunication techniques		X		
Entrepreneurial thinking			X	
Systems thinking		X		

Then, in order to gain a finer sense of how to better define these competences for innovation teams and their roles, we compared the four competence categories to the innovation roles found in the literature. At this point, we looked for similarities between the roles and behaviors that were historically recognized among innovation teams and the competences for innovation labs. We found that all four categories were present in the seven innovation team role models (see Table **7-4**). It is worth remembering that our focus for this study is the composition of lab teams. This means that while proceeding to this comparison our attention remained focused on the roles at the core of innovation lab management. This is why a fifth category emerges as “external roles”, which refer to users or external parties that revolve around the network of lab stakeholders. By no means is our intent to diminish the importance of these roles, on the contrary, we would like to mention that these external roles should definitely be studied in depth at the further stages of the research. However, considering the usually relatively small size of innovation lab teams, especially in the early stages, we believe that these four categories constitute a comprehensive and pragmatic basis for this study.

Table 7-4: Innovation Role Categorization

Reference	Orchestrate Innovation Process	Materialize Systemic Solutions	Spark Connections & Ideas	Organize & Monitor Results	External Roles
Roberts & Fusfeld., 1982	- Sponsor or Coach	- Entrepreneur or Champion	- Idea Generator	- Project Leader - Gatekeeper	
Belbin, 2010 (Originally Published In 1993)	- Plant - Teamworker	- Implementer - Specialist	- Resource Investigator - Shaper	- Coordinator - Monitor Evaluator - Completer Finisher	
Hering & Phillips, 2005	- Framer	- Librarian - Prototyper	- Connector - Storyteller - Scout	- Judge - Metric Monitor	
Kelley & Littman, 2005	- Hurdler - Collaborator - Caregiver	- Anthropologist - Experimenter - Experience Architect - Set Designer	- Cross-pollinator - Storyteller	- Director	
Gemünden, Salomo & Hölzle, 2007	- Process Promoter	- Expert Promoter	- Technology-related Relationship Promoter - Market-related Relationship Promoter	- Leadership experience of the project leader	- Power Promoter
Nyström et al., 2014	- Facilitator - Builder - Coordinator - Orchestrator	- Producer - Integrator - Tester	- Webber - Advocate - Messenger - Informant - Contributor	- Instigator - Gatekeeper - Planner	- Accessory Provider - Co-creator
Goduscheit, 2014	- Methodology Expert Promoter - Intra-organizational Process Promoter	- Technological Expert Promoter	- Inter-organizational Process Promoter - Technology Relationship Promoter - Market Relationship Promoter	- Project Process Promoter	- Seniority Promoter - Top-level Representative Promoter

Based on the previous work, we propose a competence-based role model for innovation lab teams (see Figure **7-2**). This model is intended for the establishment of a minimal base of competences and roles that an innovation lab team should bear in mind during the implementation of their project. A general description for each of the proposed roles is outlined below.

- **Facilitators – They who set the tempo and orchestrate people's collaboration.** This is probably the most distinctive role in an innovation lab team. The Facilitators are those who set the methodological tempo of the projects within the lab. They know exactly what strategy, tool or dynamics to use when divergence, convergence or a "simple" retrospective is needed. They get people involved and seek collaboration for every activity. When intentions and interests collide, facilitators keep everyone focused on the greater purpose. No collaboration is possible where there is discrimination and exclusion, so intercultural and transdisciplinary inclusion is a prime directive for them. What can be expected of facilitators in an innovation lab team:
    - Design strategies, methods, and tools for orienting the innovation process throughout every project (Belbin, 2010; Gemünden et al., 2007; Goduscheit, 2014; Hering & Phillips, 2005; Kelley & Littman, 2005).
    - Provide guidance and mentoring to stimulate the professional and personal development of project teams and participants (Kelley & Littman, 2005; Roberts & Fusfeld, 1982).
    - Get people involved and encourage collaboration in every lab activity (Gemünden et al., 2007; Goduscheit, 2014; Kelley & Littman, 2005; Nyström et al., 2014).
    - Act as peacekeepers when a conflict emerges, maintaining the focus on project objectives and common goals (Belbin, 2010; Hering & Phillips, 2005; Nyström et al., 2014).
    - Ensure intercultural inclusiveness in all lab projects or activities (Kelley & Littman, 2005; Nyström et al., 2014; Wascher et al., 2018).
- **Makers – They who make things happen.** Whoever comes up with an idea usually needs support to make it become real. Makers leverage a diverse set of instrumental skills to understand every need and to prototype any solution. They do not hesitate to mix disciplines or to go out in the field in order to understand a problem. They shine at combining ideas and driving innovative concepts. Makers are driven by experimentation, iterating through prototypes crafted on available technologies. Acknowledging the complexity of every problem in a systemic manner is part of the way they see the world. What can be expected of makers in an innovation lab team:

- Understand needs and problems through the combination of multiple research methods and settings (Kelley & Littman, 2005; Nyström et al., 2014; Wascher et al., 2018).
- Capture ideas, data, and any form of knowledge, restructure them and propose novel concept solutions (Belbin, 2010; Hering & Phillips, 2005; Roberts & Fusfeld, 1982).
- Help build physical (and digital) representations of solutions on an iterative basis (Belbin, 2010; Gemünden et al., 2007; Goduscheit, 2014; Hering & Phillips, 2005; Kelley & Littman, 2005; Nyström et al., 2014).
- Propose alternatives to address the complexity of every problem and the systemic impact of each solution (Nyström et al., 2014; Wascher et al., 2018).

- **Visionaries – They who push and connect.** Refers to the type of person who always finds an opportunity where no one else sees it. These are the very same people who know how to easily create networks. They possess an inherent talent for communicating their ideas while remaining empathetic and sensitive to others. Their particular entrepreneurial mindset keeps them moving forward, in view of achieving their vision of the future and beliefs. What can be expected of visionaries in an innovation lab team:
  - Provide a constant flow of ideas and project opportunities for the lab (Hering & Phillips, 2005; Nyström et al., 2014; Roberts & Fusfeld, 1982).
  - Build connections with communities and stakeholders to establish strong links between the lab, its stakeholders, and the territory (Belbin, 2010; Gemünden et al., 2007; Goduscheit, 2014; Hering & Phillips, 2005; Kelley & Littman, 2005; Nyström et al., 2014).
  - Create an emotional connection with people around the lab by sharing compelling stories regarding each project, event, success, or failure (Goduscheit, 2014; Hering & Phillips, 2005; Kelley & Littman, 2005; Nyström et al., 2014).
  - Go out and find opportunities for the lab whether these are new alliances, funding options or showcase scenarios (Belbin, 2010; Gemünden et al., 2007; Goduscheit, 2014; Wascher et al., 2018).

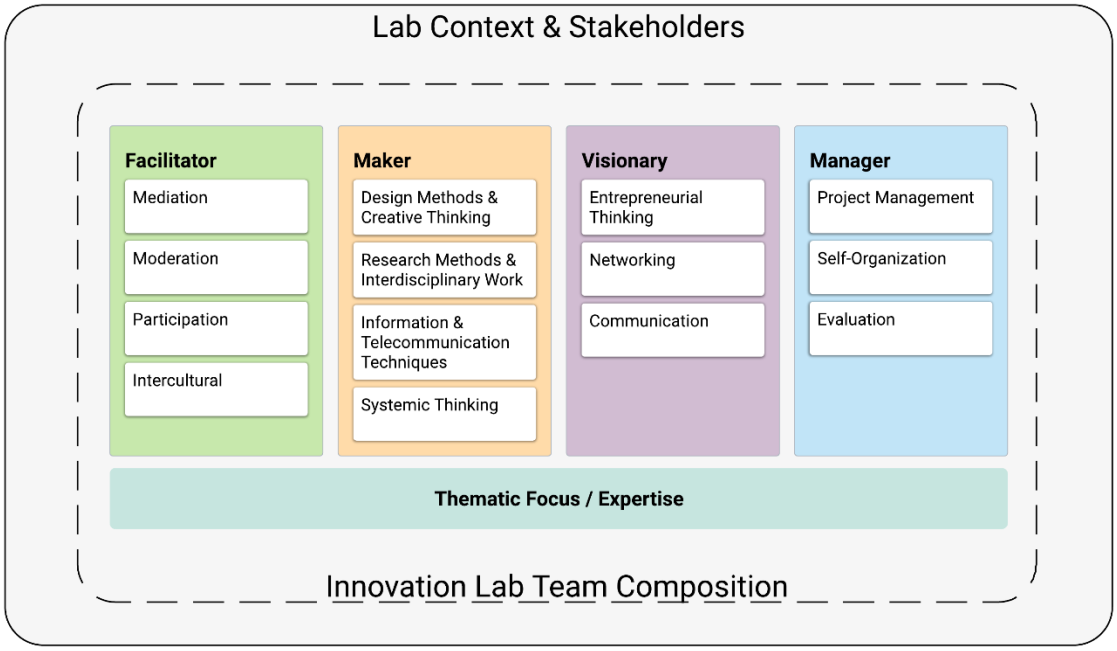


Figure 7-2: Competence-based role model proposition

- **Managers – They who keep everything on track.** Innovation lab initiatives can often be seen as fuzzy and accessory. Managers are there to organize, give sense and value to everything that happens in a lab. Because they are used to dealing with uncertain conditions, lab managers are exceptionally adept at handling innovation projects. They keep track of everything, detecting patterns of what works and what does not. Their ability to monitor metrics and results allows them to build bridges with their managerial counterparts from other institutions to defend the role of the lab in their ecosystem. Lab managers are capable of making decisions, a key asset in the highly complex contexts in which labs normally operate. What can be expected of managers in an innovation lab team:
    - Handle any technical, financial, and legal issues pertaining to the lab and its projects (Gemünden et al., 2007; Goduscheit, 2014; Nyström et al., 2014).
    - Contribute to project planning while maintaining a balance between visionary solutions and achievable goals (Belbin, 2010; Kelley & Littman, 2005; Nyström et al., 2014; Roberts & Fusfeld, 1982).

- Implement monitoring and assessment mechanisms to track the lab's evolution and communicate results (Belbin, 2010; Hering & Phillips, 2005; Roberts & Fusfeld, 1982).
- Have strong belief in themselves which helps them make decisions for the sustainability of the lab and its ecosystem (Belbin, 2010; Gemünden et al., 2007; Wascher et al., 2018).

7.3 Application of the role model through a self-assessment approach

7.3.1 Tool design: a self-assessment approach

The next step was to operationalize the proposed role model. Rather than relying entirely on a rationalistic approach where functional roles are predefined and team members are expected to fit into certain assumptions, we sought to provide a reflection and awareness tool for lab teams as they design and implement their innovation lab (Sandberg, 2000). In this sense, a self-assessment approach is instrumental in understanding the degree to which a person considers they are competent for a determined task or in a specific situation, while reflection processes are sparked (Allen & van der Velden, 2005; Sandberg, 2000). An important advantage of following a self-assessment approach is that individuals have access to information about themselves that might otherwise be more difficult to access (Allen & van der Velden, 2005). However, it is also important to be aware that relying on self-knowledge often leads to problems regarding the reliability and validity of results (Ward et al., 2002).

For this reason, the operationalization of our theoretical model first and foremost included the definition of short descriptions for each competence (see Appendix **G**), which constitute the basis of an online questionnaire as the first step to self-assessment. Accordingly, out of a total of 30 questions in the online questionnaire, 23 questions are directly related to the model criteria, 6 general questions are used for profiling purposes and the last question is an open one to collect feedback. Furthermore, and based on this structure, the

questionnaire was also made available in three languages: Spanish, Portuguese and English. In terms of self-assessment levels, a scale from 0 to 5 with anchoring phrases was applied (see Table **7-5**). In this scale, 1 corresponds to the level where respondents understand what the competence is but do not practice it, and 5, where they believe they have mastered the competence and are capable of developing new ways of applying it (Dreyfus & Dreyfus, 1986). The 0 level was introduced for people who were not aware of, or did not understand what the competence was about, so as to reduce unintentional measurement errors (Allen & van der Velden, 2005). In order to address any ambiguity or lack of clarity, a test was performed with several members of the consortium, prior to applying the study to the Latin American teams. Adjustments were then made based on the feedback and test results. The English version of the final questionnaire can be accessed at https://forms.gle/iZ1Lwyt1KUqrerb57.

Table 7-5: Self-assessment scale

Level	Numeric Scale	Anchoring Phrases
Do not understand / Not applicable	0	I do not understand what the competence is about
Novice	1	I understand what the competence is and why it is important but I don't use it
Advanced beginner	2	I use this competence under supervision or with encouragement
Competent	3	I use this competence without supervision or encouragement
Proficient	4	I encourage or supervise others in this competence
Expert	5	I develop new ways to apply this competence within or outside my organization

Then, we designed a retrospective workshop in the form of a post self-assessment intervention, where we asked participants to reflect on the results of the questionnaire as a team. One of the main hypotheses posits that a competence profile resulting from self-assessment triggers discussion among lab team members concerning: a) the strengths and weaknesses they may have as a team; b) the potential role(s) that each member could play in the lab; c) the aspects to be developed and possible strategies for doing so. In this way, lab teams are stimulated to reflect on the current conception they have of their lab and on what needs to be strengthened (Sandberg, 2000).

7.3.2 Sample and data collection

As previously mentioned, this study was conducted as part of the Climate Labs project, an Erasmus+ initiative which aims to strengthen the applied research and innovation capacities of a group of Latin American universities, via the implementation of social innovation labs for mitigation and adaptation to Climate Change. One of the project's main goals is to build multidisciplinary teams within universities in charge of designing a Climate Lab. Therefore, the self-assessment tool was conceived as a starting point to this project. The methodology was applied in 10 Latin American universities from Colombia (5), Mexico (2) and Brazil (3), between the months of April and August 2020.

The members of each team were asked to self-assess their innovation lab competences individually by means of the online questionnaire, during the months of April and May. Later in June, a webinar was held with all the teams in order to share the preliminary results and introduce the retrospective activity as the second part of the methodology. Each university team was handed a customized report consisting mainly of their competence profile according to our four generic role propositions: *Visionary*, *Maker*, *Facilitator* and *Manager*. The intention was to trigger a reflection process to identify strengths and points of improvement and discuss them with the team. Based on the results, lab members were also asked to state which of the proposed roles they identified with the most and the least. Finally, they were requested to ideate potential strategies for filling their gaps as a lab team.

A total of 65 participants completed both the questionnaire and the workshop. Lab team size oscillated between 4 and 13 members. Among the respondents there were faculty members, administration staff, researchers and students, the latter category being only represented by three undergraduate students and one doctoral student. This was mainly due to the constraints of the global COVID-19 health crisis, with repercussions on each university's academic schedule. Nevertheless, the sample is still representative of who will lead lab implementation, which guarantees that insights drawn from this analysis will provide a real picture of an innovation lab team in its early stages. Table **7-6** summarizes team composition by university.

Table 7-6: Lab team composition and thematic focus

Country	Lab	Members by position							Lab Team Size	Thematic Focus
		PR	AP	DI	AS	ST	RE	OT		
Brazil	A	5	2	2	1	1	2	-	13	Urban Flood and Heat Island Management
	B	1	1	1	1	-	-	-	4	SI and Community Development
	C	6	1	-	-	3	-	-	10	Urban Sustainable Development & Community Resilience
	D	3	-	2	-	-	1	1	7	Coffee Production and Watersheds
Colombia	E	3	1	1	1	-	-	-	6	Institutional Capacity for Climate Change
	F	2	-	1	-	-	-	1	4	Sustainable Water Governance
	G	1	-	3	1	-	-	-	5	Climate Variability and Pollinators
	H	2	-	1	2	-	-	-	5	Women's and Children's Resilience and Climate Change
Mexico	I	1	-	3	1	-	-	-	5	Waste Management and Circular Economy
	J	3	-	2	-	-	-	1	6	Sustainable Food Production
Total		27	5	16	7	4	3	3	65	Climate lab community

PR: Professor; AP: Assistant Professor; DI: Director; AS: Administrative Staff; ST: Student; RE: Researcher; OT: Other

7.3.3 Instrument internal consistency

There is interest in measuring the consistency of the tool. To do so, we chose to calculate Cronbach's alpha coefficient values, as they have been widely used for construct validation purposes (Taber, 2018). Due to the multidimensional nature of the questionnaire, the alpha coefficient was calculated for the groups of items associated to each role. Alphas for maker and manager are lower, 0.773 and 0.787 respectively, but they remain above 0.7 which is suggestive of consistency. Moreover, the alpha for visionary has an acceptable coefficient of 0.824 whereas it is higher for facilitator with 0.906. Far from reaching any conclusions in terms of reliability, these results only indicate an acceptable level of interrelatedness (or equivalence) among the grouped competences for each role, something we consider as positive at this exploratory stage and for the subsequent steps of this research.

7.3.4 Competence self-assessment results

Figure **7-3** presents the results of the self-assessment for the whole sample (black line). Three additional profiles are shown (green, blue and orange dotted lines) which correspond to the three lab team cases that will be analyzed further in this section. Here, the radar is used to visualize the median-based profiles to provide a measure of the central trend among the sample (or specific team). The median is shown for each of the 23 questions to help the teams infer where strengths or weaknesses might be. From a general perspective, some points are worth describing. The overall sample of participants declared having a high level of competence for guiding others (level 4) in activities such as moderation, research methods, networking and self-organization. This was to be expected as there is a significant number of professors and directors among the respondents, who are probably more trained and experienced than team members holding different positions. However, one result worth highlighting is the low level of competence in ICT and entrepreneurial thinking, suggesting the existence of common gaps that could pose challenges for the future development of an innovation lab.

7.4 Findings and discussion

7.4.1 A cross examination of retrospective results

Based on the results of the self-assessment, the lab teams were invited to reflect on their competence profile while the role model was introduced along with the workshop steps. The results of the second part are described through three cases: Labs H, I and J. These cases were chosen because as a result of the self-assessment, they showed a lack or a low representation of the specific roles among their team members. This allows us to frame the analysis in terms of which strategies the methodology elicits when specific roles are missing. A cross-case analysis is then conducted to discuss noteworthy observations and common elements in the way lab teams interpret results, self-positioning and what kind of actions or points of improvement were identified.

Figure 7-3: Global profile of the results obtained in the competence self-assessment

Table **7-7** presents a summary of the retrospective results for the three chosen cases. We focused on analyzing and understanding how participants related to our role model and which self-declared roles emerged for each case. We were also interested in exploring how consistent (or not) the competence profile results were with the self-declared roles, as well as with the identified improvement actions. For instance, do teams lacking a specific role propose equivalent actions to fill that gap? Besides hiring or involving new people in the team, what other reflections or improvement strategies does the methodology elicit? With these questions in mind, we discuss some of the main insights in the rest of this section.

Table 7-7: Summarized results of the retrospective

Retrospective Steps	Lab H	Lab I	Lab J
Self-declared roles	Facilitator: 1 Maker: 1 Visionary: 3 Manager: 2	Facilitator: 3 Maker: 0 Visionary: 4 Manager: 2	Facilitator: 4 Maker: 5 Visionary: 2 Manager: 4
Strengths	- Moderation of the difference, Systemic Thinking, Project Management, Participatory Methods, Networking, Empathetic Communication - Knowledge in environmental disciplines and Sustainable Development	- Institutionalized SI at the University - Bioengineering School - Strong alliances with State Government and Local Actors - 480 hours of mandatory Social Community Service for all students - Local, Regional and National status of the University - The goodwill of the team	- A Maker Team - 5+ years working as a team - Team members in managerial and decision-making positions - Networking - Experience in Waste Management - A Sustainability and Applied Ecology Lab in the University - Experience in fieldwork with communities - Team of young talents
Weaknesses	- Entrepreneurship Processes, ICT, Design and Prototyping - Building solutions for real problems in multi stakeholder contexts - Interdisciplinary Research	- Unmapped Climate Change or Environmental Action programs at the University - Slow and complicated administrative processes - Low levels of collaboration within the campus and at city level - Absence of emergency culture for Climate Action - First time a project combines SI and Climate Change	- Visionary competences - Entrepreneurial Thinking, ICT and Systems Thinking - Evaluation methodologies - Time management and limited staff - Decisions need to be scaled within the university (public context)
Missing roles	- Roles will be filled by university staff when required	- Makers with strengths in ICT, Creative Thinking and Systems Thinking - Opportunity to consolidate existing competences and expand to others	- Project Manager - ICT Engineer - Green Economy Expert
Competences to be developed	- Living Lab and SI for Climate Adaptation - Design of innovation projects - Intercultural skills	- Vision and big picture for the SI Lab - Participation Culture - Project Management adapted for SI Processes	- Disruptive changemaker strategies - Knowledge in Green Economy strategies

Retrospective Steps	Lab H	Lab I	Lab J
			- Use of basic and specialized software tools
Improvement strategies	- Involve students through research seedbeds - Foster collaboration with entrepreneurship ecosystem actors - Develop co-creation projects involving students, professors, researchers and communities - Conduct training among team members - Promote harmonious relations with national and international universities involved in the project	- Search for missing roles ensuring multidisciplinarity, innovative people and entrepreneurial spirit - Implement Learning Communities - Create an inclusive and welcoming identity around our Lab	- Training courses - Collaborative work with other universities - Engage students via social service or internships - Integrate new members with ICT expertise - Develop weak competences of team members - Leverage team strengths to consolidate individual and group capacities

The first part of the activity consisted in declaring which role each participant related with the most according to the role model and their competence profile. Some participants declared they identified with multiple roles whereas others with only one. Regarding the cases selected for this analysis, each case shows a relative low representation of one role in particular. For instance, *Lab I* does not have a self-declared maker. *Lab J* has only two visionaries and *Lab H* has only one facilitator and one maker. It is interesting to see whether the strengths or weaknesses correspond or not to their team profile. This is important, since the fact of failing to have someone identifying with, or related to, a specific role does not necessarily mean that they are not competent as a team in that respect.

In terms of strengths, the exercise seems to reveal direct links with the team's profile where high levels of competence are identified, as well as enable them to share information regarding additional key points that characterize them as a team. For example, aspects such as time working together as a team, the degree of social innovation and entrepreneurship institutionalization at the university and their strong links with the State government and local actors were highlighted by *Lab I* as their main strengths. Perhaps one remarkable characteristic is the fact that, as they stated, *"all our students have a mandatory federal duty to dedicate 480 hours to social community service, where we can count on their talent and*

work". This is something that could prove useful for the lab once it is in operation. The team of *Lab J* recognizes themselves as *"a maker team with great research capacity"*, as clearly the majority of its members self-identified as makers, which corresponds to high levels of competence in research and design according to their global profile (see Figure **7-3**). They also stress the *"good positioning"* of several of their members in terms of management and decision-making at their university. Remarkably, despite a team profile that evidences a high level of competence for facilitation (see Figure **7-3**), only one member of *Lab H* self-identified as facilitator. Still, as part of their strengths, they consider themselves *"inclusive and respectful in moderating differences"*. They also outline systemic thinking, project management, pedagogical methods, networking and communications as strong points, as well as their knowledge in environmental disciplines and sustainable development.

As already perceived in the global profile, ICT competence is a common weakness that also appears in the retrospective for all three cases. In addition, *Lab H* and *J* identify entrepreneurial thinking as limited or with low experience whereas *Lab I* as well as *H* raised concerns regarding the slow and complicated administrative processes at the university. Specifically, according to their competence profile, team members of *Lab H* acknowledge a lack of experience in designing and prototyping innovation projects, and further, in building solutions to real problems in multi-stakeholder contexts. Similarly, the *Lab I* team reveals that this is their first experience in a lab that combines social innovation and climate change. They consider this a weakness as social innovation practices are not yet commonly included to the academic work of other faculties. In addition, they highlight that the lack of an emergency culture regarding climate action could be a barrier when it comes to bringing change or actions in their institution at the operational level. Lastly, the team of *Lab J* expressed the need for consolidating their visionary capabilities along with systemic thinking and evaluation methodologies. They also pointed out time management and the limited number of people available as weaknesses, because their team members were concurrently engaged in several other projects.

