Revue Internationale des Sciences de Gestion
ISSN: 2665-7473
Volume 6 : Numéro 2

Interdisciplinarity in Living Labs, for a better Innovative Co-creation

L'interdisciplinarité dans les Living Labs, pour une meilleure Co-création Innovante

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Date submitted : 13/01/2023

Date of acceptance : 20/05/2023

To cite this article :

MEJRI H. & KAROUI ZOUAOUI S. (2023) «Interdisciplinarity in Living Labs, for a better Innovative Co-creation», Revue Internationale des Sciences de Gestion « Volume 6 : Numéro 2 » pp : 1026 - 1047

Abstract:

The advent of the new innovation generation of 4.0 has been accompanied by a shift in the workplace. A new form of work has emerged which is based on collaboration between the different members of the ecosystem. It also emphasizes openness to the outside world. This form is applied in local collaboration platforms recognized by the Co-working spaces. I In this paper we will study the Living Labs and their role in the collaborative creation of innovations. A unique embedded case study is conducted in an innovation Living Lab hosted in Tunisia with nine international collaborators. The results of this qualitative study show that Living Labs need to be configured in a way that facilitates open interaction, sharing and collaborative creation of innovations. Similarly, through the analysis of the interviews with the collaborators we deduce the emergence of the concept of interdisciplinarity as a determining variable of innovative co-creation in the Living Labs.

Key words: Living Lab ; configuration ; Co-creation ; Innovation 4.0 ; interdisciplinarity ; qualitative research

Résumé :

L'avènement de la nouvelle génération d'innovation 4.0 a été accompagné par un bouleversement dans les espaces de travail. Une nouvelle forme de travail a alors émergé et qui se fonde sur la collaboration entre les différents membres de l'écosystème. Cela met également en avant une ouverture vers l'extérieur. Cette forme est appliquée dans des plateformes de collaboration locales reconnues par les espaces de Coworking. Parmi ces espaces, nous étudions dans ce travail de recherche les Living Labs et leur rôle dans la création collaborative des innovations.

Une étude de cas encastré unique est menée dans un Living Lab d'innovation hébergé en Tunisie regroupant neuf collaborateurs internationaux. Les résultats de cette étude qualitative montrent que les Living Labs doivent être configurés d'une manière qui facilite l'interaction ouverte, le partage et la création collaborative des innovations. De même, à travers les analyses des entretiens auprès des collaborateurs nous déduisons l'apparition du concept de l'interdisciplinarité comme une variable déterminante de la Co-création innovante dans les Living Labs.

Mots clés: Living Lab ; configuration ; Co-creation ; Innovation 4.0 ; interdisciplinarité ; recherche qualitative.

Introduction:

In contrast to the regional innovation cluster system which adopts territorial proximity as a vector for cooperation and innovation creation (Porter, 1990; Leducq & Luso, 2011). A new spatial innovation structure emerged in 2005 that adopts collaborative work as a source of innovation. We are talking about micro-clusters called "Coworking Spaces" or "Collaborative Work Spaces" (Besson, 2018; Brown, 2017; Spinuzzi, 2012; Merkel, 2015).

Consulting theoretical works on the CWS phenomenon, we find a wide variety of collaborative spaces that share the same principles of the Coworking movement, but carrying out different activities for diverse purposes. We cite Hacker Spaces; Maker Spaces; Innovation Labs; Incubators and Creative Hubs... (Brown, 2017; Jakonen et al., 2017). The distinction between these different collaborative spaces is made with reference to the creative approaches adopted, the governance structures of these spaces and the outputs of the collaborative exercise. Capdevila, (2015), proposed a configuration of open spaces according to the type of governance (Top-Down / Bottom-up) and a creative approach (Exploration / Exploitation). According to this configuration, four open spaces are illustrated. The common characteristics found among them are Co-creation, free sharing and collaboration.