Moving forward in the retrospective, teams were then asked to synthesize what competences they needed to develop toward the design and implementation of their

innovation lab. Besides reaching some direct conclusions in terms of specific missing competences such as ICT or entrepreneurial thinking, the activity also helped them to draw some less obvious conclusions. For instance, the team members of *Lab I* stated that they were missing maker roles with strengths in ICT, creative thinking and systems thinking, and they pointed to the need for developing a culture of participation. However, they also mentioned the following as one of their conclusions, *"we already have the strengths of the other roles, but we must keep increasing our knowledge and expand onto other roles"*. They also agreed that having a vision or a bigger picture of the scope of their innovation lab was a key step that they needed to develop before they could move forward. On top of that, they recognized that it was also important to develop an adapted project management competence which recognized and urged the nature of social innovation projects. This is also in line with the members of *Lab J* who concluded that, despite having a high representation of the manager role, they still needed a project manager due to their time management issues. Some teams also identified competences or roles to be developed according to their thematic focus. The *Lab J* team believes that they need to develop knowledge in Green Economy strategies while *Lab H* highlighted the importance of developing competences in living labs and social innovation for climate change.

The final step in the retrospective was oriented toward the identification of strategies and actions to improve or overcome the identified weaknesses or barriers. All three cases raised the importance of involving students in this process where research seedbeds, social service or internships were identified as possible mechanisms to this end. A second common strategy would be to develop missing or weak competences through training and learning communities. Team members seem to recognize the experimental and learning nature of their innovation lab project, potentially allowing for the consolidation of both individual and team competences. More particularly, *Lab H* and *J* outlined collaboration with other universities and actors in their ecosystem as a source for fostering knowledge, exchanges and advice. Lastly, *Lab I* emphasized the importance of creating an identity around lab members and non-members alike, so that they might feel included and invited to participate.

7.4.2 Discussion

The purpose of this study is to propose a methodological approach for guidance in the creation of innovation lab teams. Since innovation labs are still an emergent field in the academic literature, this chapter is a contribution to the literature inasmuch as it connects the theory of innovation teams to the competences required for managing innovation lab processes. In this sense, we proposed a competence-based role model focusing on four main roles as a starting point for an innovation lab initiative. Although the literature recognizes the multiplicity of roles in innovation teams and networks, in this study we chose to focus strictly on the aspects of management in the early stages of innovation lab setup. Prior studies have highlighted the fact that facilitating collaborative processes across disciplines, dealing with ambiguities, integrating multiple perspectives, and building and sustaining a shared intent in multi-stakeholder projects were some of the major challenges that innovation lab teams face today. Therefore, by focusing on the facilitation, making, visionary and managerial facets of lab management, innovation lab teams can find in this chapter a deeper understanding of the roles and behaviors that could effectively assist in the implementation of the intended innovation processes.

Following an interpretative approach, the model was operationalized. As a result, the methodology put forth consists of a self-assessment tool, coupled with a retrospective workshop. To the extent that the roles required for an innovation lab have not yet been defined in the literature, the proposed model was considered as a basis that teams could not only use to position themselves at an individual level in terms of their own competences and their relation to the proposed roles, but also to position themselves at team level in order to identify and suggest improvement actions. Despite their relatively small size, instability and sometimes informal conditions, past experiences have shown that innovation lab initiatives needed to develop a human resource strategy, as this becomes fundamental when it comes to bringing in people with the right mindset to deal with social challenges (Osorio et al., 2020; Timeus & Gascó, 2018). Ultimately, this work calls for lab teams to not only focus their efforts on the projects and the different parties they interact with but also to develop *reflectum practicum* dynamics for sparking team development and cohesion (Sandberg, 2000). In this sense, our methodological approach should be seen not only as

a tool for competence development but also as a way of closing the intent-gap within a team (Gratton, 1994; Mantere & Sillince, 2007), which is essential to developing thriving innovation lab initiatives (as explained and evidenced in Chapters **4** and **6**).

On top of that, it is important to bear in mind the idiosyncratic nature of innovation labs. This is why our approach can be used by researchers and practitioners alike, to elicit conceptions of the competences required for their lab according to their own experience and context. While innovation labs continue to proliferate around the world, universities in particular seem to discern in this type of initiative a means to stimulating deep transformations and enhancing their role as agents of change in stressful times (Camargo et al., 2021; Petersen & Kruss, 2021). This is precisely the case with the Climate Lab project and the cases we analyzed in this study. Applied, the self-assessment tool helps to draw a "picture" of the lab teams where specific strengths and weaknesses are revealed, but which are also linked to the intrinsic conditions of the universities to which they belong. Hence, this tool contributes to mapping the aspects which require attention in order to ensure the future development of university-hosted innovation labs, but which also help to identify and prioritize the areas in which these labs can generate greater value. Similarly, the recognition and socialization of competence gaps seems to enable the identification of collaboration opportunities with other labs and institutions. This could eventually lead to inter-collaboration between innovation labs in terms of complementary capabilities and/or services (see Memon et al., 2018).

Notwithstanding the implications of the self-assessment approach in innovation lab research and practice, this exploratory work comes with several limitations that should be addressed in future research. Although the competence-based role model proposed in this chapter takes into account a broad spectrum of the literature on roles and competences for innovation, there is still plenty of room left to investigate the underlying competencies for each role and each competence, in terms of knowledge, skills, aptitudes and experience (Chatenier et al., 2010). Further theoretical and empirical research could explore the dynamics involved in the management of socially innovative processes and how they differ from open innovation teams, for example (Podmetina et al., 2018). In addition, any self-assessment approach suffers from subjectivity. Therefore, the results of the questionnaire

should not be seen as absolute statements, on the contrary, they should be interpreted by providing the appropriate space for collective reflection at the lab team level. The use of a competence profile should motivate the development of human talent, a process that consists of chained events rather than one single intervention at the start of an innovation lab project (Sandberg, 2000).

Lastly, our choice of only four roles may be perceived as excluding the multiplicity of behavioral and functional roles recognized in the field of innovation. However, the aim of this work is not to overlook the importance of previous studies; on the contrary, it seeks to open new research avenues for a deeper analysis in terms of innovation lab management and the talent in charge of carrying out its intent. In practical terms, this work offers a starting point for nascent lab teams with limited resources, which is often the case for innovation labs, particularly in contexts such as Latin America (Osorio et al., 2020). Future research efforts should focus on the evolution of role profiles over time and on the competences that prevail for projects addressing social challenges (Rayna & Striukova, 2021) (i.e., what does it mean to be a facilitator, maker, visionary or manager for climate change adaptation and mitigation?). Further empirical studies could also assess which aspects of the proposed model are most influential in the performance of an innovation lab (Caccamo, 2020).

7.5 Conclusion

This chapter explored the competences and team roles that could guide the conformation of an innovation lab team. Consequently, it develops a competence-based role model consisting of an existing set of 14 competences for innovation labs gathered from the literature, which are then organized in 4 generic roles specifically for innovation lab teams. The methodology, composed of an online self-assessment questionnaire and a retrospective activity, provides an interpretative approach for innovation lab teams to position themselves with regards to their competence profile and the proposed roles, while identifying improvement strategies. Applied to 10 lab teams from Latin American universities, the methodology proved instrumental in identifying the teams' strengths and weaknesses as well as key actions that could guide team conformation. The results not only

contribute to building knowledge from the team and managerial point of view on the (emergent) innovation lab literature, but they also share detailed conceptions and experiences of nascent lab teams in a Latin American context.

This study is not without limitations. The self-assessment approach is often criticized for the subjectivity of its results, which could be problematic when looking for reliability and results validation. However, at this stage the purpose of this work is not to produce generalizable results on which roles an innovation lab should have and its underlying competences, but rather to provide a methodological approach to support the assembling of such heterogeneous teams. Finally, further research efforts should explore in greater depths how team roles perform and interact within an innovation lab, in order to better understand functional and behavioral roles. Furthermore, adding a processual perspective to this study could provide insights on the changes in roles linked to an innovation lab's evolution.

8. Conclusion

The development of this thesis has consisted of explaining how the strategic intent of innovation labs is built and can be used to orient their performance. In doing so, this thesis recognizes that innovation labs are intermediary organizational forms created to support and facilitate innovation intent in multi-stakeholder contexts. Moreover, it has been shown that these laboratories' settings require sensemaking and feedback processes that allow them to create and maintain a strategic alignment among their stakeholders. In this sense, our focus in this work is on the design of mechanisms that enable (1) the representation of the constituent elements of the organizational strategic intent of an innovation lab, (2) understanding how this intent unfolds over time and the stages it goes through, and (3) the identification of competences and roles within the lab teams that help to navigate the innovation lab intent. Altogether, they constitute a methodological approach to support strategy making processes in such collaborative environments.

In this concluding chapter, the main contributions of this thesis are recapitulated and then lessons learned for practitioners and decision-makers are shared. This is followed by a discussion of the limitations before closing with future steps and perspectives of this research.

8.1 Contributions

The way in which innovation labs are designed, implemented and subsequently used has been addressed throughout this research. This has been carried out through the application of multiple methods and in different settings that have provided a contrast of experiences and different facets of this phenomenon, leading to various theoretical and practical

contributions. They each add to the theoretical and managerial knowledge in the design and management of collaborative innovation environments. The following is a recapitulation of the main contributions of this research work:

- ***An updated perspective on innovation labs as key organizational forms for the intermediation of (increasingly open and social) innovation ecosystems and their focus on innovation process facilitation.*** Although innovation labs are widely recognized for their beneficial impact in supporting innovation, a proliferation of initiatives, concepts, manifestations and lab labels can make them difficult to understand. In this regard, Chapters **2** and **3** explain the integrative and transversal character of the innovation lab concept by focusing on the organizational perspective of innovation process facilitation. Innovation labs are therefore considered to be the embodiment of an organization's will to innovate and to stimulate organizational learning. Yet, the contexts in which these initiatives are created today are increasingly open and social, adding to the complexity of the management and continuity of these initiatives. Rather than being conceived as embedded in a single organization, we argue that because of the way innovation processes occur nowadays, innovation labs should be thought of in a more open and shared way to serve multiple stakeholders.
- ***Consolidation of innovation lab management prior research into an updated conceptual framework for representing the strategic intent of innovation labs.*** On the basis of the scientific and theoretical positioning carried out in Chapters **3** and **4**, a gap in the knowledge of the strategic intent of innovation labs and the capabilities needed to mobilize this intent is identified. Accordingly, a theoretical framework is proposed building on Moultrie, Nilsson, et al. (2007), which is subsequently updated based on the current knowledge and our experience to fit to the most collaborative conditions where innovation labs are developed and the objective of this research. The framework consisting of 5 dimensions and 30 criteria constitutes a detailed depiction of the innovation lab intent in terms of how it is conceived (strategic intent), designed (creation process), implemented (physical embodiment), operated (use process) and valued (outcomes). This provides the

theoretical basis for proposing a method for assessing innovation laboratory practices.

- ***Operationalization of the conceptual framework through a strategy-oriented assessment tool for innovation labs consisting in a maturity grid and a multilingual online questionnaire.*** One of the main contributions of this work is the construction of a strategy-oriented and maturity grid-based assessment tool (see Chapter **5**). The theoretical framework is operationalized using maturity grids as a methodological representation to propose the prototype of an assessment tool through an international survey in three languages (Spanish, English and French). This is applied to 27 cases, thus making it possible to capture practices and experiences that ultimately contribute to consolidate the tool. In general, both the maturity networks and the questionnaire are envisioned as a guiding tool to help lab teams and managers to assess the results of their innovation lab and potentially guide the planning of a new initiative in a more comprehensive basis.
- ***Demonstration of the evolutionary nature of an innovation lab and the underlying stages of its organizational strategic intent***. Drawing on existing theory on strategic intent, Chapter **6** sets up a multi-case study to examine in depth not only how the strategic intent of an innovation lab is defined but also how it is developed over time. On the basis of a within-case analysis followed by a cross-case analysis, the evolutionary nature of innovation labs is described in detail according to the dimensions of our theoretical framework. The results help to depict the stages through which the innovation lab intent is discovered (finding purpose), leads to the reorganization of existing capabilities and development of new ones (changing perspective), helps to increase awareness of the lab's potential (emphasizing context) and favors the institutionalization of practices and competencies towards its ecosystems (building consistency).
- ***Both the strategy-oriented assessment tool and the intent stage model constitute the fundament for a methodological approach for the collective design and orientation of innovation lab intent.*** Altogether, results from Chapters **5** and **6** show how the chosen approach is useful to understand the sensemaking process that is carried out within an innovation lab, by looking at the collective intent from team members, how resources and competences are configured, and the

subsequent conducted actions. This suggests the potential use of the framework and the stage model to be applied as a coherence-building tool from which strategic intents can be made recognizable and operational.

- ***Construction of an ad-hoc methodology to support the conformation of innovation lab teams consisting of a competence-based role model, a self-assessment tool and a retrospective workshop.*** The last contribution of this thesis focuses on exploring how innovation lab teams are composed, including the underlying competences and main roles needed in managing these organizational forms. Consequently, in Chapter **7** a competence-based role model is developed consisting of a set of 14 competences for innovation labs which are then organized in 4 generic roles. The methodology (an online self-assessment questionnaire and a retrospective workshop), provides an interpretative approach for innovation lab teams to position themselves with regards to their competence profile and the proposed roles, while identifying improvement strategies. Applied to 10 lab teams from Latin American universities, the methodology proved to be instrumental in identifying the teams' strengths and weaknesses as well as key actions that could guide the team conformation. Results contribute to building knowledge from the team and managerial point of view on the emergent innovation lab literature.

This research work has been the subject of several publications whose peer review process has been key to enrich the analysis, discussion and validity of the results and proposals put forth in this dissertation. Appendix **H** contains the complete list of journal publications and participation in conferences and seminars in which many of the insights and findings presented in this document have been disseminated.

8.2 Implications

The theoretical and practical contributions compiled in this thesis comprise a process that has provided several lessons which have allowed in some instances to corroborate part of the assumptions with which this research began, as well as to open new avenues to explore. These lessons will now be discussed in an effort to synthesize the most relevant practices

based on our findings, why they are important, and how they are associated with what has been previously discussed in the literature.

This research was aimed at offering an in-depth understanding of the strategic intent of innovation labs through a conceptual framework conceived to guide the strategic assessment of this type of initiatives. The different cases studied throughout this work were also addressed with the interest of retrieving detailed explanations of how innovation labs are set up, how they evolved in the course of its operation and which factors enable or limit its adaptation. As a matter of fact, by analyzing the cases through the five dimensions defined in the framework, the dynamic and flexible character of these organizational forms can be observed. This seems to be driven by a constant learning and adaptation that involves alignment not only with the innovation objectives of its allies, but also with their political, economic and social interests. But while innovation labs are regarded as favorable environments to foster innovation processes, it cannot be ignored that at the same time they must face the administrative, legal and financial barriers inherent to the form and context in which they are created.

First of all, it is important to stress the importance of establishing a clear strategic intent before setting up an innovation lab. Ignoring the motivations that lead to the creation of an innovation lab can lead to a lack of cohesion between the interests of its stakeholders, as well as to decisions about the design and configuration of the lab that could become a limiting factor in the future. This becomes more relevant in cases where the creation of an innovation lab includes investment in physical and technological infrastructure and which, without a clear intent, can lead to merely superficial choices (Moultrie, Nilsson, et al., 2007). For our case studies, this was a process of discovery, learning, and adaptation, in which many of the initial characteristics and activities of the innovation labs were driven by their hosting organization or initial sponsors. However, once innovation labs were in operation, the vision and capabilities of the other stakeholders began to shape their purpose leading to unforeseen uses that in some cases were constrained by the initial arrangement of the labs. While innovation labs are created with a certain level of autonomy and flexibility, it is not always possible to adapt all these features, and sometimes decisions on matters such as space design may become bottlenecks in the future.

From the above, it can also be said that the objectives of an innovation lab change over time, but a shared long-term intent is constantly needed to maintain strong links with stakeholders. In highly changing contexts governed by political or economic agendas, the lab teams, who tend to have a strong vocation for their activity (Björklund et al., 2017), are the ones who can ensure that the essence and symbolic objectives of the innovation lab intent are preserved in each transition. However, when it comes to translating that intent into strategic objectives, project and activities, the interests of all the parties must inevitably converge in terms of the intended innovation processes. The evidence from this study shows that innovation lab initiatives are highly dependent on their sponsoring or host organizations, and that with each change in their parent institutions, the objectives of the lab can change and with them the activities and projects that are undertaken. According to our cases, these transitions can be navigated by making observable the lab's tangible and intangible results, a long-term perspective, and the flexibility to adapt such intent to the short-term objectives of its allies. The latter could be problematic, as lab teams prefer to avoid getting involved in political issues (despite being immersed in a political and social contexts), which could lead them to distance themselves from their sponsoring institutions (McGann et al., 2019; Rayna & Striukova, 2019; Tõnurist et al., 2017). In any case, beyond taking political or economic positions, what should be kept in mind is that the purpose of an innovation lab is to strengthen the innovation capabilities of its stakeholders and its environment, an important aspect that should not be lost from sight (M. Lewis & Moultrie, 2005; Timeus & Gascó, 2018).

Moreover, as semi-autonomous organizations, innovation labs are certainly dependent on higher priorities and strategies. However, the legal and administrative frameworks in which they are created seem to be an important factor that is being taken lightly. Since innovation labs are often part of a parent institution or a group of institutions, they do not necessarily have an independent legal status or a clearly defined organizational structure. This is a consequence of creating such organizational forms while avoiding abrupt changes in existing organizations or excessive administrative effort (Timeus & Gascó, 2018). While in the early stages this informality may offer a practical path to a rapid implementation, it makes

innovation labs much more sensitive to changes in leadership within their host institutions. For our case studies this has meant that the operation of an innovation lab is strictly tied to the government terms of office (of a public ally for instance) or the vision of the host organization's director, in either way leading to periods of uncertainty and redefinition of the innovation lab purpose with each new management cycle. Thus, governance transitions carry not only the uncertainty of abrupt policy changes but also possible periods of paralysis in which the operation and the talent linked to the innovation lab can be compromised. The close relationship with their stakeholders can be a strong point for an innovation lab, but it can also be a great vulnerability (Kant & Kanda, 2019; Tõnurist et al., 2017).

While innovation labs tend to be associated mostly to the co-creation and rapid prototyping stages and are often being called into question because of their "quick and dirty" methodologies (Schuurman & Tõnurist, 2016), our case studies have shown that advanced stages of design and implementation support can also be achieved in an innovation lab. In this aspect, university-hosted innovation labs benefit from a differentiating factor that translates into permanent access to a valuable source of knowledge and human talent that becomes an advantage to support the diversity and complexity of social and territorial challenges (Camargo et al., 2021). In any case, having a human resources strategy is a key aspect when it comes to bringing in people with the right mindset and from different backgrounds to support lab activities (Osorio et al., 2020; Timeus & Gascó, 2018). Furthermore, this should be accompanied by the establishment of conditions and mechanisms for continuous knowledge generation, something where agile principles fit (Dupont, 2019). On the one hand, this contributes to increasing the ability of an innovation lab to understand and adapt according to its context needs, and on the other, it fosters the personal and professional development of the individuals who participate in and benefit from it.

Financial sustainability is identified as an additional driver influencing the evolution of innovation labs. In fact, their performance is defined by the constant search for a balance between meeting public and social interests, while at the same time trying to cover its own financial needs (Jezierski et al., 2014). Although the funding for an innovation lab may come from a variety of sources, such initiatives usually begin with the support of a sponsoring

institution. However, these resources may not be permanent, and sponsors often expect innovation labs to be able to attract additional funding by offering their ideas or solutions to third parties (You et al., 2020). Based on this, governments, universities, companies and sponsoring institutions proceed to encourage the creation of new "labs", but the reality is that the path to self-sustainability is a long and often uncertain process, leading these initiatives to have a possible short life span. Experiences such as the ones analyzed in this research show that an innovation lab may choose to design service portfolios in the pursuit of finding a financial model. These services may also be offered to other entities who may eventually become new allies of the lab, thus diversifying its sources of funding. However, this is not an easy task, and it should be considered from the earlier stages of innovation lab implementation, given that this will affect the way in which it will subsequently carry out its mission. Financial stability is particularly important as it reduces the risk of innovation labs pursuing their own interests and survival to the detriment of the interests of their stakeholders (Kant & Kanda, 2019).

In general, we have seen that the actions carried out in an innovation lab are shaped by the interactions with its environment. Nevertheless, in addition to adapting to political priorities, economic conditions or technological aspects, one of the main functional roles of this type of organization is to act as a forum to facilitate dialogue and develop innovative projects by engaging the different actors of the society in which it is developed. In particular, this refers to the inclusion of users and communities of practice in practically every activity conducted by the lab under different innovation mechanisms (i.e., workshops, ideation sessions, hackathons, prototype testing, entrepreneurship cycles, etc.). The evolution of the activities and projects of our cases shows how participatory dynamics can range from looking at users as receivers and validators of the activities undertaken by the lab, to seeing them as active parties to innovate with, based on their own needs and in their own niches. This implies, first, that an innovation lab with a territorial approach aimed at working with communities should build organizational capabilities to foster innovative initiatives of a social nature (Gregoire, 2016; Rayna & Striukova, 2019), and consequently, that its physical dimension should not focus solely on its actual facilities, but that its presence can be distributed throughout the territory (Leminen et al., 2019).

8.3 Limitations

Despite the implications that this work has for the design and management of innovation labs, it is important to stress its limitations.

The first limitation is fundamentally associated with the approach taken and the possible questions regarding the generalizability of our results and findings. Working under action research implies the need to prioritize the application and analysis with a low number of cases seeking to identify significant practices that help to understand and improve our phenomenon (Bradbury, 2015). In addition, results of this thesis should not be seen under the idea of “one fits all”, on the contrary, our approach and tools (theoretical framework, maturity-based assessment tool, intent stage model and competence-based role model) call for considering the idiosyncrasy of innovation labs where each case may lead to different responses, practices or performance (Moultrie, Clarkson, et al., 2007). Consequently, one limitation is the lack of further case analysis to demonstrate a broader generalization.

The second limitation is related to the perspective from which the phenomenon was analyzed and the case settings. Since our research problem focuses on managerial and strategic issues, we were mainly interested in analyzing innovation lab management practices (i.e., from the lab manager and the lab team perspective). While the conducted interviews included senior managers from the host organizations, an important layer to add in future research efforts is other stakeholders' perspectives (i.e., sponsoring institutions, partners and users). Furthermore, this research focused on innovation labs in semi-autonomous configurations (hosted or sponsored by parent institutions), therefore, private and self-financed innovation labs were not addressed in this study. A complementary aspect would be to consider whether alternative lab settings influence the ability to mediate and foster organizational learning, or whether they would instead act in a more consultative manner (Memon et al., 2018).

Another limitation considers the exploratory nature of this dissertation. This means that the proposed tools are a first approximation to address our research question but require

further iterations to reach a higher level of validation. For instance, although the maturity grid-based assessment tool has been put into application, showing its potential as a methodological tool, it is still a prototype that requires further development. On the one hand, it is important to keep in mind that maturity grids require updating as the phenomenon evolves and new practices are unveiled (Maier et al., 2012). Thus, even if the maturity grids presented in this document (see Appendix **B**) constitute an iterated version of those originally published (Osorio, Dupont, Camargo, Palominos, et al., 2019), they still require maintenance over time.

On the other hand, our tool can also benefit in operational terms by deepening the identification of observable phenomena for each identified practice, as well as the consolidation of a maturity model to improve guidance on the progression from one level to another (see Enjolras, 2016; Galvez Manriquez, 2015; Moya Sedan, 2021). In this line we consider that the innovation lab intent stage model can contribute as the underlying logic between the desired levels for innovation labs. Yet, to achieve this, it is necessary to inquire not only into the evolutionary stages of innovation labs, but also to unveil the factors that drive the transition from one stage to the other. This process view can help elucidate how consensus is reached, change is processed, and unexpected situations are addressed (Giones et al., 2021; Kant & Kanda, 2019; Langley, 1999).

Finally, with respect to the competence-based role model and the self-assessment tool, it is important to emphasize that this is an ad-hoc methodology proposal and is therefore subject to further development and validation. Consistent with the purpose of this research, we find it essential to shed light on which roles and competences could assist in creating more resilient innovation lab teams. Consequently, this work lays the groundwork for further discussion on the management of innovation labs and the talent responsible for driving their intent, but also opens the door to explore what their underlying competencies are (Rose et al., 2021).

8.4 Perspectives

This dissertation also provides a glimpse of several perspectives that not only indicate improvement paths for this work, but also open up new avenues of research in the design and management of innovation labs.

Strengthening the operational development of the innovation lab intent assessment tool

The methodological approach resulting from this dissertation (theoretical framework, maturity-based assessment tool and intent stage model) is proposed as a set of awareness-building tools around innovation lab intent and performance, thus helping to navigate the evolutionary stages of these innovation endeavors. Nevertheless, as mentioned in the previous section, the assessment tool is still in the prototype stage. Therefore, we propose to continue the operational development seeking to facilitate its application in different contexts. An improvement path could then be to add semi-automation functionalities (e.g., report generation) seeking to improve its adaptability and usability (Enjolras et al., 2020; Maier et al., 2012). Additionally, we envision enhancing the methodology with visual tools (such as Appendix **D** used in Chapter **6**) to facilitate collective discussions while fostering prospective thinking (Henike et al., 2019).

Keep developing the social intent of the innovation labs

Innovation lab initiatives have the potential to bring about change or leaps in organizational stakes by triggering innovation processes that go beyond financial or competitive benefit. Recent research is showing recent interest in using these configurations to address social problems (Rayna & Striukova, 2019; Rezaee Vessal et al., 2021). Yet, as promising as innovation labs are, their capacity to address more systemic challenges remains to be understood (Zivkovic, 2018). We therefore urge that functional roles and impacts of these initiatives to generate more sustainable practices be explored in greater depth. For example, we have identified the extent to which these spaces can be favorable environments for the implementation of circular economy strategies (Kasmi et al., 2021). Innovation labs should be seen not only as the experimentation and learning arena for a

local group of actors, but rather as interconnectors to enable favorable conditions for territories to work together while exploiting complementarities (Kasmi et al., 2021).

Innovation lab teams for inter innovation lab collaboration

The growth and popularity of innovation labs has prompted research in terms of how these forms organizations can collaborate with each other (Memon et al., 2018). This becomes more relevant considering one of the premises is that these spaces serve as a meeting point for their stakeholders, but now that organizations are increasingly seeking to have their own lab it seems that innovation lab settings are becoming the interlocutors of the innovation process (Memon et al., 2021). Therefore, lab teams will have to act as the facilitators of this collaboration. This raises questions about how such interlocution happens and to what extent innovation lab teams are prepared to deal with the intent gap and reach consensus (Kant & Kanda, 2019; Rose et al., 2021).

Assessing double loop learnings within the innovation lab ecosystem

One of the main characteristics of the innovation laboratory phenomenon is the potential to trigger organizational learning (M. Lewis & Moultrie, 2005). Although throughout this research different types of tangible and intangible results generated by these initiatives have been glimpsed, what kind of outcomes are actually transferred to their stakeholders and how this process is carried out remains to be investigated. In this sense, our last perspective is based on the design of feedback methods and tools that allow understanding of the double loop learning dynamics between innovation labs and their ecosystems. We suggest that this is possible through the study at the project lab level and the interactions with stakeholders (Roux-Marchand et al., 2020; Ten et al., 2020). In addition, a process view supported by ethnographic observations can be useful (Fuglsang & Hansen, 2022; Zenk et al., 2021).

Appendix A. Comparison of methods and contributions

Technology testing (TT), Urban, rural & public experiences (UE), Collaborative project applications (CA), Lab management (LM), Lab assessment (LA), Other contributions (OC)

Reference	Year	Type	Method/Tool	Type of Contribution
Vasilescu M.D., Ionel I.	(2017)	Paper	Didactic Process	**LM**
Lin Q., Wong S.	(2017)	Paper	IP Protection	OC
Herron J., Kaneshiro K.	(2017)	Article	Planning Development	**LM**
Ahmad T., Ahmad S., Jamshed M., Sherwani F.K., Ali R., Khan W., Nomani A., Qaisar T.M.	(2017)	Paper	ISM Modelling	**LM**
Finocchiaro L., Wågø S.I.	(2017)	Paper	Single Case Study	UE
Schmitt U.	(2017)	Article	SECI Model	OC
Sharp D., Salter R.	(2017)	Article	Participatory Co-design	UE
Carter K., Morgan E., Webb L., Goddard N., Webb J.	(2017)	Paper	Living Lab Method	UE
Marantos C., Paraskevas I.S., Siozios K., Mothe J., Menou C., Soudris D.	(2017)	Paper	Digital Platform	TT
Fuller M.	(2017)	Paper	Cross-case Analysis	**LA**
Gallegos-Segovia P.L., Vintimilla-Tapia P.E., Bravo-Torres J.F., Yuquilima-Albarado I.F., Larios-Rosillo V.M., Arévalo-Cordero S.J.	(2017)	Paper	Cloud Ecosystems & IoT	TT
Chessa S., Girolami M., Foschini L., Ianniello R., Corradi A., Bellavista P.	(2017)	Article	Results Assessment	TT
Beel J., Aizawa A., Breitinger C., Gipp B.	(2017)	Paper	Recommender Platform	TT
Sandoval-Almazan R., Valle-Cruz D.	(2017)	Paper	Interviews	UE
Seo J., Lysiankova L., Ock Y.-S., Chun D.	(2017)	Article	Analytic Hierarchy Process	**LA**
Boeri A., Longo D., Gianfrate V., Lorenzo V.	(2017)	Article	Community based approach	UE
Memon A.B., Meyer K.	(2017)	Article	Survey & Interviews	**LM**
Lacroix J., Dupont L., Guidat C., Hamez G.	(2017)	Paper	Focus Group	UE
Hugo H., Espinoza F., Morales I., Ortiz E., Pérez S., Salcedo G.	(2018)	Article	Logic Framework	UE

Technology testing (TT), Urban, rural & public experiences (UE), Collaborative project applications (CA), Lab management (LM), Lab assessment (LA), Other contributions (OC)

Habibipour A., Ståhlbröst A., Georges A., Bergvall-Kåreborn B., Schuurman D.	(2018)	Paper	Semi-structured Interviews	TT
Putra A.B.N.R., Mukhadis A., Poerwanto E.E., Irdianto W., Sembiring A.I.	(2018)	Paper	Questionnaire Survey	**LA**
Mastelic J., Emery L., Previdoli D., Papilloud L., Cimmino F., Genoud S.	(2018)	Paper	Living Lab Method	CA
Xu L., Hu W.-B., Guan X.-Y.	(2018)	Paper	Data Envelopment Analysis	**LA**
Miranda J., Chavarria-Barrientos D., Macias M., Molina M., Ponce P., Molina A., Wright P.K.	(2018)	Paper	Interactive Collaboration	CA
Deng J.	(2018)	Article	Literature Review	**LM**
Herrera N.R., Davis-Owusu K., Van Oers S., De Van Der Schueren M., Alberts J., Vastenburg M.	(2018)	Paper	Research through Design	CA
Mochizuki Y.	(2018)	Article	Smart City IoT Platform	UE
Memon A.B., Meyer K., Thieme M., Meyer L.-P.	(2018)	Article	Service-based taxonomy	**LA**
Patterson B., Casucci T., Hull B.E., Lombardo N.T.	(2018)	Article	Single Case Study	**LM**
Le Dinh T., Ayayi A., Vu M.C., Nomo T.S.	(2018)	Article	Living Lab Method	CA
Fitzpatrick G., Malmborg L.	(2018)	Paper	Interviews	CA
Wang S.-M., Yeh P.C.	(2018)	Paper	Smart Space Management System	TT
Oladele-Emmanuel B.D., Rejeb H.B., Redlich T.	(2018)	Paper	SWOT Analysis	**LA**
Fonteijn R., Roos M.H., Nguyen P.H., Morren J., Slootweg J.G.	(2018)	Paper	Living Lab Method	TT
Valencia M., Villacreses S., Benitez D.S., Velasco A., Ochoa-Herrera V.	(2018)	Paper	Dynamic System Modelling	UE
Servaty R., Perger G., Harth V., Mache S.	(2018)	Article	Job-demands-resources model	**LA**
Böhm K., Paul C.	(2019)	Paper	Multi Case Study	CA
Arciniegas G., Šileryté R., Dąbrowski M., Wandl A., Dukai B., Bohnet M., Gutsche J.-M.	(2019)	Article	Living Lab Method	TT
Aguilar M.G.S., Rosillo V.M.L., Perez C.O.M., Arellano M.R.M., Ramirez J.R.B., Trejo J.A.O.	(2019)	Paper	Circular Economy model	TT
Oliva F.L., Kotabe M.	(2019)	Article	Cluster Analysis	**LM**
Geist M.J., Sanders R., Harris K., Arce-Trigatti A., Hitchcock-Cass C.	(2019)	Article	Critical Thinking Assessment Test	CA
Osorio F., Dupont L., Camargo M., Pena J.I.	(2019)	Paper	Bibliometric Analysis	**LM**

Technology testing (TT), Urban, rural & public experiences (UE), Collaborative project applications (CA), Lab management (LM), Lab assessment (LA), Other contributions (OC)

Osorio F., Dupont L., Camargo M., Palominos P., Peña J.I., Alfaro M.	(2019)	Article	Maturity grids	**LA**
Günzel H., Brehm L., Haak H.-J., Gronvall M., Sainio A.-M.	(2019)	Paper	Agile Project Management	CA
Annett M., Grossman T., Wigdor D., Fitzmaurice G.	(2019)	Paper	Multi Case Study	CA
Stickel O., Stilz M., Brocker A., Borchers J., Pipek V.	(2019)	Paper	Questionnaire Survey	CA
Tasca R., Ventura I.L.S., Borges V., Leles F.A.G., Gomes R.D.M., Ribas A.N., Carvalho W.M., Jimenez J.M.S.	(2019)	Article	Multi Case Study	UE
Zamiri M., Marcelino-Jesus E., Calado J., Sarraipa J., Goncalves R.J.	(2019)	Paper	Single Case Study	**LM**
Woods R., Berker T.	(2019)	Paper	Living Lab Method	UE
Amenta L., Attademo A., Remøy H., Berruti G., Cerreta M., Formato E., Palestino M.F., Russo M.	(2019)	Article	Living Lab Method	UE
Jin Z.R., Qiu A.Z.	(2019)	Paper	Single Case Study	TT
Jukema J.S., Veerman M., Van Alphen J., Visser G., Smits C., Kingma T.	(2019)	Article	Focus Group	**LM**
Beel J., Collins A., Kopp O., Dietz L.W., Knoth P.	(2019)	Paper	Single Case Study	TT
Bouncken R.B., Aslam M.M., Brem A.	(2019)	Paper	Single Case Study	**LA**
Benabbas A., Nicklas D.	(2019)	Paper	Literature Review	TT
Ponsard C., Nihoul B., Touzani M.	(2019)	Paper	Goal-oriented analysis	UE
Maravilhas S., Martins J.	(2019)	Article	Semi-structured Interviews	**LA**
Sittoni L., Van Eekelen E.M.M., Van Der Goot F., Nieboer H.E.	(2019)	Paper	Building with Nature	UE
Sandiford P.J.	(2019)	Article	Literature Review	**LM**
Crippa D., Di Prete B.	(2019)	Paper	Digital Healthcare Platform	TT
Song R., Clemon L., Telenko C.	(2019)	Article	Regression analysis	TT
Espinosa J.M.M., Miranda J., Cortés D., Medina J., Molina A.	(2020)	Paper	Single Case Study	TT
Soomro S.A., Georgiev G.V.	(2020)	Paper	Multi Case Study	CA
Goncalves G.M., Meneses R., Faria J.P., Vidal R.M.	(2020)	Paper	Project Based Learning	TT
Breytenbach J., Kariem I.	(2020)	Paper	Single Case Study	**LM**
Papadopoulou C.-A., Hatzichristos T.	(2020)	Article	Living Lab Method	UE
Gingstad K., Jekteberg J., Balog K.	(2020)	Paper	Recommender Systems	TT

Technology testing (TT), Urban, rural & public experiences (UE), Collaborative project applications (CA), Lab management (LM), Lab assessment (LA), Other contributions (OC)

Bousbiat H., Klemenjak C., Leitner G., Elmenreich W.	(2020)	Paper	Non-Intrusive Load Monitoring	TT
Sroufe R.	(2020)	Article	Single Case Study	UE
Siekkinen T., Pekkola E., Carvalho T.	(2020)	Article	Semi-structured Interviews	OC
Roux-Marchand T., Cruz F., Dupont L., Camargo M., Osorio F.	(2020)	Paper	Single Case Study	**LA**
Christensen M.H., Li R., Pinson P.	(2020)	Article	Demand side management	TT
Markopoulos E., Aggarwal V., Vanharanta H.	(2020)	Paper	Company Democracy Model	CA
Arnould M., Morel L., Fournier M.	(2020)	Paper	Living Lab Method	UE
Raabe J.-P., Horlach B., Drews P., Schirmer I.	(2020)	Paper	Cross-case Analysis	**LA**
Jin X., Zhang M., Liu J.	(2020)	Paper	Three-stage Data Envelopment Analysis	**LA**
Hawkins N., Lewis J.E., Robinson B.S.	(2020)	Paper	Questionnaire Survey	CA
Kaar C., Stary C.	(2020)	Paper	Design Science Approach	**LA**
Bartelt V.L., Urbaczewski A., Mueller A.G., Sarker S.	(2020)	Article	Social Capital Perspective	**LA**
Brock K.L.	(2020)	Article	Literature Review	CA
Turillazzi B., Leoni G., Gaspari J., Iadanza E., My M., Massari M., Boulanger S.O.M., Djalali A.	(2020)	Article	Living Lab Method	TT
Polderman A., Haller A., Viesi D., Tabin X., Sala S., Giorgi A., Darmayan L., Rager J., Vidovič J., Daragon Q., Verchère Y., Zupan U., Houbé N., Heinrich K., Bender O., Bidault Y.	(2020)	Article	Decision-Making Toolkit	UE
Midwood A.J., Hannam K.D., Forge T.A., Neilsen D., Emde D., Jones M.D.	(2020)	Article	Stable Isotope analysis	UE
Fecher F., Winding J., Hutter K., Füller J.	(2020)	Article	Team Formation and Performance	**LA**
Baedeker C., Piwowar J., Themann P., Grinewitschus V., Krisemendt B., Lepper K., Zimmer C., Geibler J.	(2020)	Article	Living Lab Method	UE
Hund A., Holotiuk F., Wagner H.-T., Beimborn D.	(2020)	Paper	Semi-structured Interviews	**LM**
Wettergreen M.A., Saterbak A., Kavalewitz A.J., Nunez-Thompson A.M., Leautaud V., Mkandawire T., Petney M., Dos Santos C.A., Oden Z.M.	(2020)	Article	Multi Case Study	**LM**
Klautzer L., Hong S.Y., Narayan R.	(2020)	Paper	Literature Review	UE

Technology testing (TT), Urban, rural & public experiences (UE), Collaborative project applications (CA), Lab management (LM), Lab assessment (LA), Other contributions (OC)

Ruijer E., Meijer A.	(2020)	Article	Strategic Niche Management	UE
Seo E., Bae S., Choi H., Choi D.	(2020)	Article	Questionnaire Survey	TT
Pham T.V., Nguyen A.T.T., Ngo T.D., Le D.H., Le K.C.V., Nguyen T.H.N., Le H.Q.	(2020)	Paper	Multi Case Study	UE
Mao C.	(2020)	Paper	Blockchain Decentralization Principles	**LM**
Provenzano V., Seminara M.R., Arnone M.	(2020)	Paper	Literature Review	UE
Paje R.C., Boco L.B., Gloria J.C.A., Go H.A.R., Paje R.C.	(2020)	Paper	Structural Equation Model	**LA**
Patterson M.G., Godon C.H., Segan L.D., Mannickarottu S.	(2020)	Paper	Supply Chain Management	**LM**
Greve K., Leminen S., De Vita R., Westerlund M.	(2020)	Article	Bibliometric Analysis	**LM**

Appendix B. Maturity grids for the innovation lab framework

Strategic intent

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
Strategic & Symbolic Goals	To support the mission of the organization or association and its innovation strategy.	There was no clear perspective on the objectives	As short-term goals	As mid-term goals	As long-term goals	Lewis & Moultrie, 2005; Moultrie, Nilsson et al., 2007
Ecosystem Approach	To generate added value for all the stakeholders involved, to create long-term engagement and identification with the laboratory.	There was no plan to generate value for the lab's stakeholders	Value generation for the lab's stakeholders was limited to contractual commitments	Value generation was planned to foster stakeholders' involvement in the lab	Value generation for all stakeholders was envisaged to create long-term engagement and identification with the lab	Veeckman et al., 2013; Dupont et al., 2014; Dupont et al., 2017
Real-World Context	To capture or resemble real life environments (through space, equipment or methodologies).	The lab was never planned to capture or resemble real-life environments	The lab was conceived as an isolated testbed	The lab was thought so it could emulate some real-life conditions	The lab was designed to capture and/or resemble real-life environments	Schuurman et al., 2013; Veeckman et al., 2013; Roux-Marchand et al., 2020
User Centric Innovation	To involve users in the different phases of innovation cycle in which they can test, evaluate, contribute and co-create.	There was never considered to involve users in the lab's activities	Users were seen as passive actors mainly for testing purposes	Users were seen as contributors whose inputs may lead to pivots in the innovation process	Users were considered as co-creators who should be an active part of the whole innovation process	Veeckman et al., 2013; Fecher et al., 2020; Ten et al., 2020
Culture and Community	To build an identity and to grow a community of users engaged and motivated with access to the laboratory.	There was not a clear intention to build a community around the lab	Interested people could access to lab facilities to conduct specific activities under demand	The lab was viewed as meeting point for groups of people and existing communities to gather and shared knowledge	The lab sought to create a broader sense of community by bringing together multiple groups of people with whom to co-organize activities, events, and knowledge sharing	Moultrie, Nilsson et al., 2007; Oksanen & Ståhle, 2013; Dupont et al., 2017

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
Teamwork	To enhance teamwork in innovation, encouraging better communication (physical or virtual), encourage formal and informal social interaction and motivate staff	There was not an intention to stimulate teamwork	Teamwork and social interaction were seen as limited, formal, and hierarchical	There was an expectation that the lab would foster teamwork through physical or virtual mechanisms, while allowing for dynamic interaction between people	There was a clear desire to stimulate teamwork through the design of the lab, enabling people to constantly interact under formal or informal circumstances	Moultrie, Nilsson et al., 2007; Nicolai et al., 2016 and authors' experience
Lifespan	To estimate the length of the project as a whole (short, mid or long-term).	Short-term (less than a year)	Mid-term (from 1 to 2 years)	Long-term (from 2 to 3 years)	Very long-term (more than 3 years or permanent)	Veeckman et al., 2013 and authors' experience

Process of creation

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
Intended Innovation Processes	The innovation processes the lab is intended to facilitate: Opportunity Identification, Concept Creation, Concept Validation, Solution Development, Solution Deployment	1 stage or less	2 stages	3 or 4 stages	All stages of the innovation process	Moultrie, Nilsson et al., 2007; ISO, 2019
Intended Creative Activities	The creative activities the lab is intended to support: Search, synthesis, creation, prototyping or evaluation	1 activity or less	2 activities	3 or 4 activities	Full creative activities are held in the space	Moultrie, Nilsson et al., 2007 and authors' experience
Potential users and facilitators	The intended users of the lab: from occasional test users or students through to dedicated environments for co-located project teams. The degree of dedicated facilitation that the lab is intended to provide for the activities performed in/by the lab.	Individuals with sporadic participation in the lab with no retention. Facilitation through a technical assistant.	Individuals who frequently participate in lab activities. Lab team composed of dedicated facilitators and technical assistants.	Project teams regularly participating in the lab's activities. Lab team supported by researchers, experts or entrepreneurs.	Project teams located in the lab. People from the lab community involved and acting as facilitators.	Magadley & Birdi, 2009; Fecher et al., 2020

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
Available resources & constraints	The intended availability of physical, financial, human and technical resources	Budget: <500k EUR. Staff: <2	Budget: <2M EUR. Staff: <10	Budget: <5M EUR. Staff: <20	Budget: >5M EUR. Staff: >20	Moultrie, Nilsson et al., 2007 and authors' experience
Intended events	The type of "events" that are intended to be held in the space, ranging from one-off meetings, marathons, conferences or project work	One-off meetings, Master lectures.	Creativity sessions, Access to technical resources	Experimental workshops, open networking meetings	Project showcase, hackathons, virtual collaborative sessions	Moultrie, Nilsson et al., 2007; Caccamo 2020 and authors' experience

Physical embodiment

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
Geographic Location	The physical location of the innovation lab and its relationship with the organization. This can include the organization's own in-house space up to external third-party facilities.	An external rented facility	Space granted by an ally or interested party under consideration	An existing facility in your organization adapted for the lab purposes	A new dedicated facility owned by your organization	Moultrie, Nilsson et al., 2007; Memon et al., 2014 and authors' experience
Scale	The physical scale of the lab.	A single room. Less than 100m2	Multiple detached and fixed rooms. Less than 200m2	Multiple reconfigurable and modular rooms. Less than 400m2	A dedicated building with areas for both fixed and modular use. More than 400m2	Moultrie, Nilsson et al., 2007; Memon et al., 2014 and authors' experience
Real vs Virtual	The degree to which the lab is designed around virtual teamwork and communicatio n.	Fully centralized to the lab physical space	Mostly centralized with sporadic activities outside the physical space and/or remote work	Mostly decentralized with regular activities outside the physical space and/or remote work	Fully decentralized lab interactions (virtual lab)	Moultrie, Nilsson et al., 2007; Osorio et al., 2020 and authors' experience
Flexibility	The degree of flexibility embodied in the lab environment to enable alternative configurations and uses. The degree of flexibility/reco nfigurability of resources in	Not adaptable nor reconfigurable setup	Poor flexibility which implies a high effort of adaptation	Acceptable flexibility allowing almost full reconfiguratio n of the space	High flexibility that allows a smooth adaptation to different purposes	Moultrie, Nilsson et al., 2007; Oksanen & Ståhle, 2013 and authors' experience