In this research, we focus on Living Labs which have been structured in a top-down manner, adopting a more operationally oriented approach (Capdevila, 2015). These physical platforms play a crucial role in the collaborative creation of open innovations through the working structures they offer where informality predominates and the transfer of knowledge is done with confidence and where the exploration of new ideas will be the fruits of collaborative acts (Capdevila, 2015).

Taking into account the novelty and emergence of this Coworking phenomenon, interventions from academics and practitioners are more often requested in order to understand this new economic movement (Spinuzzi, 2012; Davies & Tollervey, 2013; Capdevila, 2014; Chroneer et al., 2019; Ersoy and Van Buren, 2020). Indeed, despite the studies that have addressed the problem of the design, development and sustainability of these innovation Living Labs, there is still a gap in the in-depth understanding of this open collaborative innovation phenomenon (Morel et al., 2018), upstream of its implementation and operation process. Moreover, through their seminal study on innovation Living Labs (2005-2018), Ballon and colleagues demanded in 2018 that studies on this new phenomenon must go beyond the mere description of operating structures. These studies must be thorough and

explain in detail the mechanisms that ensure the success and sustainability of Living Lab projects.

Therefore, we aim through this research to study in depth the phenomenon of Coworking adopted in Living Labs, its specific configuration compared to other Coworking spaces as well as its role in the Co-creation of innovative ideas. These shortcomings lead us to ask the following question: How do Living Labs ensure the Co-creation of innovative ideas?

To answer this research question, we will carry out, through a qualitative research, a single case study of a Living Lab hosted in Tunisia gathering international collaborators (France, Canada, USA, Netherlands, Tunisia). The data will be collected during the 2016-2019 periods and through a triangulation of methods: Non-participant observation; Semi-structured interviews; Documentation. The analysis of all the data collected will be carried out using the qualitative analysis software "AMI Enterprise Intelligence". This analysis will lead to an empirical validation of the role played by Living Labs in the creation of innovative ideas. As it gives rise to a new concept of interdisciplinarity which represents a fundamental role in the success of this innovative collaborative configuration.

This work is structured in four parts. The first part will present a review of the literature, the second part will present the research methodology and the case study, the third part will present the main results and the fourth part will conclude with a discussion.

1. The Living Lab and its role in innovative co-creation:

"The concept of a living lab refers to the involvement of multiple stakeholders, including users, in the exploration, Co-creation and evaluation of (usually ICT-related) innovations within a realistic setting" (Ballon et al., 2018). This Living Lab movement serves NOT ONLY to bridge the gap between research and commercialization (Dubé et al., 2014) but also between innovation and its users (Schuurman, 2016). This new approach has placed users on the same level as other stakeholders, integrating them into the innovation process from the early stages. Similarly, Living Labs with their logic of integrating all ecosystem actors in the same collaborative space serve to bridge the gap between researchers and entrepreneurs. Indeed, in the same Living Lab space, we find researchers, public and private stakeholders and citizens working together to co-create innovations. All these actors participate jointly in the fundamental and applied research related to innovation, the demonstration and piloting of the innovative project, the development of innovative products and services and their availability on the

market. We therefore believe that Living Labs play the role of intermediaries between the different actors in the ecosystem with diverging interests, but also with the same innovative perspectives.

In addition, the involvement of companies in Living Lab projects serves to:

✓ Incorporating the views of users and stakeholders into the innovation process;

✓ Testing products with collaborating users before they are made available on the market;

✓ To have a better understanding of the market and minimize the risk of innovation failure;

✓ To increase knowledge and skills, and access to new sectors of activity;

✓ Making more connections between ideas, innovative products and its users in the market.

Ballon et al. (2018) showed in their study that 93% of participants in Living Lab projects find this new innovation strategy very effective as it takes into consideration all user and market related information upstream of the innovation process. This allows these participants to direct their investments towards efficient ends. Similarly, these Living Lab projects allow companies to accelerate the development and commercialization of innovative products and services by benefiting from the resources, project monitoring and funding provided by the Living Lab, and above all by benefiting from the specific expertise of Living Lab practitioners.