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
	the workspace.					
Design Values	Specific design values targeted at encouraging specific behaviors. The use of imagery and specific areas to reinforce desired actions.	No particular mindset Space composed mainly of passive areas such as staff offices, reception, library or meeting room	A professional ambience for stakeholders Space composed with areas such as creativity or ideation rooms, open classrooms, coworking, cafeteria or free expression area	An open mindset for attracting communities of practice and users Space composed of active areas such as co-creation and prototyping rooms or showroom	An environment to encourage new behaviors and learnings among different kinds of users Space enriched with specialized areas according to thematic focus such as immersive area, auditorium, robotics lab, drone aviary or electronics	Moultrie, Nilsson et al., 2007; Oksanen & Ståhle, 2013 and authors' experience
IT Resources	The role of IT to enable group work, activities and processes.	No IT tools	Presentation and office tools mostly	Productivity and communication tools (e.g., chat and video conferencing platforms, project management software)	Co-creation workspaces along with specialized software to support creativity and design	Moultrie, Nilsson et al., 2007 and authors' experience
Data and information	The availability of local data/information to support innovation, creativity or design processes/activities.	No access to sources of information and/or datasets	Library or internet access is available as generic sources of information	Access to data repositories such as wikis, manuals and/or technical reports	Access to datasets and specialized sources of information (e.g., open data, scientific databases, patents, etc.)	Moultrie, Nilsson et al., 2007 and authors' experience
Prototyping & Visualization	Availability of equipment, facilities and tools to support/enable modeling and visualization activities as a core component of creative and design processes.	Prototyping is mainly based on paper tools such as cardboard, idea cards, moving or interactive boards, etc.	Prototyping is supported by mechanical tools such as laser cutters, vinyl cutters, milling and routing machines, Legos, etc.	Prototyping is based on digital tools such as 3D printing, CAD modeling, digital animation, 3D scanner, etc.	Prototyping is supported through immersive and emerging technologies such as virtual and augmented reality, biometric sensors, drones, smart objects, etc.	Moultrie, Nilsson et al., 2007; Ten et al., 2020 and authors' experience
Constraints	Practical constraints on the design and	Issues associated with the lab's facilities and	Challenges related to administrative	Challenges concerning the lab staff (competencie	Constraints related to governance and	Moultrie, Nilsson et al., 2007; Osorio et al., 2020

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
	implementation of the lab	their conditioning	and financial issues	s, turnover, stability, etc.)	institutionalization of the lab by the host institution or its stakeholders	and authors' experience
Evolution	The degree to which evolution is planned to meet future goals.	No future changes contemplated	Adaption needs are identified but no changes are contemplated	Adaptation needs are identified but their implementation is limited due to constraints (e.g., budgetary, legal)	The lab is designed to be continuously adapted to each project or activity	Moultrie, Nilsson et al., 2007; Osorio et al., 2020 and authors' experience

Process of use

Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
Supporting Innovation	The stages of the innovation process that are facilitated in the lab	None of the intended stages are currently facilitated by the lab	Some of the intended stages are facilitated by the lab	All the intended stages are currently facilitated by the lab	All intended and additional stage(s) are currently facilitated by the lab	Moultrie, Nilsson et al., 2007; ISO, 2019
Supporting Creativity	The actual way the lab supports creative activities	None of the intended creative activities are currently supported by the lab	Some of the intended creative activities are supported by the lab	All the intended creative activities are supported by the lab	All intended and additional creative activities are currently supported by the lab	Moultrie, Nilsson et al., 2007 and authors' experience
Actual users & facilitators	The actual users that are welcome in the space. The actual degree of facilitation required for the activities conducted in/by the lab	None of the current users match with those intended	Some of current users match with those intended	All users match with those intended	New users are attracted beyond the intended ones	Magadley & Birdi, 2009; Fecher et al., 2020
Enabling teamwork	The actual role of the lab in enabling physical and virtual teamwork	Absence of teamwork support	Teamwork support is mainly driven by the products or results of each activity or project	Teamwork support is focused on facilitating interaction between teams and their partners, improving communication and accelerating results	Teamwork support is aimed at fostering agility, experimentation, cohesion and retrospective thinking	Moultrie, Nilsson et al., 2007; Nicolai et al., 2016 and authors' experience
Actual events	The type of events that actually take place in the lab	None of the events hosted by the lab matched with those intended	Only some events hosted by the lab match with those intended	All events hosted by the lab match with those intended	The lab is used for hosting additional events beyond those intended	Moultrie, Nilsson et al., 2007; Caccamo 2020 and authors' experience

Outcomes

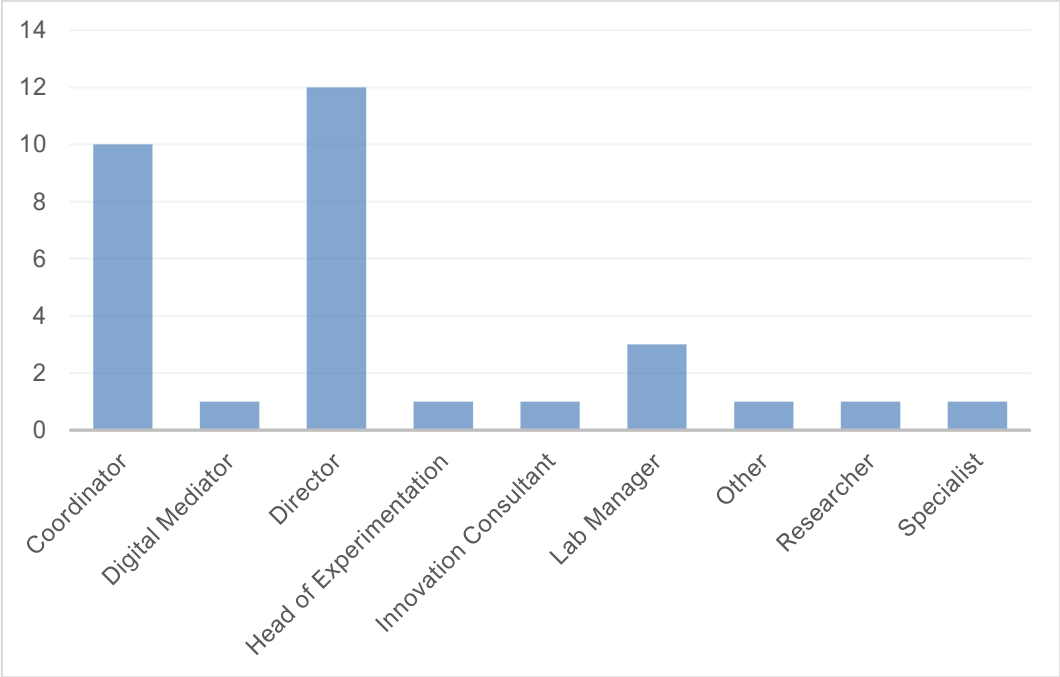
Criteria	Description	Level 1	Level 2	Level 3	Level 4	Reference
Achievement of strategic intent	The degree to which the lab's intent has been realized	Less than 25%	Between 26 and 50%	Between 51 and 75%	More than 76%	Moultrie, Nilsson et al., 2009; Nogeste & Walker, 2005 and author's experience
Tangible results	The ones that have been operationalized and can be measured, monitored and controlled					
Intangible results	Those that are operationalized through high or low perceptions but contribute directly to capacity building of the lab and its stakeholders for future projects.					

Appendix C. Insights from International Survey

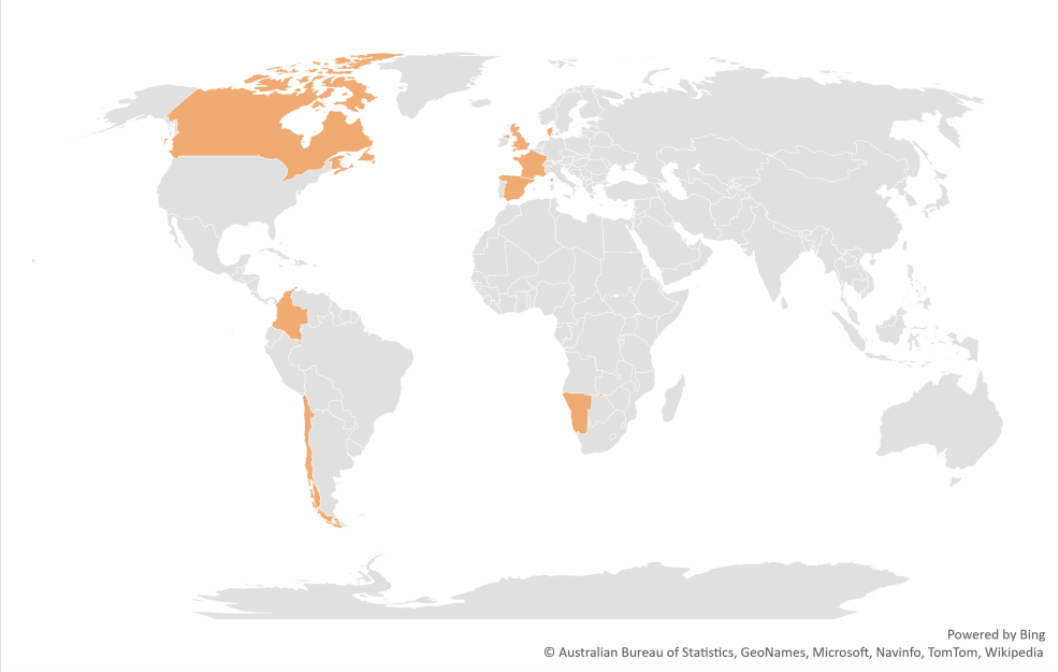
Summary of responses

Case	*Date submitted*	*Tool Version*	*Survey Language*	*City*
I	06-07-15	1	Spanish	Madrid
II	**07-07-15**	**1**	**Spanish**	**Santiago**
III	09-07-15	1	French	Sarreguemines
IV	14-07-15	1	Spanish	Manizales
V	18-07-15	1	Spanish	Pasto
VI (2015)	**20-07-15**	**1**	**French**	**Nancy**
VII	21-07-15	1	Spanish	Pasto
VIII	21-07-15	1	Spanish	Pasto
IX (2015)	**22-07-15**	**1**	**Spanish**	**Bogotá**
X	**29-07-15**	**1**	**English**	**Vancouver**
XI	03-08-15	1	Spanish	Monteria
XII	03-08-15	1	Spanish	Cartagena
XIII	26-10-15	1	French	Paris
XIV	04-06-17	1	Spanish	Santiago
XV	06-06-17	1	Spanish	Santiago
XVI	28-01-19	1	Spanish	Santiago
IX (2019)	04-10-19	1	Spanish	Bogotá
XVII	19-02-20	1	English	Fredericia
XVIII	26-02-20	1	English	Sønderborg
VI-A (2020)	18-07-20	2	English	Nancy
VI-B (2020)	20-08-20	2	English	Nancy
XIX	23-09-20	2	English	Santiago
XX	06-10-20	2	Spanish	Santiago
XXI	19-10-20	2	Spanish	Antofagasta
XXII	04-11-20	2	English	Dieuze
XXIII	30-11-20	2	French	Nancy
XXIV	04-12-20	2	English	Windhoek
XXV	09-12-20	2	French	Nancy
XXVI	14-12-20	2	French	Metz
IX (2020)	14-12-20	2	Spanish	Bogota
XXVII	22-12-20	2	English	Manchester

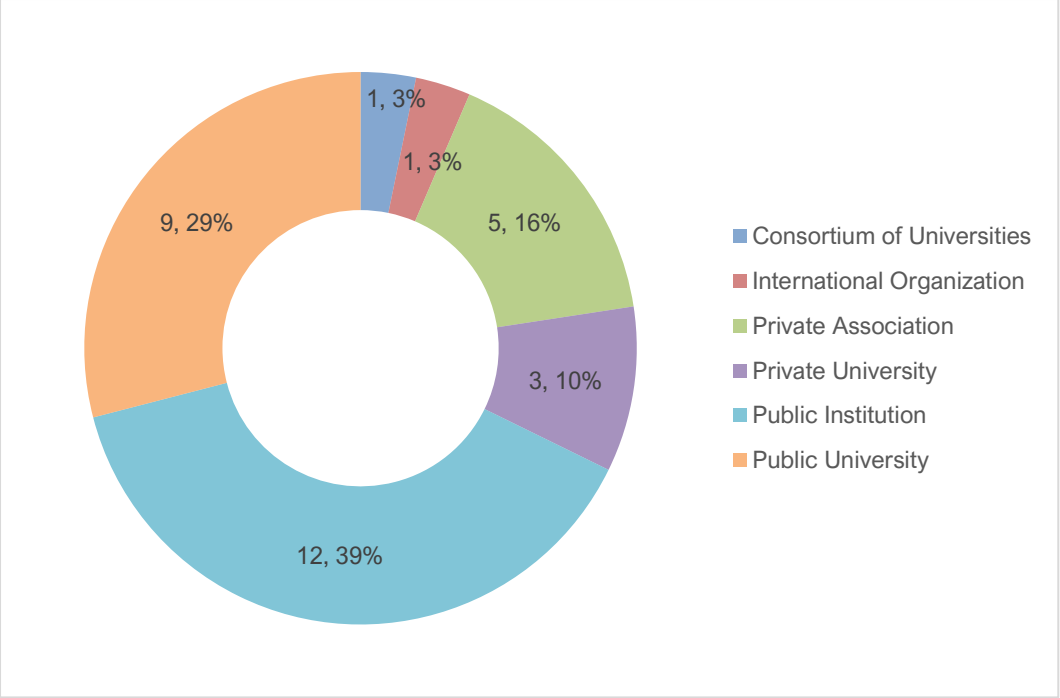
Your main role at the lab:



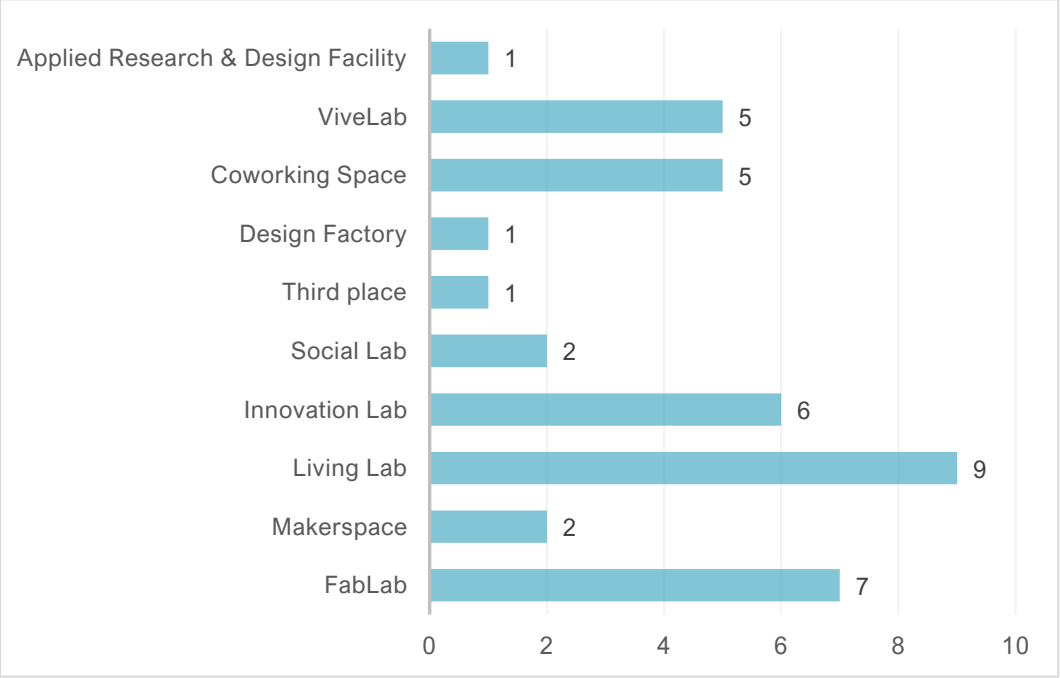
Country representation:



Types of lab hosting organization

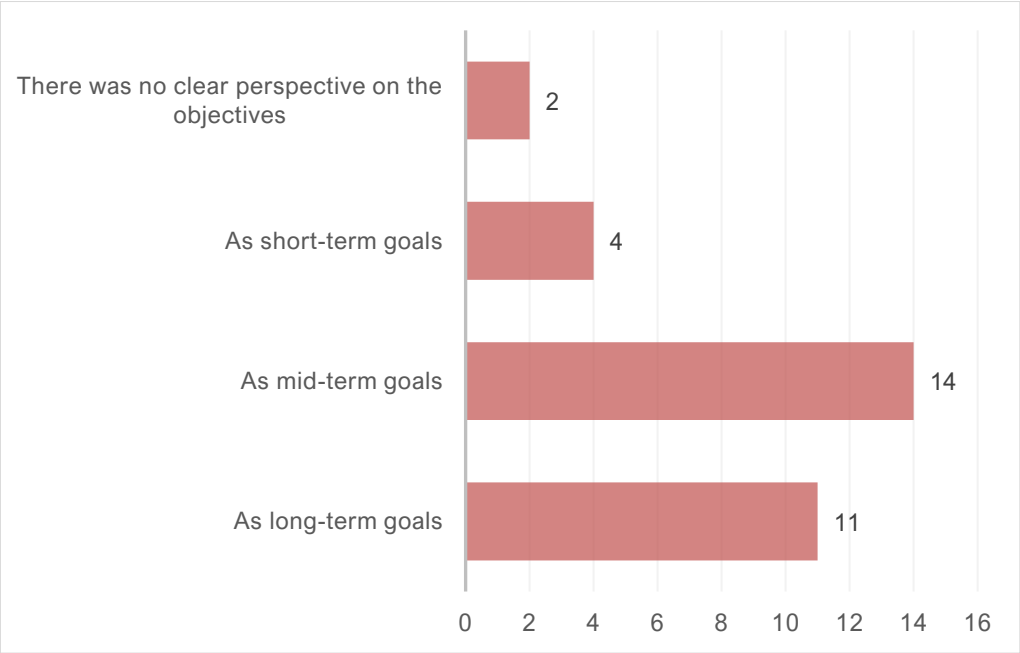


Type of laboratories

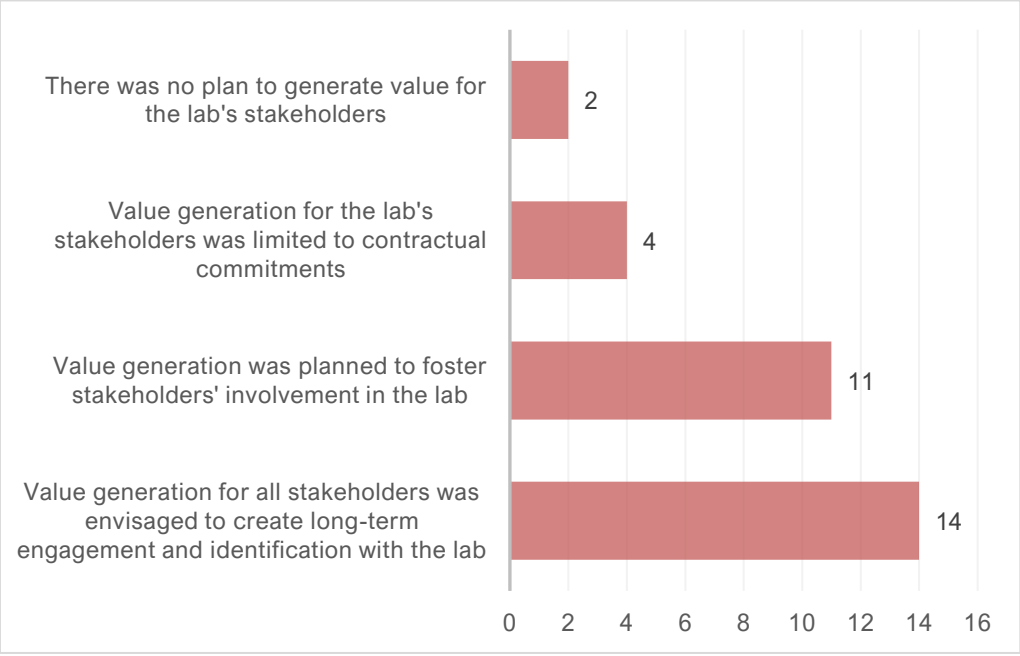


Strategic Intent

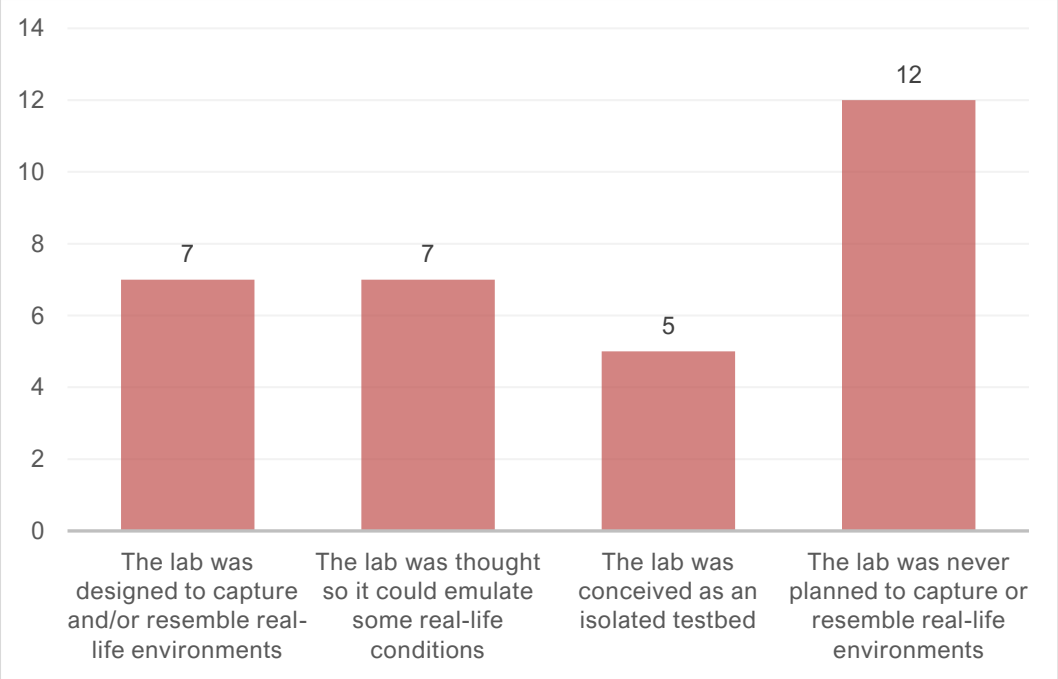
Strategic goals *- With what perspective were the objectives of the lab defined at the beginning-*



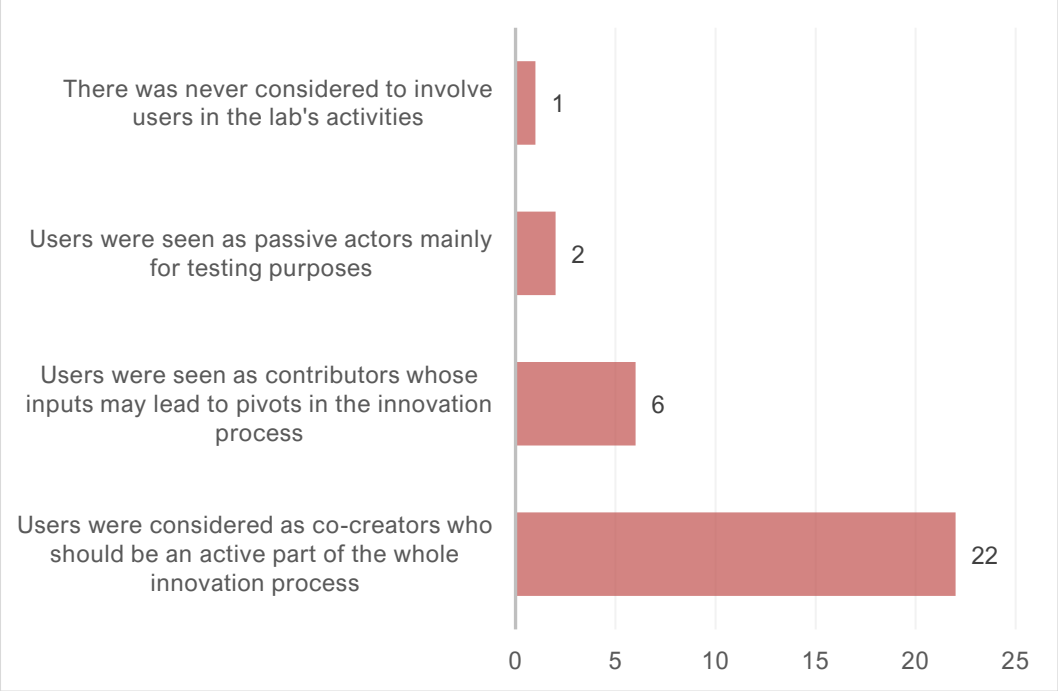
Ecosystem approach *- How was value generation for the lab's host organization and stakeholders considered-*



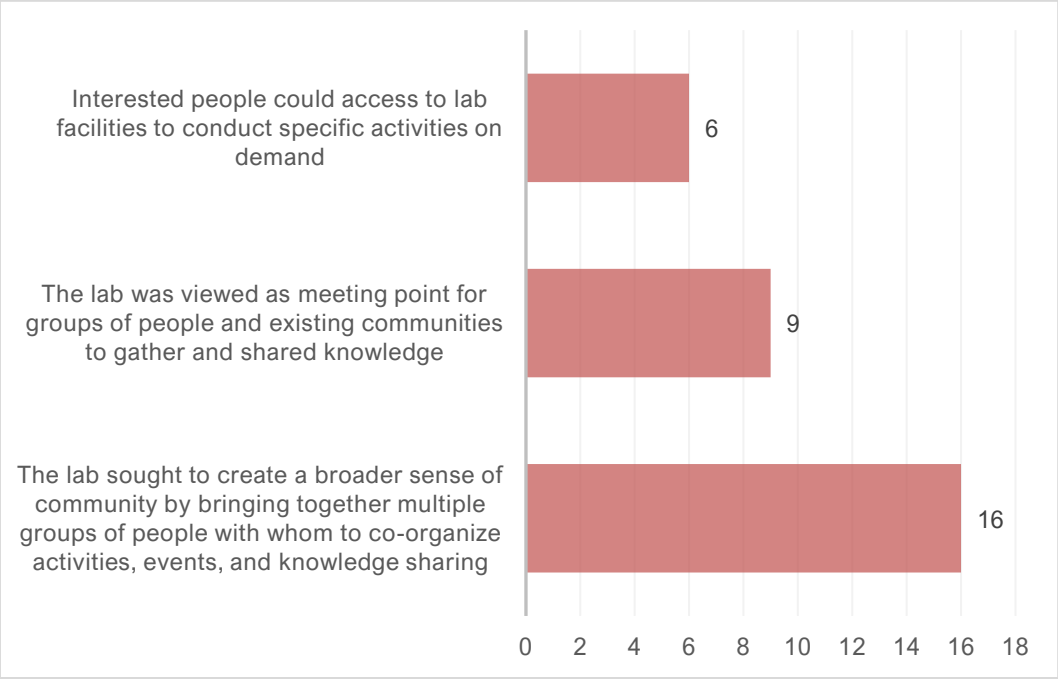
Real-world context *- To what extent was your lab conceived to capture or resemble real life environments-*



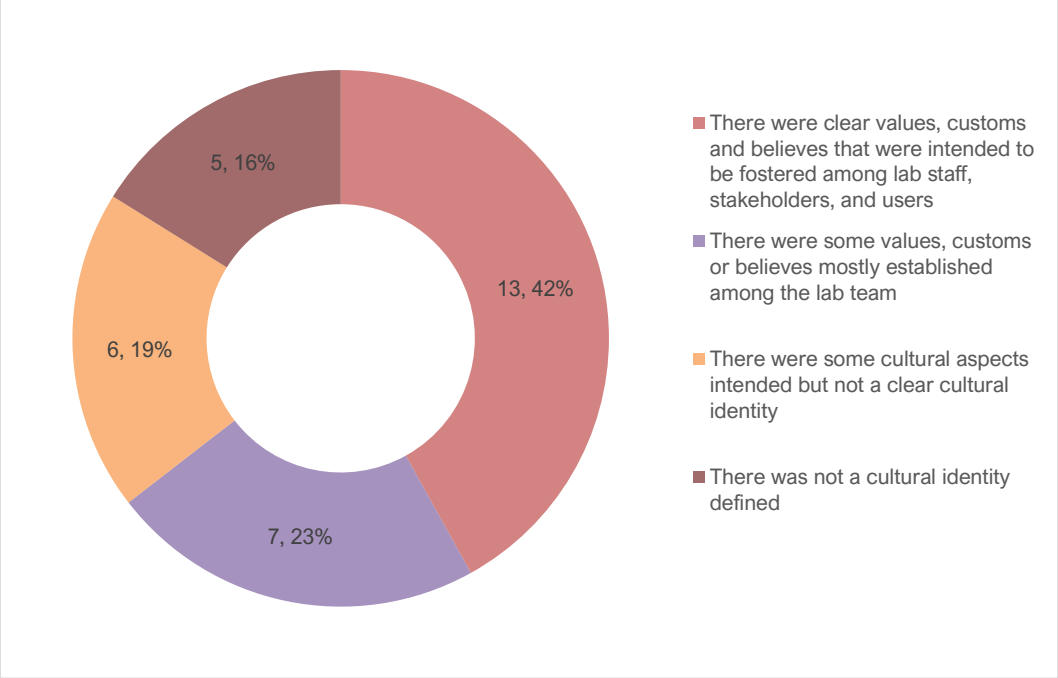
User-centric innovation *- In what way was it thought that users could be part of the innovation process in the lab-*



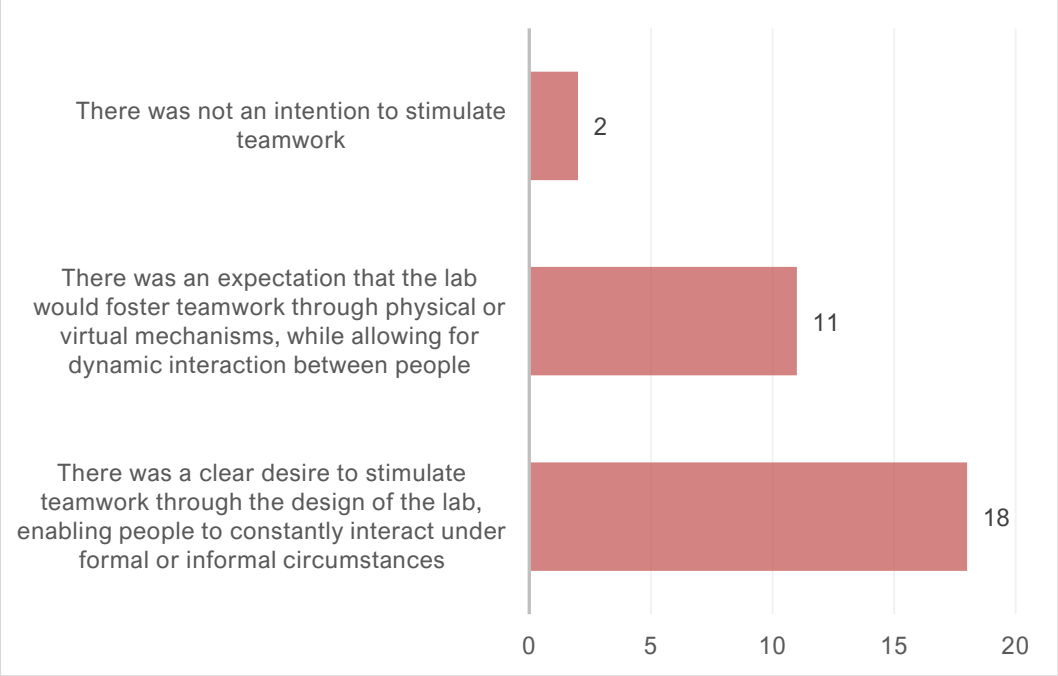
Culture and community *- Up to what point was it sought to establish a community around the lab-*



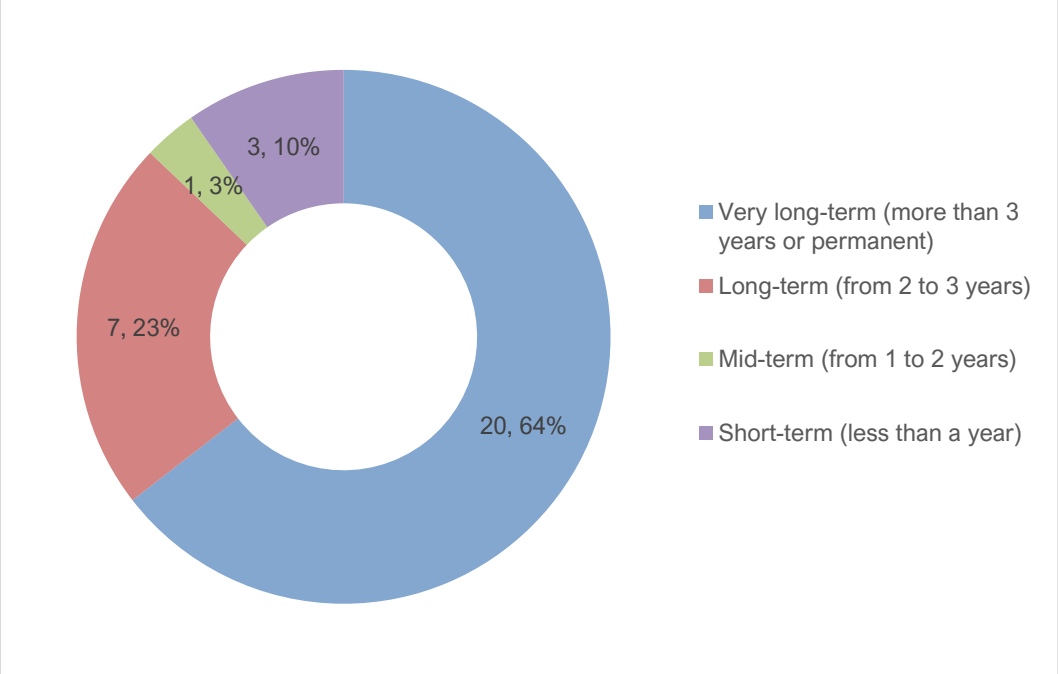
Culture and community *- As for the definition of a cultural identity for your laboratory, you would say*



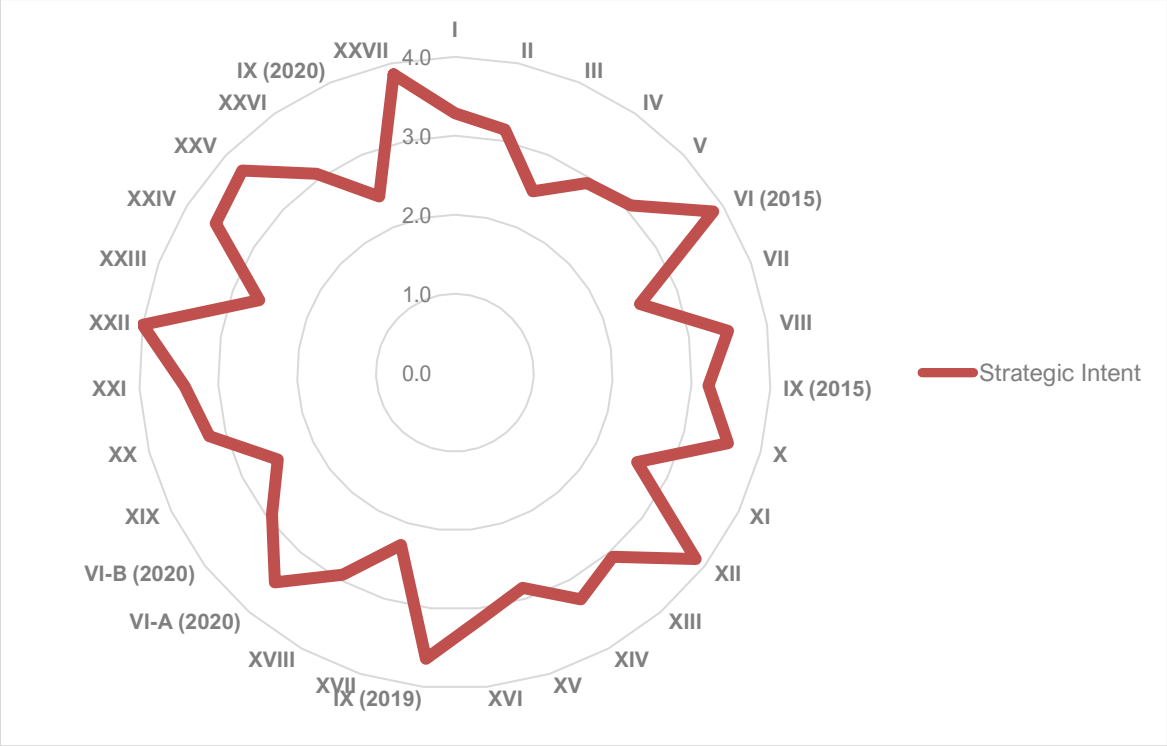
Teamwork *- To what extent was the lab intended to stimulate teamwork and social interactions-*



Lifespan *- At the beginning the lifespan of the lab was seen as:*



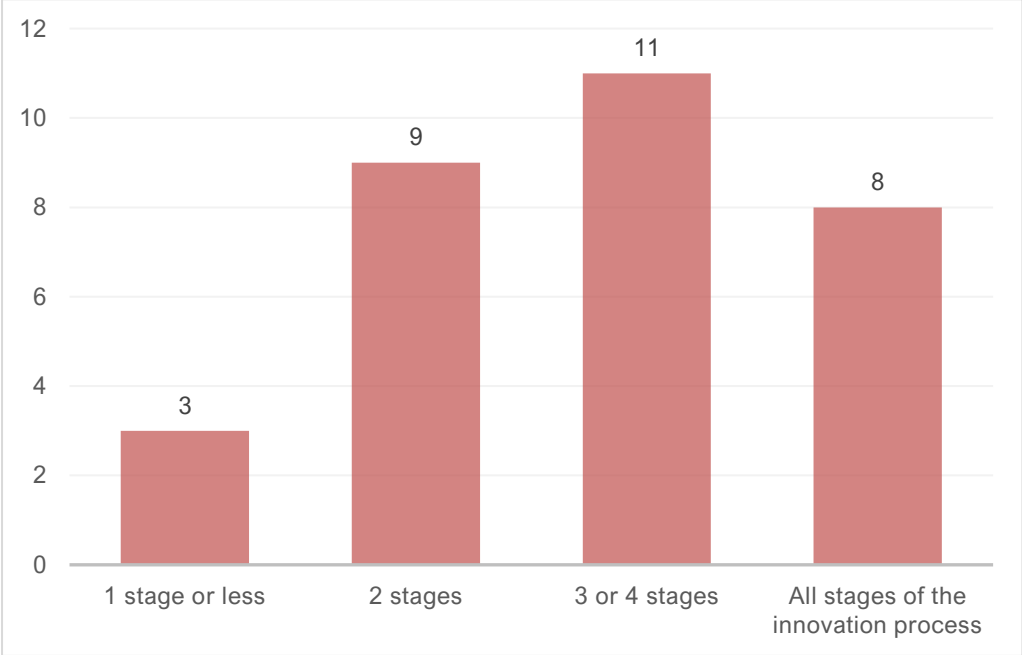
Strategic intent – overall cases radar



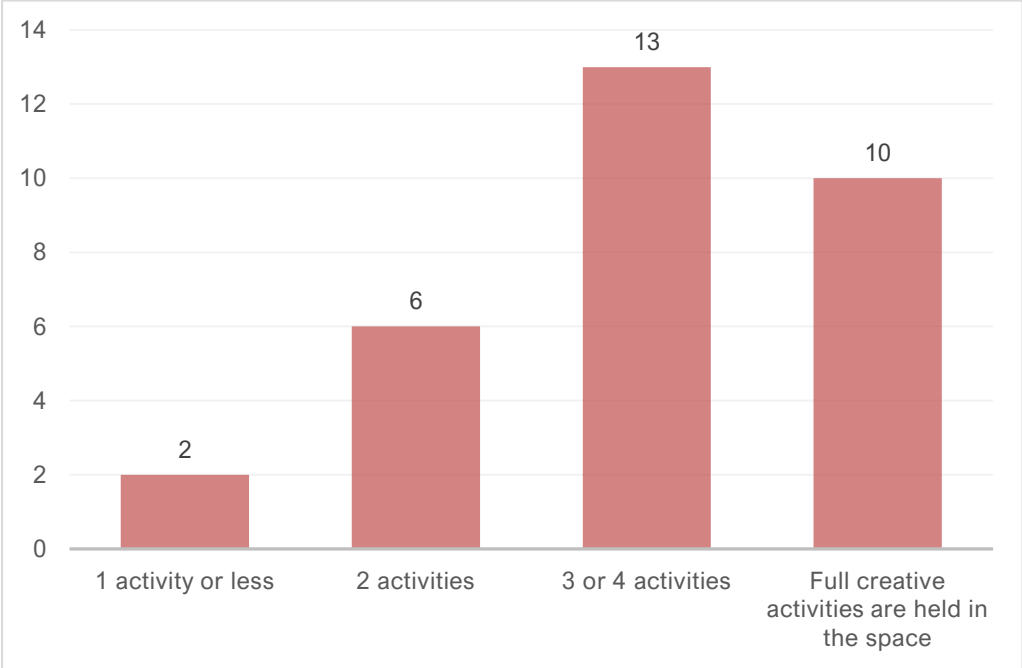
Average of the strategic intent dimension for each lab

Process of Creation

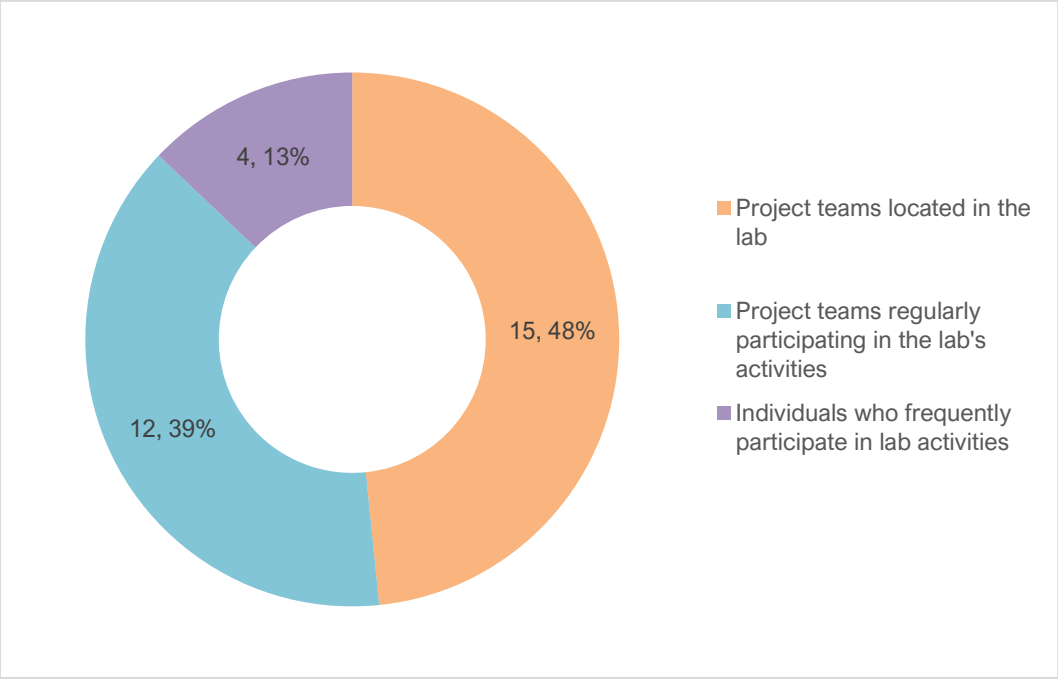
Intended innovation process *- Which stages of the innovation process was the lab intended to facilitate?*



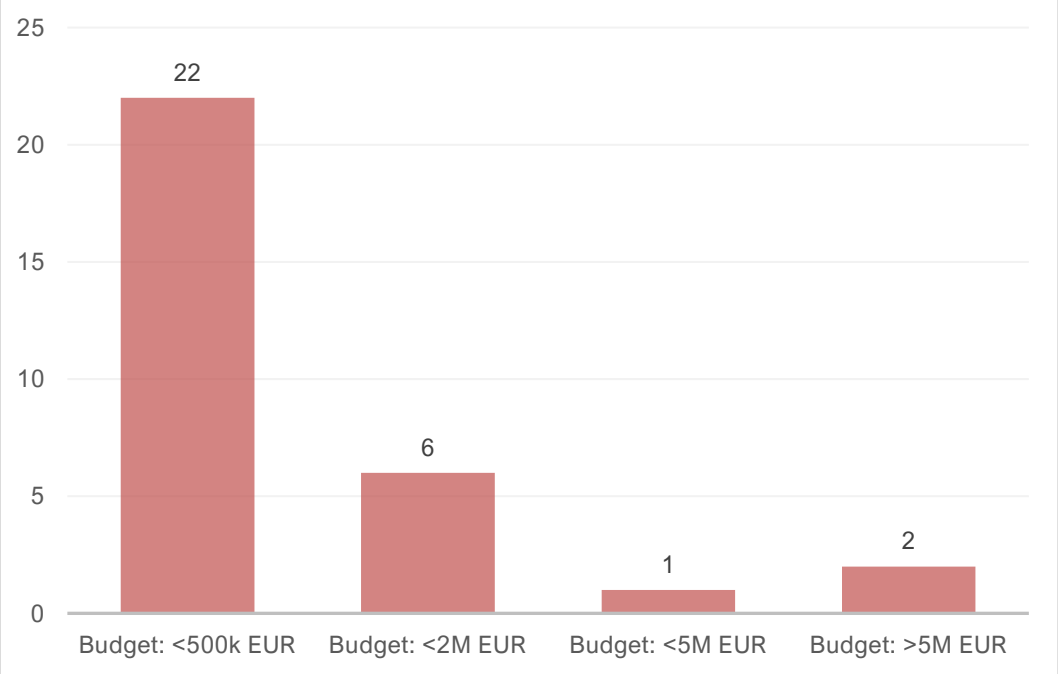
Intended creative activities *- Which creative activities were expected to be encouraged in the lab?*