1.1 Living Lab: configuration and activity

According to Ballon (2005), the Living Lab is characterized by a confrontation between users and prototyping of innovations upstream of the Co-OI process; this rules out the closed system of innovation that allows for the confrontation of users/innovations in the market. Indeed, this Living Lab system helps to develop a specific context for the process of development and acceptance of innovations and especially the interaction between the two. Also, this experience of working in Living Labs clarifies the conditions that can stimulate the social fixation of innovations as well as the societal impacts of these innovations. Thus, 'in a living lab problems [...] are no longer solved exclusively by institutional experts, but by networks of actors engaging and co- creating with users, in a creative social space' (Voilmy, 2016, p.75).

However, the Living Lab concept refers to the involvement of different stakeholders, while integrating users in the Living Lab approach to innovation (Exploration; Co-creation; Evaluation), (Ballon et al., 2018; Voilmy, 2016). This approach not only guarantees the Co-design of innovations but also ensures the principles of collaboration and openness by offering

collaborators the opportunity to interact, to learn together, to share their knowledge and experiences, to Co- create new technologies and to test them together in order to bring them to the market (Ballon et al., 2018; Morel et al., 2018; Schuurman et al., 2018; Basson, 2018; Voilmy, 2016; Dubé et al., 2014).

Furthermore, Dubé et al. (2014) identified the four activities that guide collaborative work in innovation Living Labs, namely:

Co-creation "is the set of collaborative value-creation processes in which the parties involved in a product or service participate, from its conception to its use. Co-creation includes all the divergent collaborative activities related to the ideation, production, but also the implementation of the innovation", (p. 65).

Exploration "aims to discover new market opportunities and new uses; and above all to identify collectively the first obstacles to the adoption of the innovation", (p. 66).

Experimentation: "the aim is to test the prototypes and collect observations on usage and adoption behavior in order to feed into further development" (p. 68).

Evaluation "uses must be addressed along all three dimensions to maximize the alignment of the innovation with the needs and desires of the users", (p. 70).

A Living Lab is a physical platform that follows a collaborative approach (Exploration / Elaboration / Evaluation), typically configured to co-create, explore, experiment and evaluate open innovations, by integrating the different actors of the ecosystem (Communities / Investors / Companies / Users / Researchers) upstream of the innovation process.

1.2 Living Lab: between a real environment of multi-actor interaction and a Co-creation of innovations approach

By analyzing the literature, we observe that Living Labs are interpreted as a real environment of interaction of different economic actors (Folstad, 2008; Ballon et al., 2008; Almirall et al., 2012; Liminen et al., 2012) or as an approach of Co-creation of innovative activities (Schaffers et al., 2012; Schuurman, 2015; Ballon, 2015). Indeed, a Living Lab environment is a familiar context for innovating products and services, managed by Living Lab practitioners and integrating the different stakeholders in the innovation activities (Ballon et al., 2018). This Living Lab environment is nowadays presented as a platform ensuring a trustworthy environment facilitating the interactions between the actors of the platform. On the other side, the Living Lab phenomenon is an iterative approach that includes a cycle of activity from Co-

creation of innovations to its commercialization, through prototyping and testing (Ballon et al., 2018). This iterative approach is reinforced by the interactive nature of Living Labs, by the learning exercises carried out during Living Lab activities and finally by the complexity and unavoidable dynamics of the Living Lab environment (Liminen & Westerlund, 2017; Ballon et al., 2018).

However, the integration of the Living Lab phenomenon in the organizational world is realized through three different approaches (Schuurman, 2015). The adoption of this collaborative phenomenon is often done either through the implementation of test Living Labs where users and stakeholders collaborate in the creation and validation of ICT services (Ponce de Leon et al., 2006; Zhong et al, 2006), or through the creation of Living Labs that support research and co- creation while supporting the upstream phases of the innovation process (Thiesen Winthereik et al., 2009; Stahlbrost, 2008) or simply, through the creation of Living Labs for collaboration and support of cognitive activities. According to this third approach, the actors of the ecosystem collaborate to develop a community for sharing and creating knowledge (Schaffers et al., 2007; Coetzee et al., 2012; Buitendag et al., 2012).