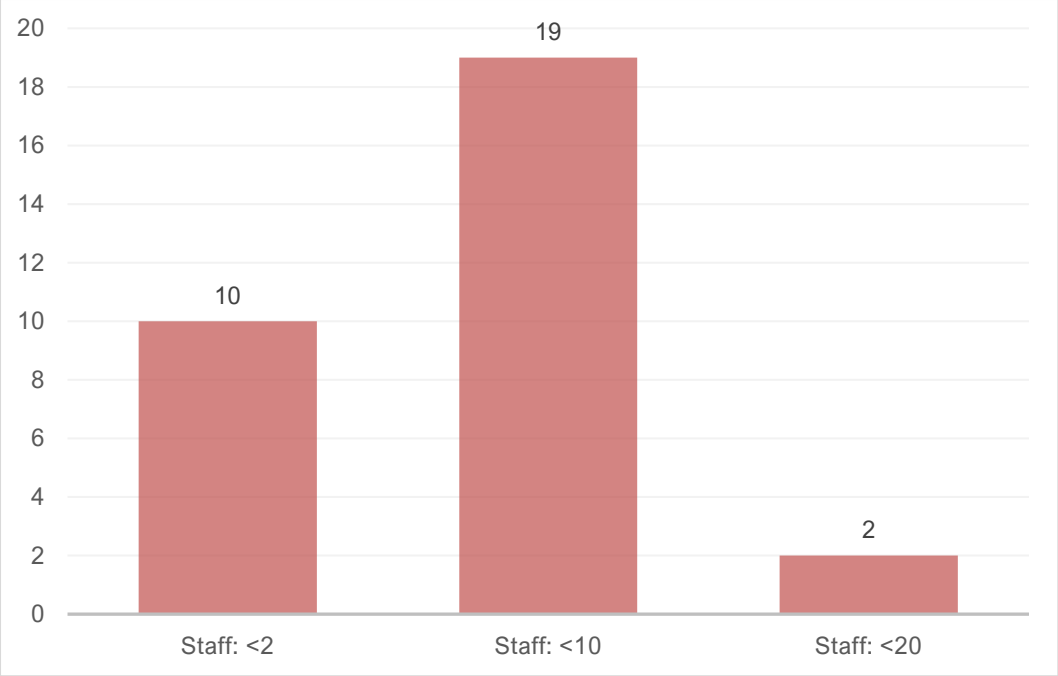
Potential users & facilitators *- In relation to the intended users, it was expected that their relationship with the lab would be:*



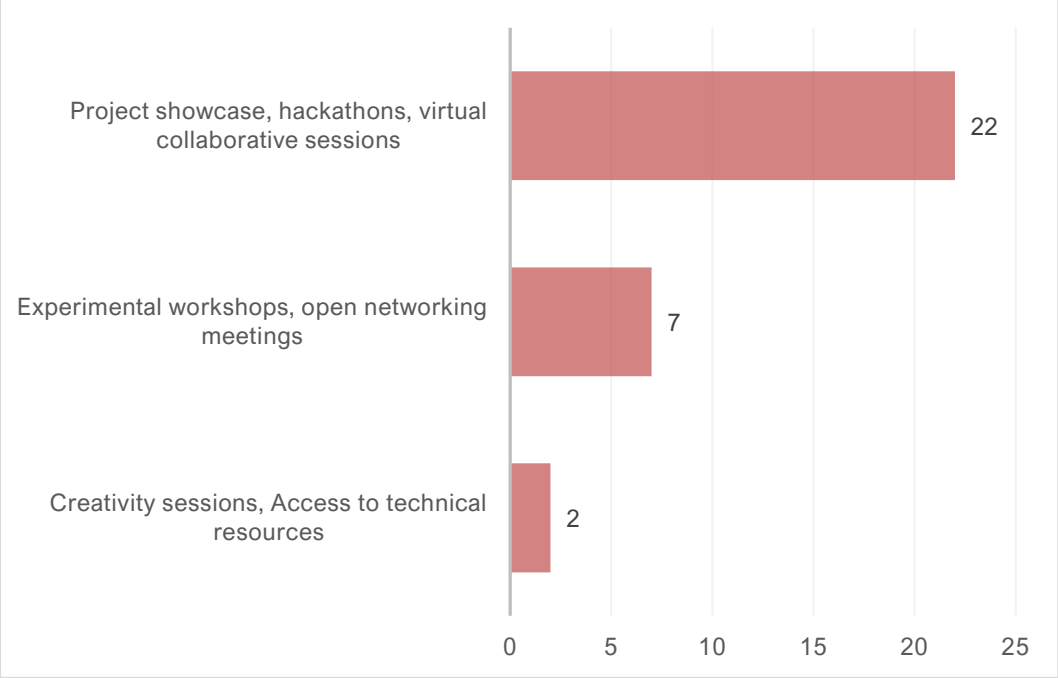
Available resources & constraints *- Could you indicate what was the approximate initial budget (in euros) for the creation of the lab-*



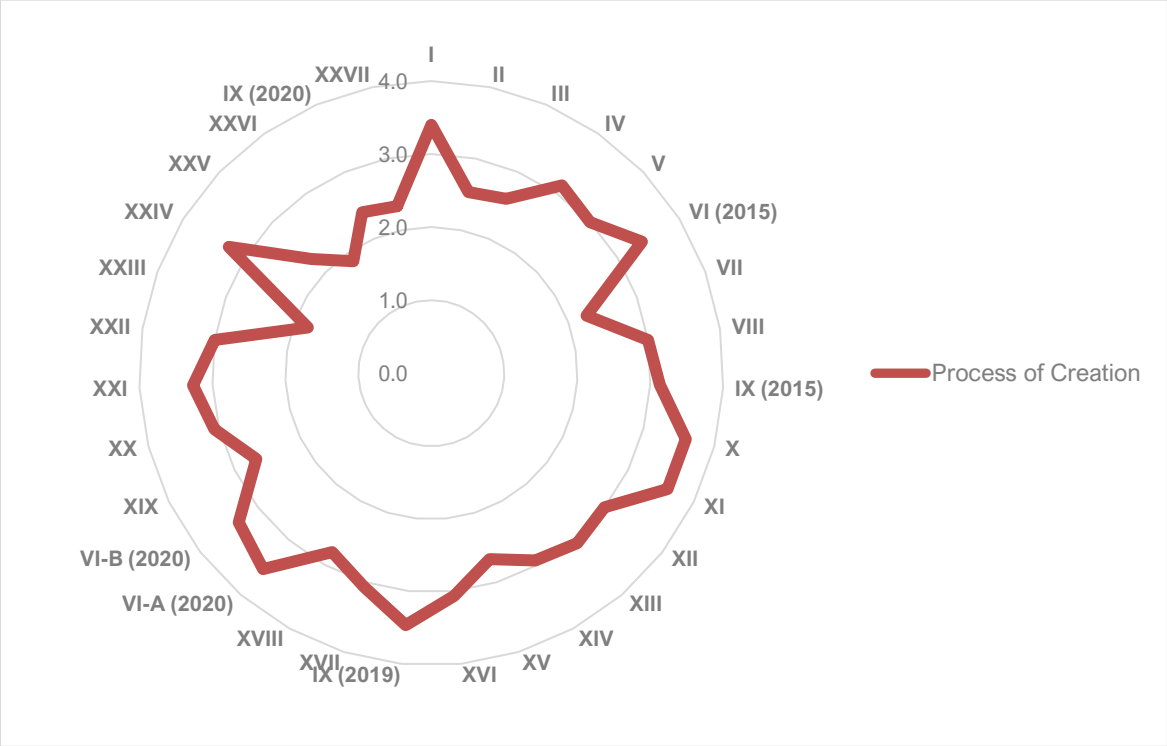
Available resources & constraints *- How many people were part of the lab team at the beginning of the operation-*



Intended events *- Could you share with us, what kind of events or activities were expected to be held at the lab?*



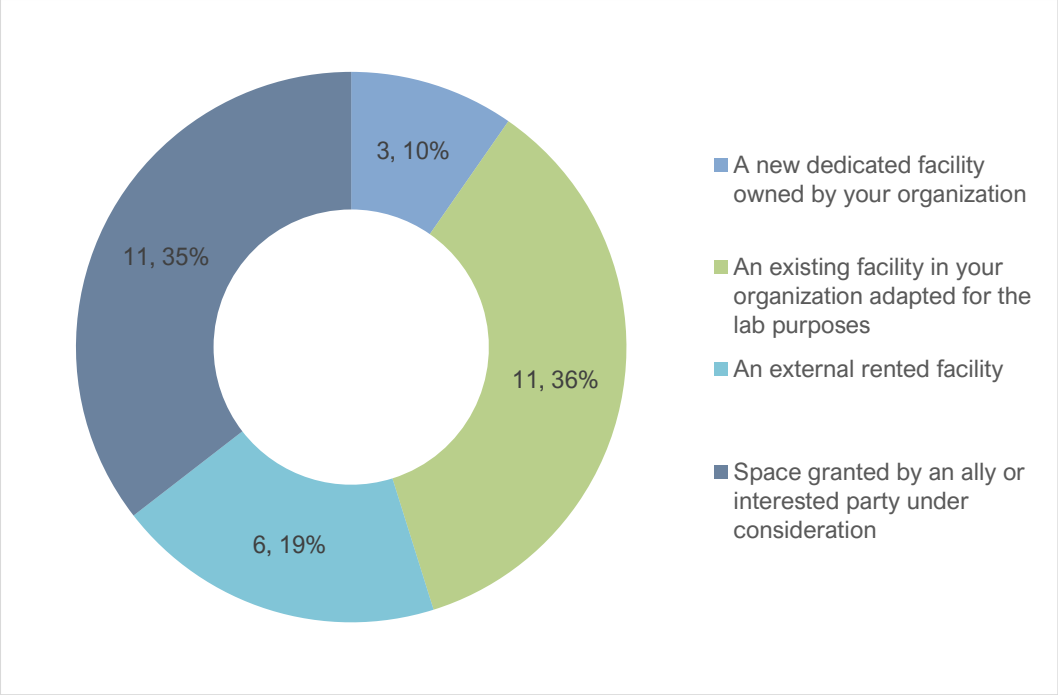
Process of creation – overall cases radar



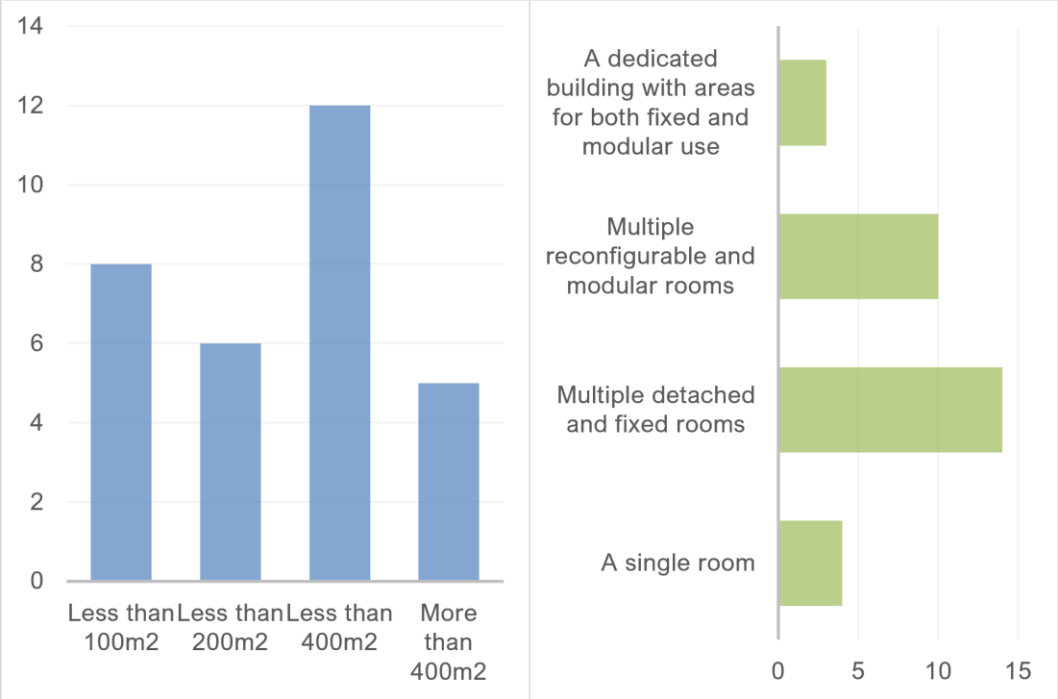
Average of the process of creation dimension for each lab

Physical Embodiment

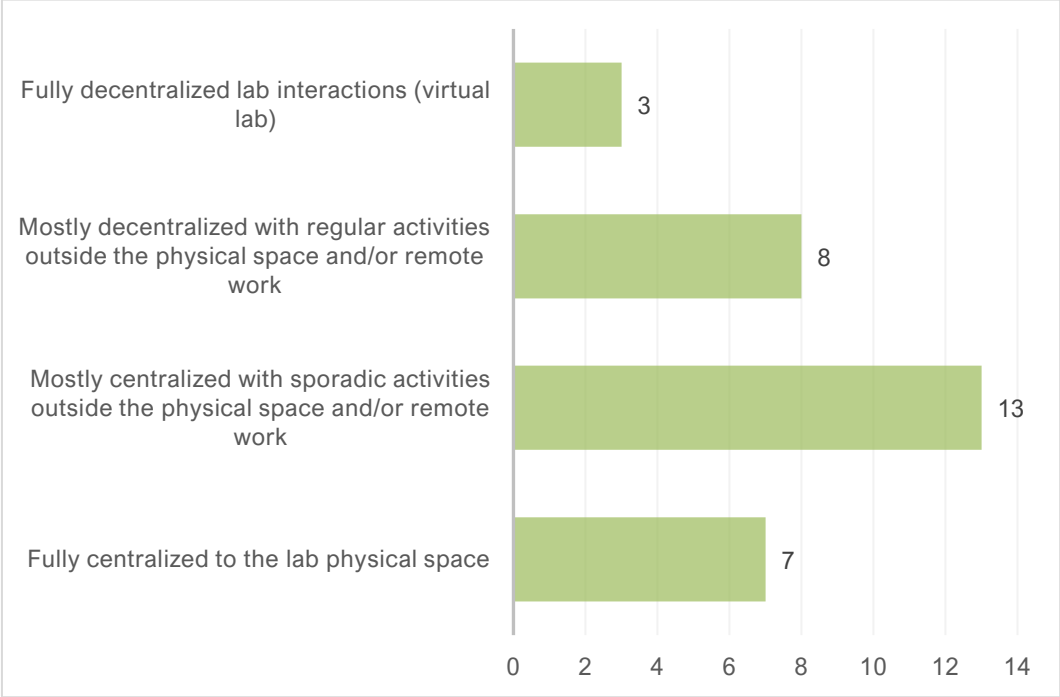
Geographic location *- In what kind of facilities is the laboratory located-*



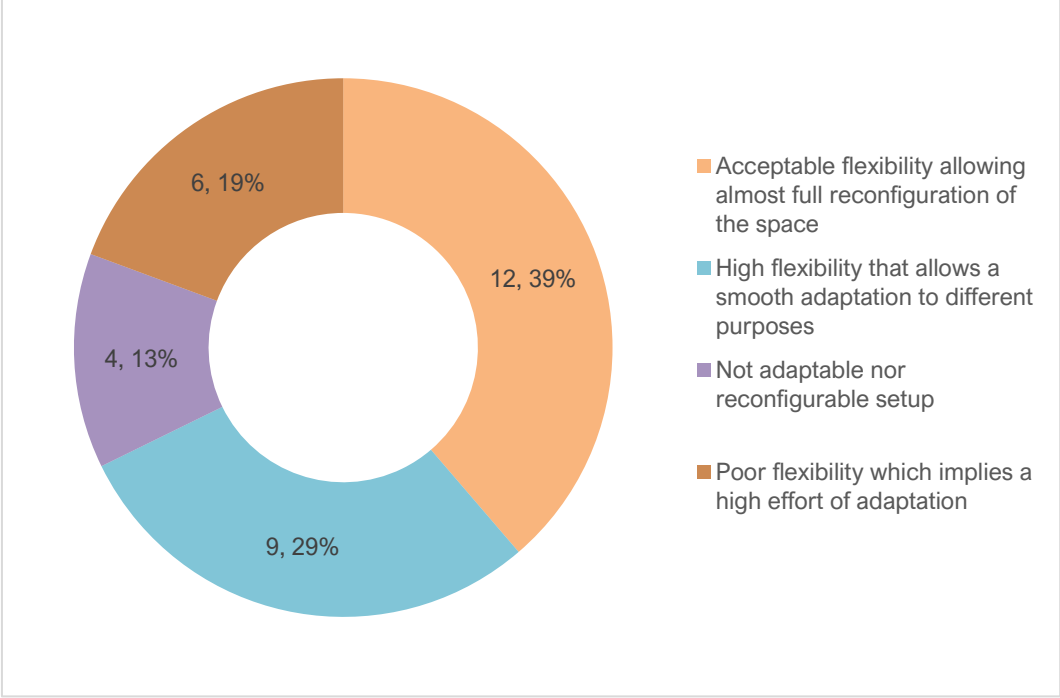
Scale *- In general, the spatial setup of your lab is composed of:*



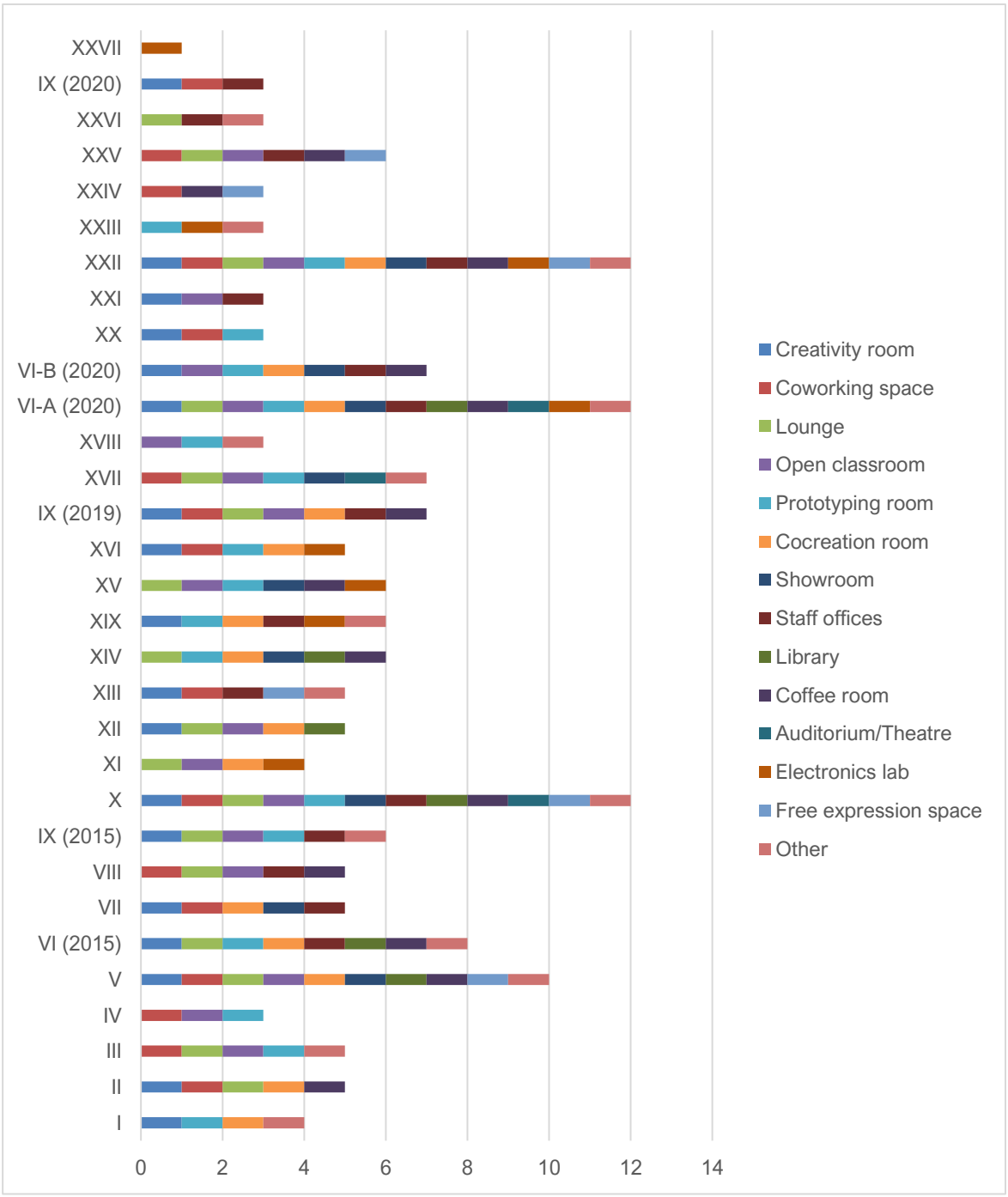
Real vs virtual *- How would you describe the decentralization degree of the lab-*



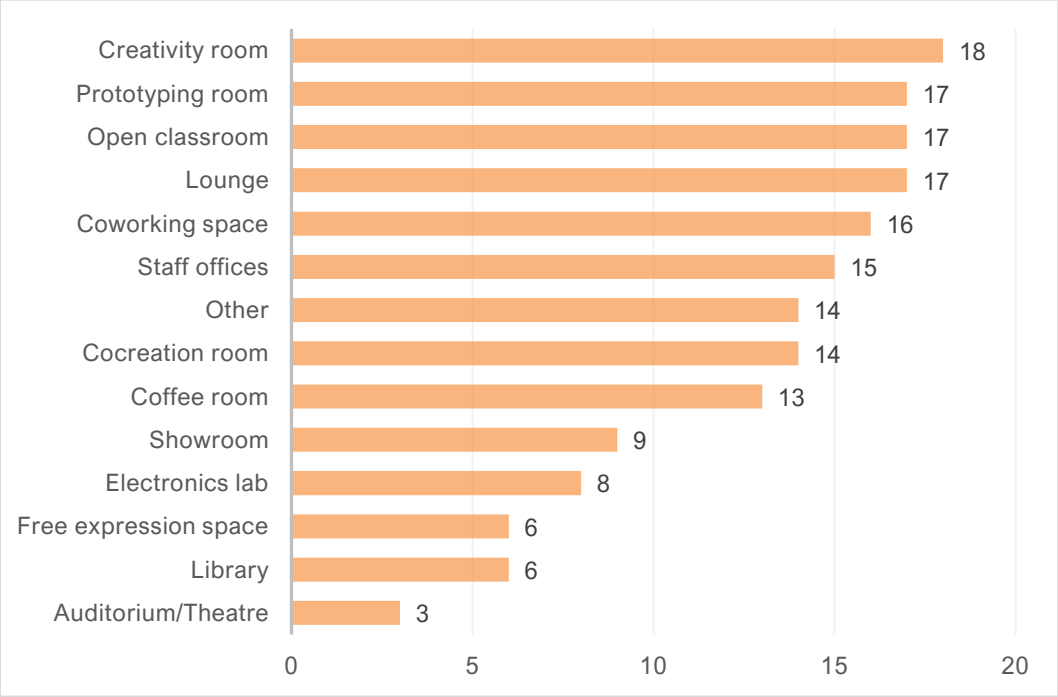
Flexibility *- What is the degree of flexibility of the lab-*



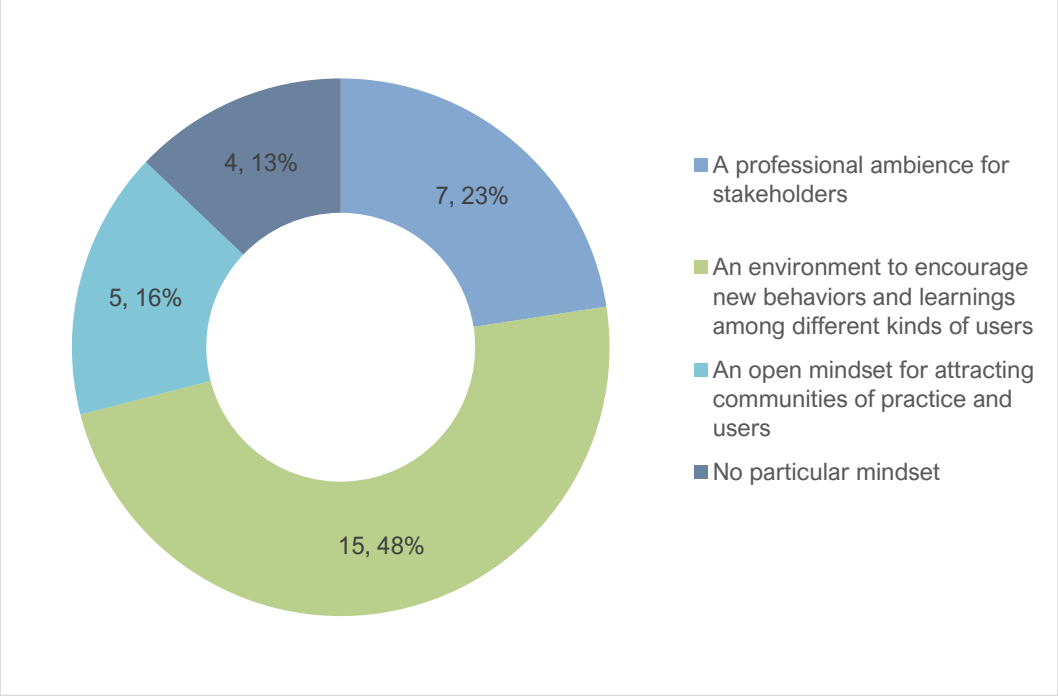
Design values *- What kind of areas can be found in the lab?*



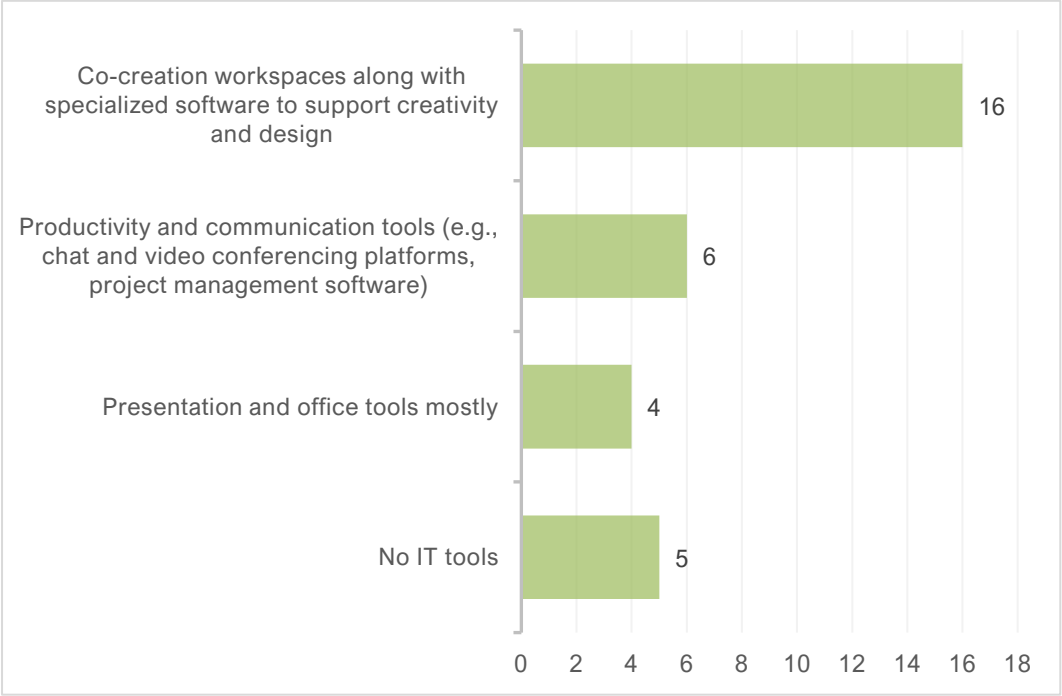
Design values *- What kind of areas can be found in the lab?*



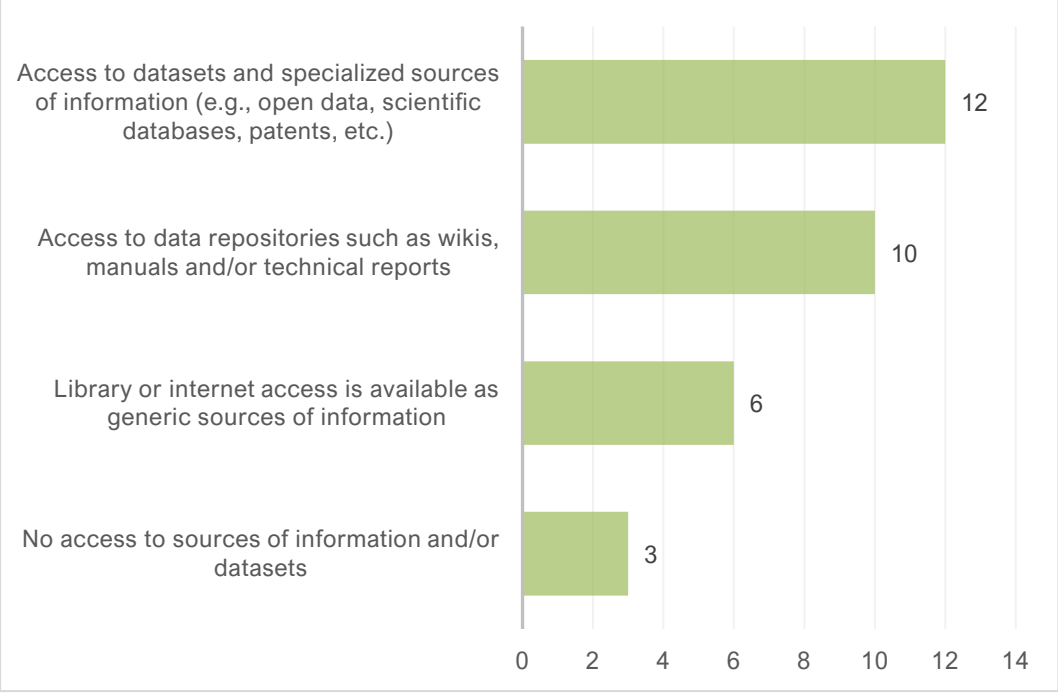
Design values *- In general, you would say that the lab's facilities reflect:*



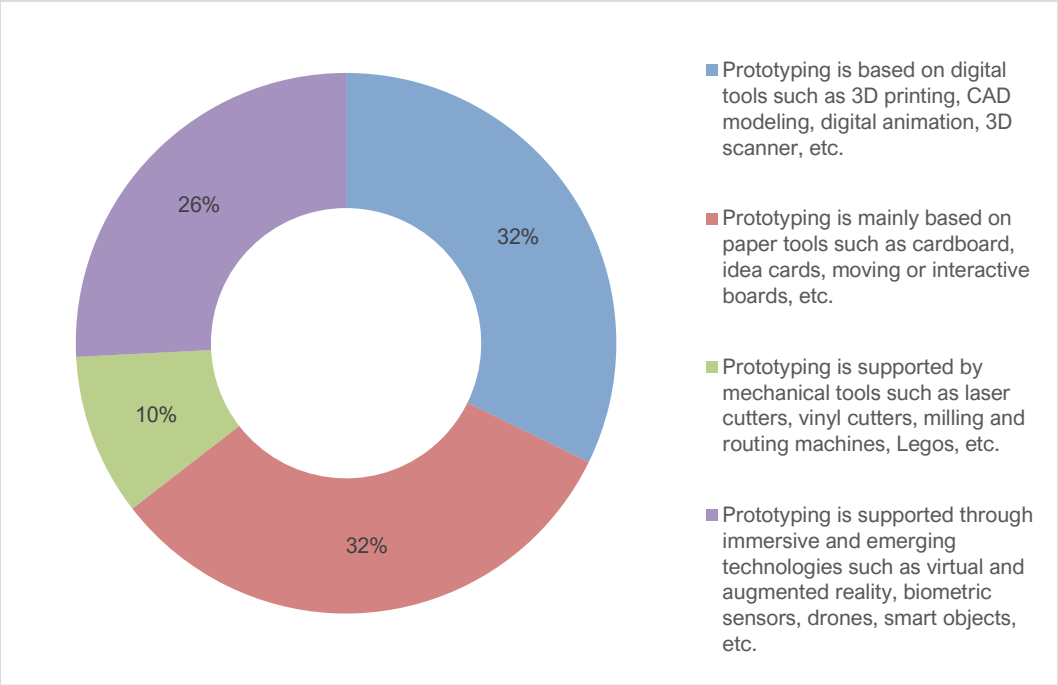
IT resources *- Could you tell us what are the key IT tools in your lab-*



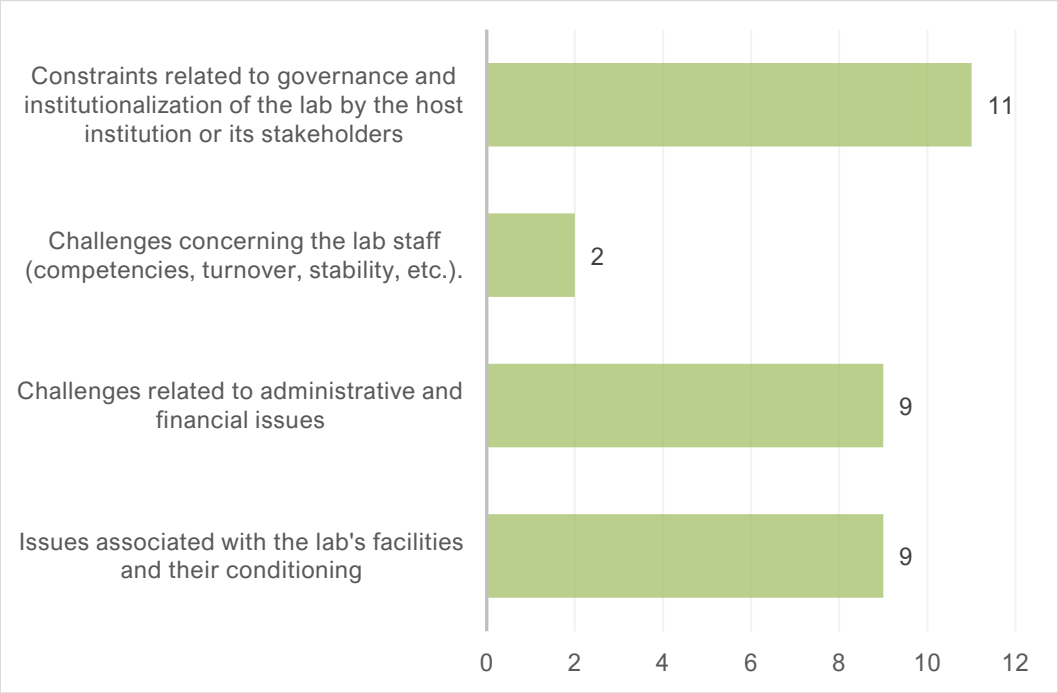
Data sources *- What are the main sources of data/information available in the lab that often support the development of projects or activities-*



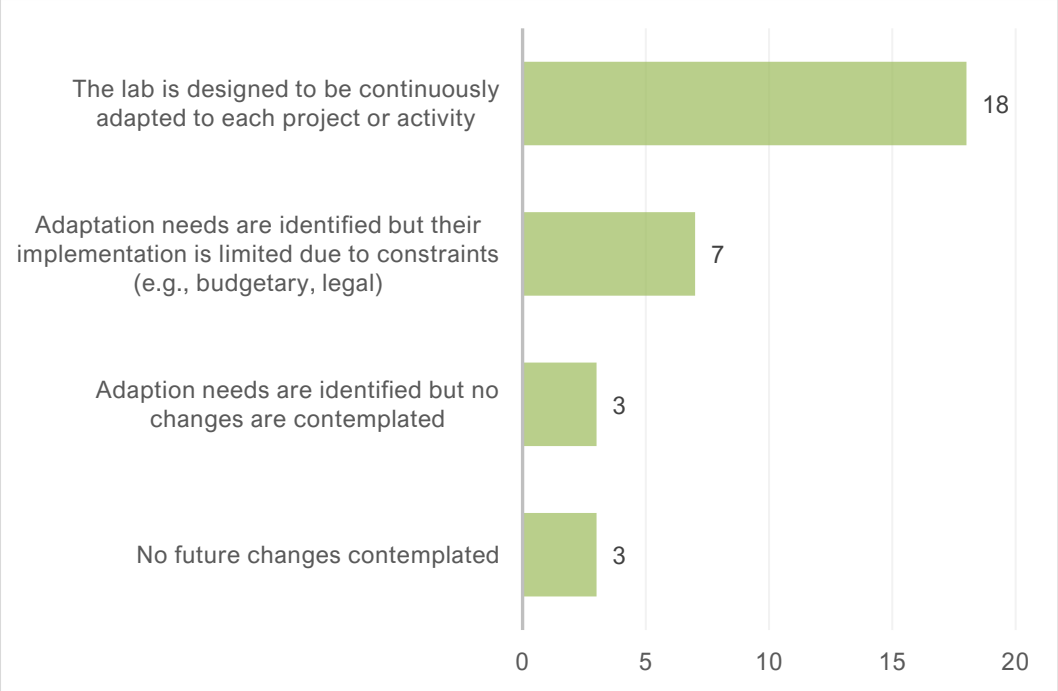
Prototyping & visualization *- What kind of equipment and tools are available in the lab to support prototyping-*



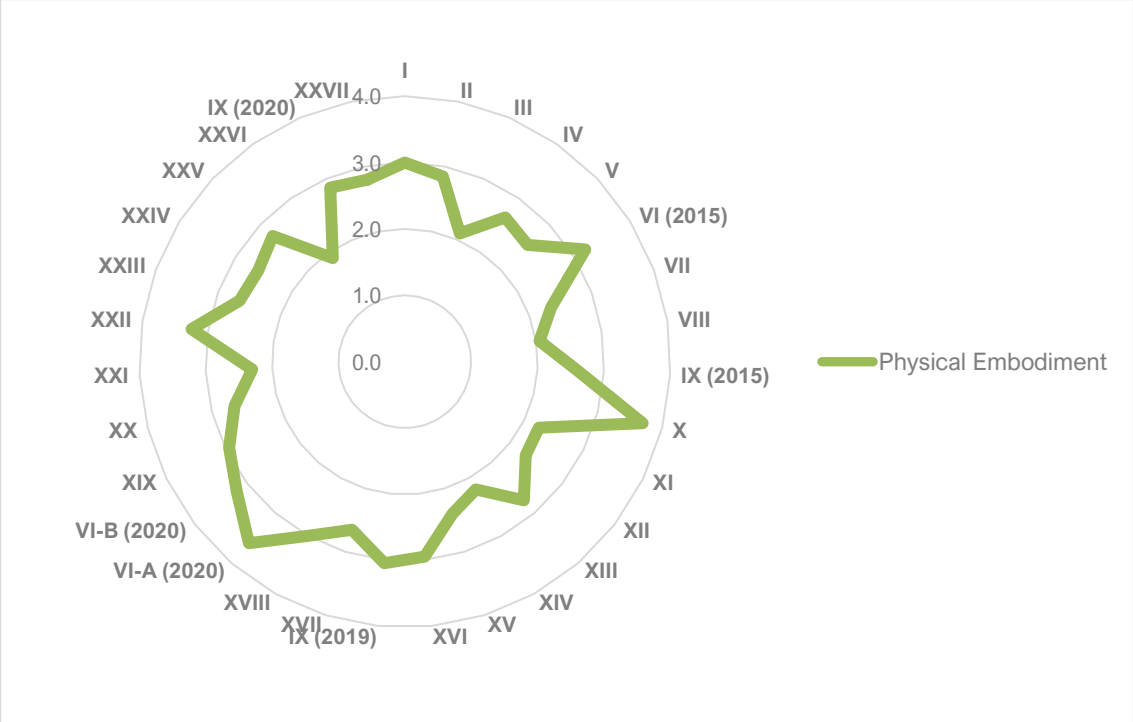
Constraints *- Based on your experience, please list the main constraints or challenges you faced during the implementation of the lab*



Evolution *- Could you tell us, in what way the adaptation of the lab to serve future activities or projects is contemplated-*



Physical embodiment – overall cases radar

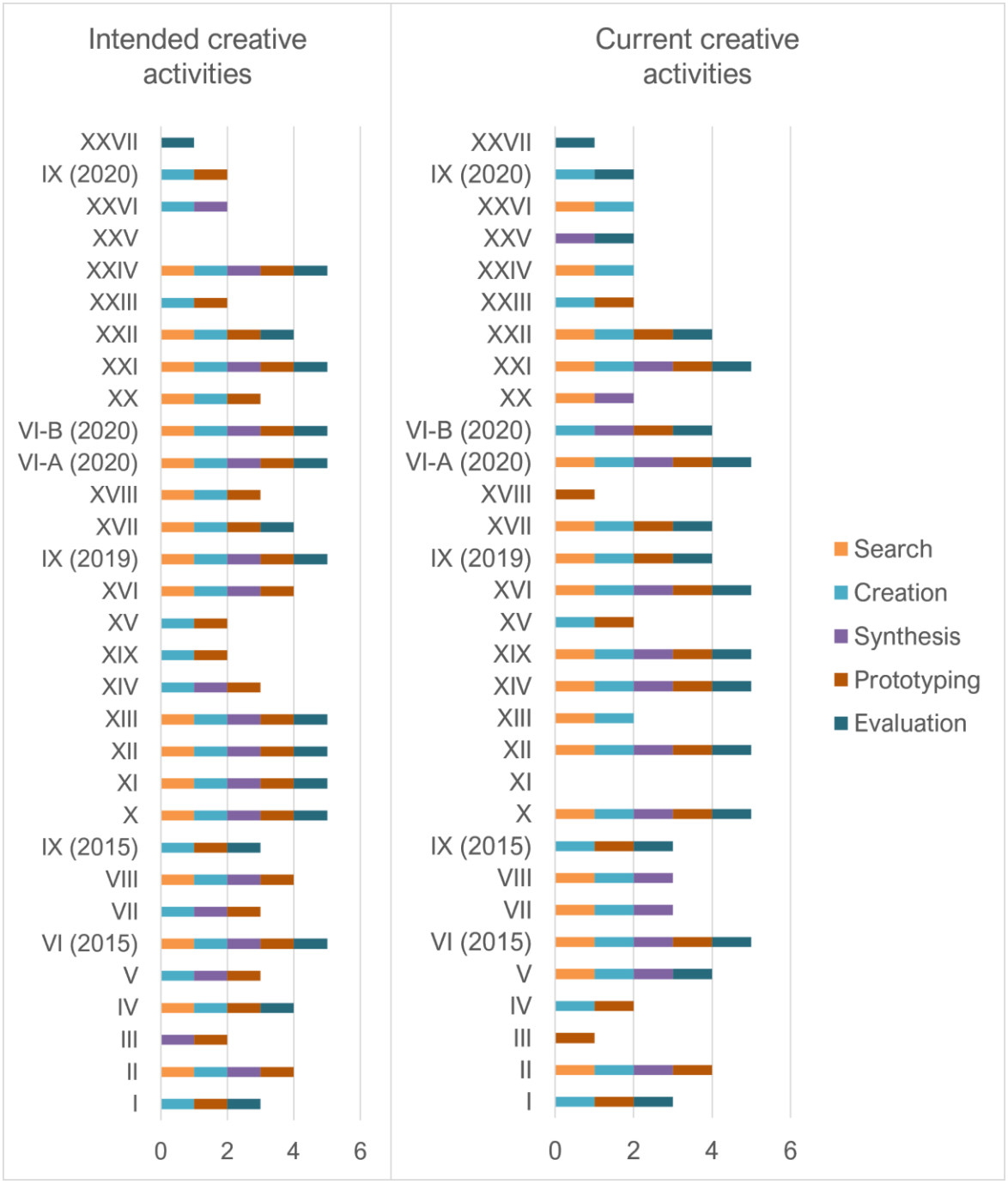


Average of the physical embodiment dimension for each lab

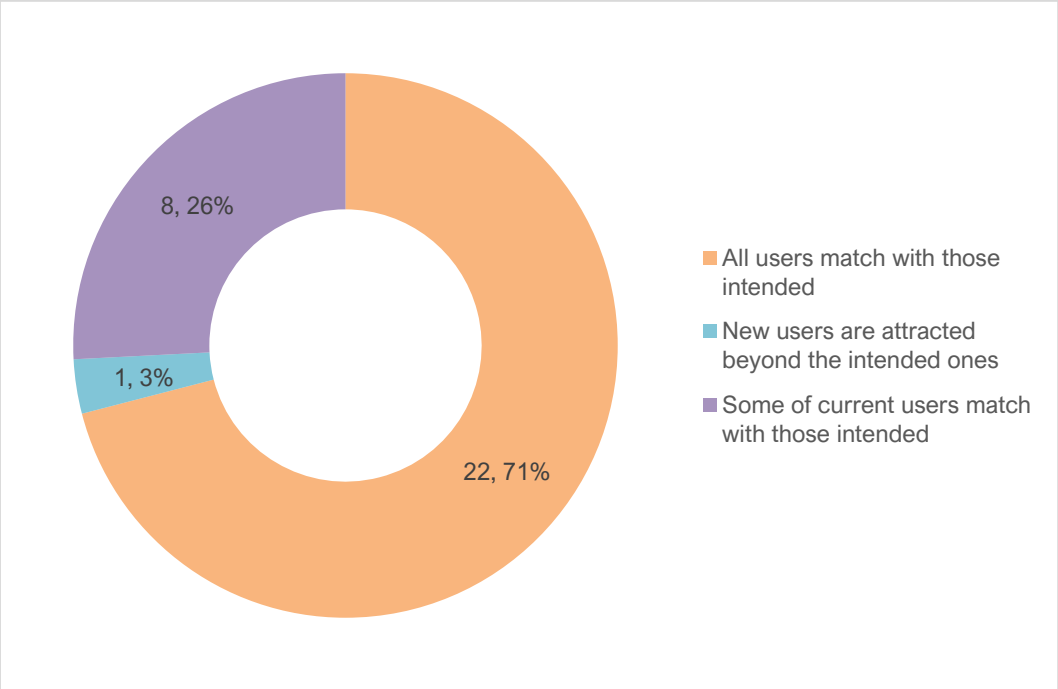
Process of use

Supporting innovation process *- Compared to what was intended, which stages of the innovation process are actually facilitated in the lab today?*