We stress that it is absurd to analyze the Living Lab phenomenon from a single angle without taking into consideration both components (environment VS approach). In reality, the Living Lab is not a separate interactionist environment or an iterative approach to Co-innovation. To engage in a Living Lab project is to respect the values of a context open to any person and any public or private organization, entering into a collaborative partnership relationship "Public-Private-People Partnership: PPPP" (Schuurman, 2015). This type of partnership ensures an implicit rather than explicit exchange of knowledge in order to co-create, prototype and test innovations in Living Labs. This interaction between the Living Lab environment and the innovation development process aims at realizing economic opportunities either through the commercialization of these innovations or by creating innovative start-ups. We conclude that the Living Lab phenomenon is an open environment for "Public-Private-Population" partnerships, i.e. pursuing a collaborative approach to the development of innovations for economic purposes.

2 Research methodology:

To answer to our research question we opt for a qualitative research methodology (Saunders et al., 2019; Kellmereit, 2016) using an embedded case study (Yin, 1990; Eisenhardt, 1989), in order to examine the phenomenon of Living Lab in its real context. The choice of this method

of empirical investigation is made by referring to the nature of the phenomenon studied as well as the question of research. Indeed, by referring to Yin's matrix (2003, p.40), our research serves to understand the innovative coworking phenomenon while unveiling the process of co-creation. So, at this level, the unique case study is needed, moving away from the logic of replication. As for the unit of analysis is a built-in type, because the nature of the case studied strongly requires this type of unit. Indeed, the case of the innovative open project is implanted in a Living Lab which brings together researchers, investors, companies, public organizations, students ... whose main objective is to co-innovate. As a result, the study of the implementation of this project is carried out by analyzing the role of the Living Lab as well as the role of all the actors involved in this innovative project. So, our studied case fits in the built-in model where the main unit of analysis is The Living Lab and the second-order analysis units are the economic members involved in the innovative project.

2.1 The embedded case study:

"Elghazala Innovation Lab" (EInnoL) is an Innovation Lab hosted in Tunisia since January 2016 and it brings together national and international collaborators. In fact, this Living Lab is a collaborative workspace founded by the Tunisian State whose objective is to set up projects between research structures and industries in order to jointly develop innovative smart products and services. As a result, EInnoL is structured in a way that brings together different ecosystem actors who are aware of the need to work collaboratively to innovate together and meet the needs of the city in the digital age. As shown in the following table, nine collaborators were located within the Living Lab (table 1) and they started Co-work since January 2016, the date of the creation of the Living Lab.

The selection of these nine collaborators was made in accordance with the rules for the configuration of Living Labs, i.e. in accordance with the PPP partnership criteria. In the following table we present the type of partnership of each member as well as their role within the Living Lab.

Table n°1: collaborators partnership

Nbr	Collaborators	Partnership	Home country	Activity
1	Living Lab direction	Public	Tunisia	Management
2	U-Accelerator	Public	Tunisia	Mentoring
3	US-CERT	Private	USA	Cyber security
4	QOS DESIGN	Private	French	Telecommunication
5	Laser Afrique	Private	Amsterdam	Research lab
6	PI-LAND	Project promoter	Tunisia	Graduate from Business school
7	Look4Care	Project promoter	Tunisia	Graduate from healthcare university
8	DRT	Project promoter	Tunisia	Graduate from computer science school
9	ESPEROO	Project promoter	Tunisia	Graduate from computer science school

2.2 Data collection:

In order to be faithful to the reality on the ground and to present credible results (Graue, 2016), we opted for a triangulation of data collection modes based mainly on semi-structured interviews; non-participant observation and documentary analysis. The data collection process began with cross-observation sessions rather than longitudinal observation (2016 – 2019). This choice to opt for a time horizon of cross-observation (Saunders et al., 2019) was based on the nature of the topic which aims to explore the phenomenon of Co-working in Living Labs and the dynamics of innovative Co-creation at different phases but also to retrieve the opinions of Co-workers on the implementation of this phenomenon. The observation grid contains five main elements of observation, namely The subject of observation (the working style in the Living Lab: degree of collaboration); The system of categories (to observe the role and commitment of each collaborator); The units to be observed (the collaborators of the Lab); The sampling plan (to observe the collaborators by noting their activities and interactions with regard to the co- creation of innovations); The data analysis plan (starting from the configuration and activities of the Living Labs developed in the theory, we evaluate its correspondence with the model adopted by EInnoL).