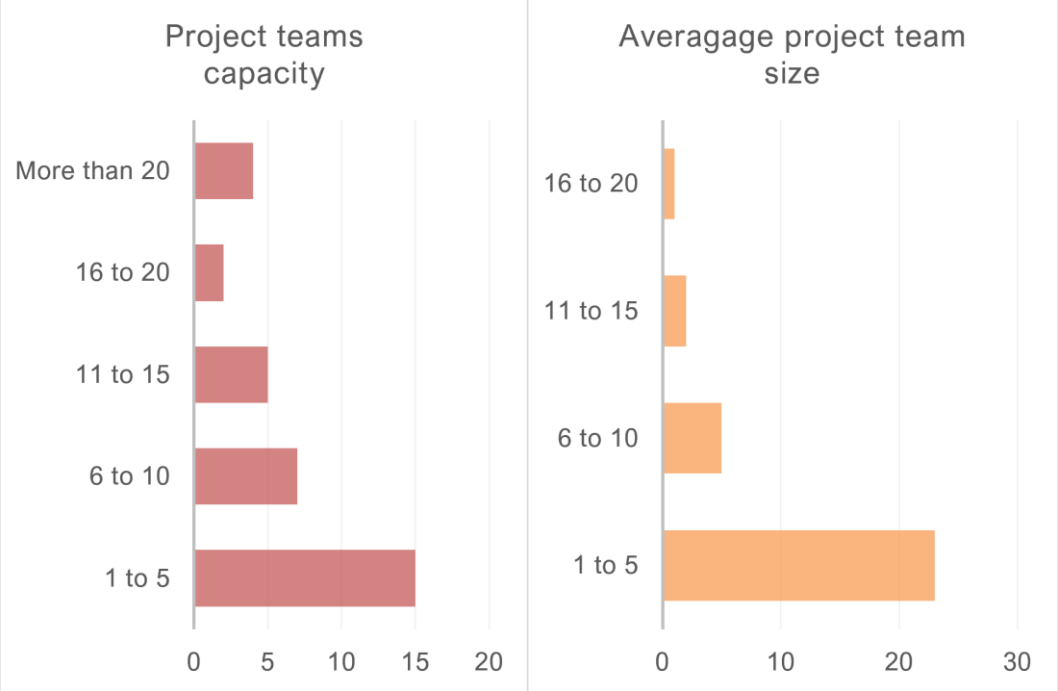
Supporting creative activities *- Compared to what was intended, which creative activities are actually done in the lab today?*



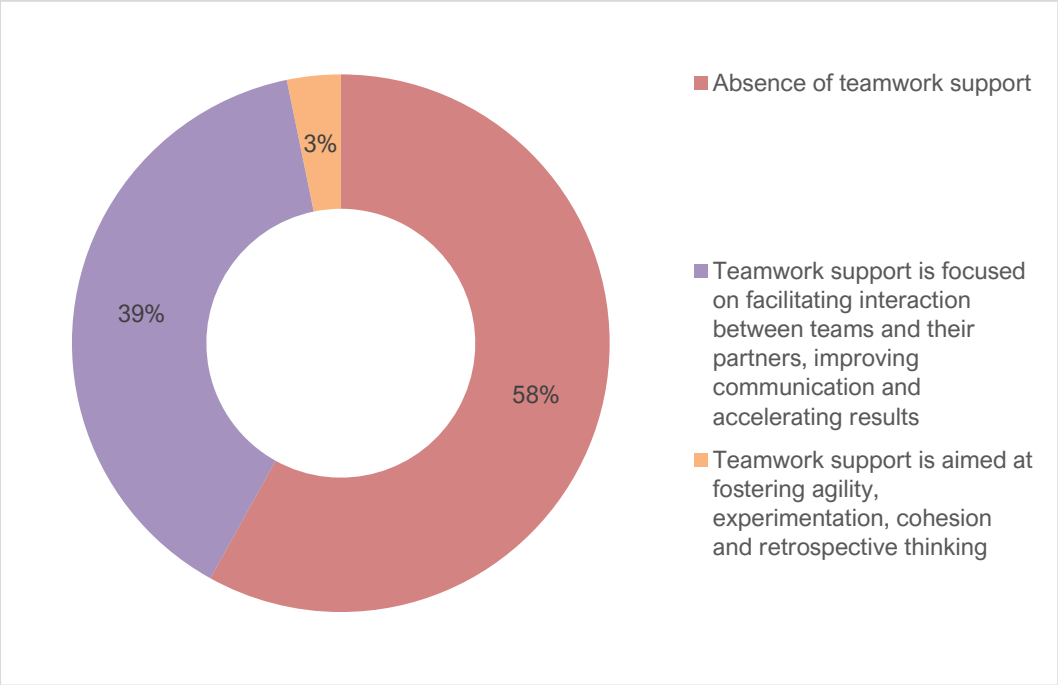
Actual users & facilitators *- In relation to the users who are welcome nowadays, their relationship with the lab is:*



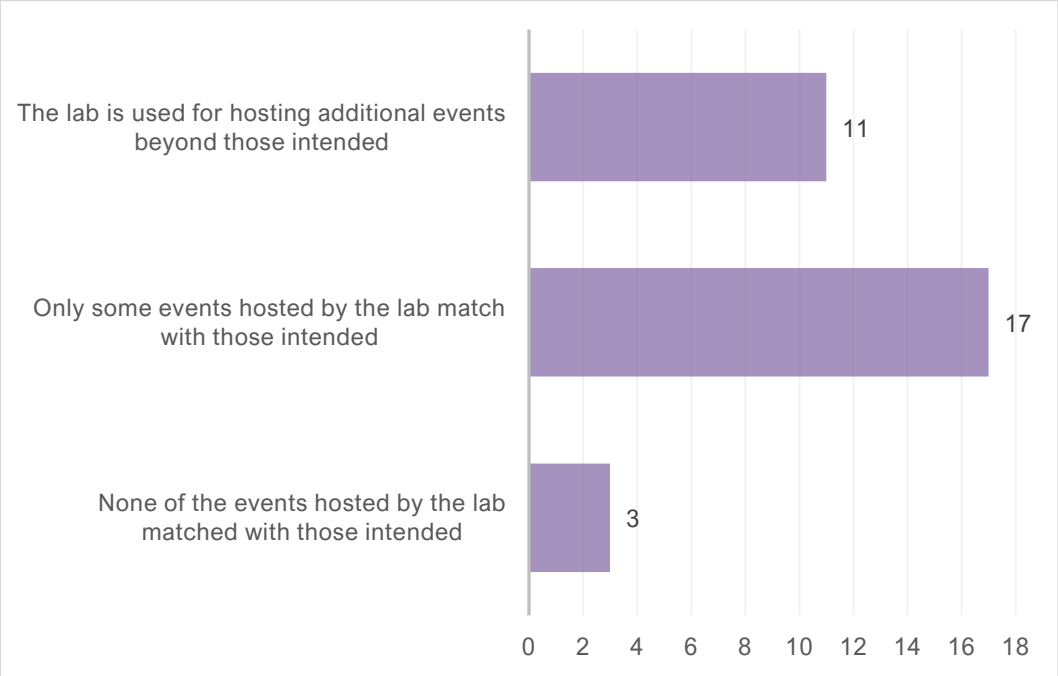
Enabling teamwork *- How many project teams can be hosted in the lab-*



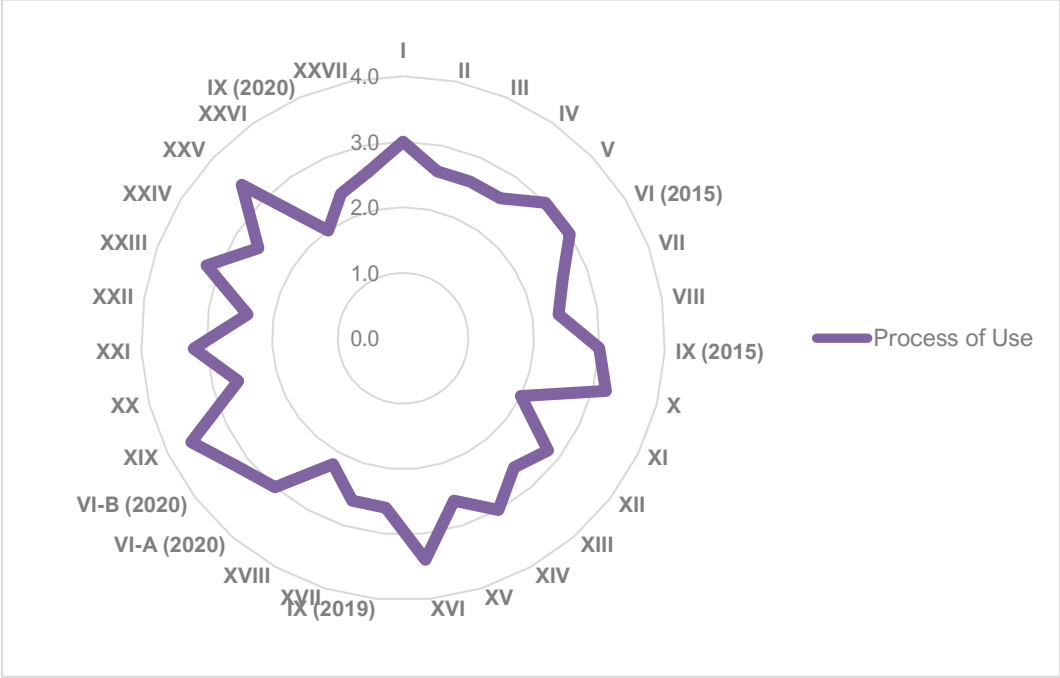
Enabling teamwork *- How do you assess the influence of the lab on the project teams*



Actual events *- Has the lab been used to hold events other than those intended- If so, what kind of events-*



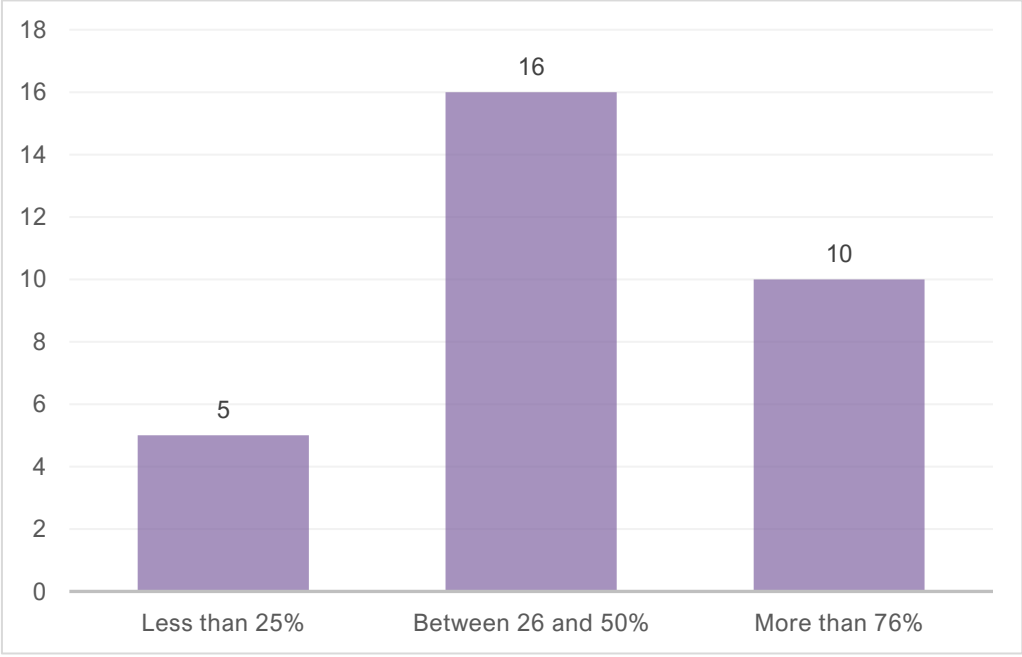
Process of use – overall cases radar



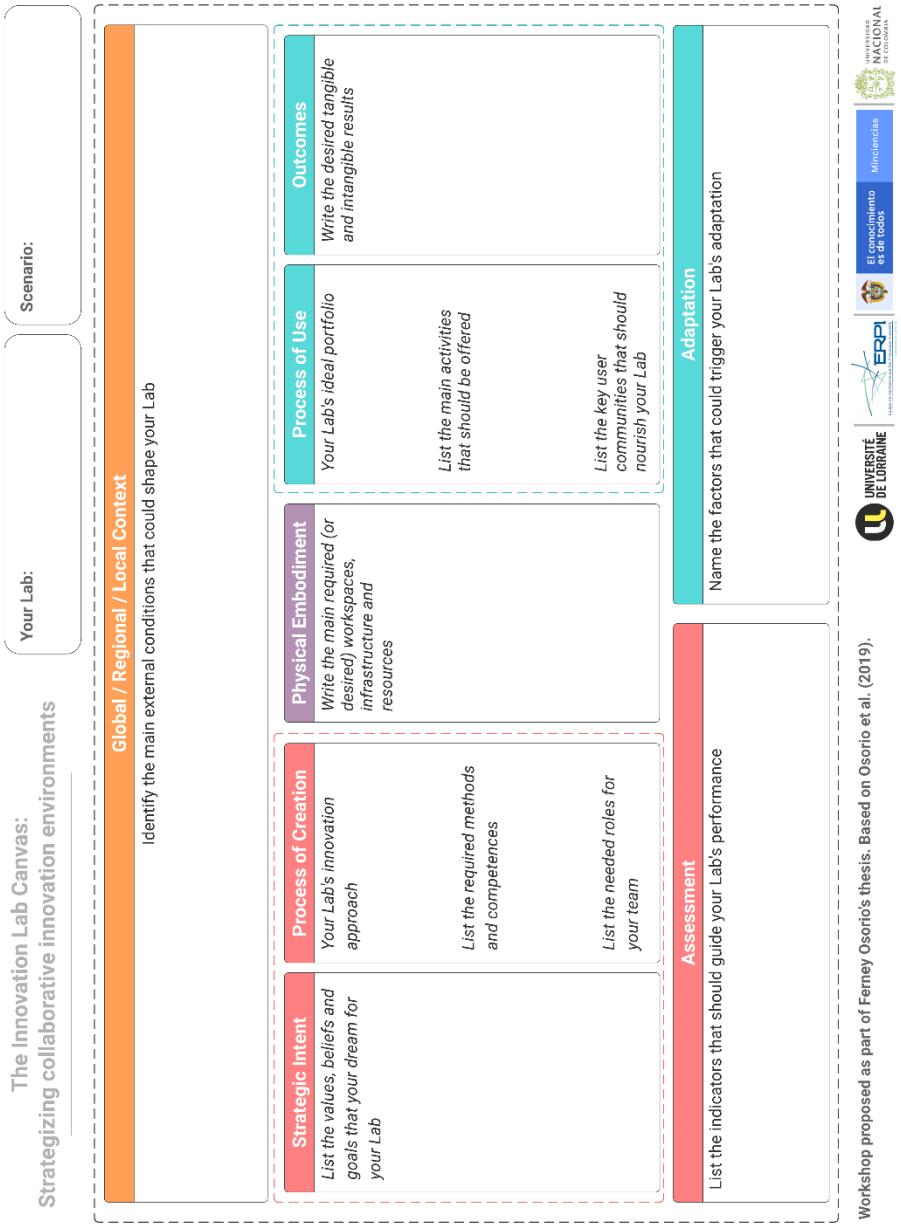
Average of the process of use dimension for each lab

Outcomes

Achievement of strategic intent *- In what measure do you believe that the purpose of the lab has been achieved today-*



Appendix D. Prospective workshop canvas



Appendix E. Semi-structured interview guideline

Dimension	Guiding questions
Introductory questions	▪ Introduction of the researcher and the purpose of the interview. Ask for consent to conduct the interview and record it. ▪ Please present yourself briefly (Background, position, profession, studies)
Strategic Intent	▪ Why an innovation lab in your institution? What were the conditions that led to the creation of the innovation lab?
Process of Creation	▪ Through which innovation processes or activities was expected to achieve the lab's purpose? ▪ What exactly does the innovation lab bring that is different from other labs in your institution or territory? Why is this important?
Physical Embodiment	▪ In which way having the space has helped or limited the intended activities? Why? ▪ What were the most challenging aspects of implementing the innovation lab? Why?
Process of Use	▪ What are the most challenging aspects of keeping running the lab today? Why? ▪ Could you explain how the innovation lab is organized?
Outcomes	▪ What were the main milestones achieved by or thanks to the lab? Why were they so important?
Adaptation & Evolution	▪ What have been the main setbacks and why? What is your vision for the innovation lab for the years to come?

After the first interview, I realized how long the interview was. I also detected that I had too many questions that I could answer by consulting other data sources (e.g., archival data or observations). Although the questions were shortened to try to keep the interviews under 30 minutes, in the end they lasted 47 minutes on average. In the end these questions were used simply for guidance. Depending on the interviewee I delved into some aspects or not. Also, the more interviews that were done, I felt that I was gaining more insights that ultimately allowed me to focus on aspects that I felt were missing.

Appendix F. Interview characterization

Case	Interviewee	Status	Date of interview	Duration	Language	Mode
IX	1	Lab Manager	22/05/2019	1:19:00	Spanish	Videocall
IX	1	Lab Manager	30/05/2019	0:51:00	Spanish	Videocall
IX	1	Lab Manager	30/05/2019	0:45:00	Spanish	Videocall
XVIII	2	Former Lab Manager	13/02/2020	0:38:35	English	Videocall
XVIII	3	Head of Section, Professor	13/02/2020	0:37:07	English	In-person
XVIII	4	PhD Student	14/02/2020	0:37:55	English	In-person
XVIII	5	PhD Student	14/02/2020	0:41:22	English	In-person
XVIII	6	Former Head of Section, Professor	17/02/2020	0:43:08	English	In-person
XVIII	7	PhD Student	18/02/2020	0:42:54	English	In-person
XVIII	8	Lab Consultant	18/02/2020	0:50:52	English	In-person
XVIII	9	Professor	24/02/2020	0:40:43	English	In-person
XVIII	10	Professor	24/02/2020	0:29:16	English	In-person
VI	11	Professor	16/06/2020	0:50:10	French	Videocall
VI	12	Lab Technical Responsible	16/06/2020	0:51:37	French	In-person
VI	13	Lab Assistant	17/06/2020	0:35:45	French	In-person
VI	14	Researcher	17/06/2020	0:51:37	French	In-person
VI	15	Researcher	19/06/2020	0:55:25	French	In-person
VI	16	PhD Student	22/06/2020	0:30:10	French	In-person
VI	17	PhD Student	24/06/2020	0:39:38	French	In-person
VI	18	Lab Manager	24/06/2020	1:25:20	French	In-person
VI	19	Administrative Head of Research Institute	25/06/2020	0:40:21	French	In-person
VI	20	Researcher	25/06/2020	0:53:09	French	In-person
VI	21	Director of Research Institute, Professor	30/06/2020	0:52:59	French	In-person
VI	22	Former Director of Engineering School, Professor	03/07/2020	0:56:14	French	Videocall

Appendix G. Role model operationalization

Innovation lab role	Competence	Variable	Description
Facilitator	Mediation	Medi.1	Designing and implementing conflict resolution strategies
	Moderation	Mod.1	Designing of emerging strategies to incorporate new knowledge and steer the overall project in real time
		Mod.2	Helping to set up a collective vision, encouraging people to share ideas and participate
		Mod.3	Applying experience and pedagogical methods to ensure the progression of the teams and participants
	Participation	Parti.1	Reconfiguring traditional project models based on current participatory approaches
		Parti.2	Applying participatory mechanisms to invite people to join in project activities, introduce them to the project, welcoming and inductions
	Intercultural	Intercul.1	Designing ways to ensure inclusion across cultures, ages, economic backgrounds, physical locations
Maker	Research methods and interdisciplinary work	Research.1	Working with other disciplines/actors in the social ecosystem
		Research.2	Applying different work/research methods to those used in my discipline
	Design methods and creative thinking	Design.1	Combining ideas and knowledge in new ways, using conceptual design methodologies in innovation
	Information and telecommunication techniques	ICT	Developing applied technological prototypes through coding, simulating, modeling, etc.
	Systems thinking	Systems.1	Designing and implementing strategies for handling complexity, anticipatory thinking, transformative literacy
Visionary	Networking	Network.1	Building connections and relationships with local organizations and businesses, funding agencies, community groups.
		Network.2	Making deliberate and meaningful introductions between people.

Innovation lab role	Competence	Variable	Description
Manager	Communication	Comm.1	Being empathetic and open to changes of perspective by feeling the experience of others.
		Comm.2	Using media in a clear, positive and conversational style
	Entrepreneurial thinking	Entrepen.1	Managing a venture or entrepreneurial activity
		Entrepen.2	Recombining assets and opportunities as part of a project incubation process
	Project management	Project.1	Designing and implementing projects of an innovative nature
		Project.2	Meeting projects' technical, financial and legal requirements
	Self-organization	Self-org.1	Believing in one's own ability to select an effective approach to carrying out tasks or activities in increasingly complex environments
		Self-org.2	Being tolerant in increasingly ambiguous and frustrating situations
	Evaluation	Eval.1	Designing and implementing mechanisms to capture and analyze data to inform the strategy and provide evidence for the outcomes

Appendix H. Scientific dissemination and publications

Journal articles

- **Osorio, F.**, Dupont, L., Camargo, M., Palominos, P., Peña, J. I., & Alfaro, M. (2019). Design and management of innovation laboratories: Toward a performance assessment tool. *Creativity and Innovation Management*, 28(1), 82–100. https://doi.org/10.1111/caim.12301 *[TOP DOWNLOADED PAPER 2018-2019 Wiley]*
- **Osorio, F.**, Dupont, L., Camargo, M., Sandoval, C., & Peña, J. I. (2020). Shaping a Public Innovation Laboratory in Bogota: Learning through Time, Space and Stakeholders. *Journal of Innovation Economics & Management*, n°31(1), 69. https://doi.org/10.3917/jie.pr1.0066
- Kasmi, F., **Osorio, F.**, Dupont, L., Marche, B., & Camargo, M. (2021). Innovation Spaces as Drivers of Eco-innovations Supporting the Circular Economy: A Systematic Literature Review. *Journal of Innovation Economics & Management*, Prépublication(0), I113-42. https://doi.org/10.3917/jie.pr1.0113

Conference proceedings

- **Osorio, F.**, Dupont, L., Camargo, M., & Pena, J. I. (2019). Constellation of Innovation Laboratories: A Scientific Outlook. *Proceedings - 2019 IEEE International Conference on Engineering, Technology and Innovation, ICE/ITMC 2019*, 1–10. https://doi.org/10.1109/ICE.2019.8792816
- Kasmi, F., **Osorio F.**, Marche B., Dupont L. (2020). Innovation spaces as enablers of the circular economy implementation: a systematic literature review. *Spring of Innovation 2020: International Conference on Innovation and Circular Economy*. 26-27 March 2020, Santiago de Compostela.

- Roux-Marchand, T., Cruz, F., Dupont, L., Camargo, M., & **Osorio, F.** (2020). Connecting the strategic intent of innovation labs and projects: the case of the Green Fablab. *2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, 1–10. https://doi.org/10.1109/ICE/ITMC49519.2020.9198320
- **Osorio, F.**, Dupont, L., Camargo, M., & Peña, J. I. (2021). Making the strategic intent of innovation labs operational: A process perspective on the case of the Lorraine Fab Living Lab. *R&D Management Conference 2021 Innovation in an Era of Disruption*, 1–13. https://hal.archives-ouvertes.fr/hal-03285670
- Salas, A., Arbelaez-Garces, G., **Osorio, F.**, & Dupont, L. (2021). Digital Collaborations for the Common Good: Key Learnings from Four Community Projects. In M. Botta & S. Junginger (Eds.), *Swiss Design Network Symposium 2021. Design as Common Good Framing Design through Pluralism and Social Values* (pp. 1–13). SUPSI, HSLU, swissdesignnetwork. https://designascommongood.ch/

Seminars and summer schools

- **Osorio, F.** (2019). NITIM International Graduate Summer School 2019. 13-15 June, Nice. Oral presentation.
- **Osorio, F.** (2019). 6th Greater Region PhD Workshop on “Entrepreneurship & Innovation” 2019, 19-20 September, Trier. Oral presentation.

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