The interviews were conducted after two years of collaborative work (in 2019) with the nine collaborators mentioned above (table 1) for an average of 45 minutes with each collaborator. The semi-structured interviews were guided by an interview guide dealing with the themes of

the research (the collaboration strategy and the role of the Living Lab structure in the development of exchange and co-creation activities).

In addition, the adoption of the two primary data collection modes to construct a logical and credible answer to our research question was reinforced by a third secondary data collection mode, namely internal documentation. Documents were provided by the management of the Lab which present the collaborative project, the Coworkers, the purpose and the challenges of the Lab. Similarly, this document reveals the Lab's configuration chart and the different phases of implementation of innovative projects within the Lab. It also presents a state of the art of all the Co-realised projects in the Innovation Lab.

Adopting Huberman & Miles' (1991) iterative qualitative analysis model, three stages were pursued, namely data condensation, coding and verification and conclusion. The coded data set is analyzed using the qualitative data analysis software 'AMI Enterprise Intelligence'. This software allows us to obtain volumetric statistics on the degree of importance of a concept or theme. This software also allows us to automatically detect new concepts and to map all the information.

3 Results and discussion:

3.1 The Living Lab: a Co-innovative strategy:

As the following table shows (table 1), the approach adopted by EInnoL in implementing its innovative collaboration project meets the strategic requirements of the collaborative approach to innovation.

Indeed, the collaborative approach adopted by the Innovation Lab is based on the principle of openness and co-creation by integrating the various members of the ecosystem into its innovation process from the upstream phases. This approach consists of creating added value by collaborating with companies from the private and public sectors, and by benefiting from the R&D results of universities and laboratories, while integrating the end users into this Co-creation process. The implementation of this strategic approach is achieved through the creation of teams of researchers, investors and entrepreneurs working on different project themes. This range of themes provides the community with a range of innovative products and services that meet the needs of citizens in the digital age and the 4.0 revolution. This places the EInnoL experience at the heart of the national collaborative strategy for technology creation and

development, as an example to follow in the field of local networking and collaborative and open innovation.

Table n°2 : Collaborative strategy

	General strategy for innovative collaboration	***Strategy applied by EInnoL***
Approach	1-Strategic Partnership/Joint Venture 2-Design with suppliers/customers 3- Consortium 4- Mixed research teams	1- Partnership with international private companies 2- Participation of customers and suppliers in the innovation process 3- Collaboration with the Technopark ecosystem 4- Research team working on an innovative Smart project
Description	1- Co-creation/ Equity investment in R&D oriented companies in target markets 2- Integration of suppliers/customers in product design and development 3- Temporary collaboration of several actors in a research program 4- Virtual or physical pooling of research teams for a specific project	1- Co-creation of Smart products and services 2- Integration of end-users in the Co-creation of innovative service products 3- Collaboration with universities and research laboratories 4- Constitution of research teams working on specific themes
Expected benefits	1- Presence in target or adjacent markets, development of new territories, sharing of R&D risks 2- Integration/pooling of R&D resources, R&D and production cost optimization 3- Enhanced research and funding capacity, Networking 4- Creation of research community, increased research capacity.	1- Presence on the French and American market/ support for project leaders in the design of their projects 2- Participation of customers and suppliers in the creation of innovations from the early stages of the process 3- Collaboration with the Lab ecosystem to Co- create Smart products. 4- Creation of teams working on the different themes (E-Health, Cyber Security, Smart Environment, Smart Energy).

3.2 The Living Lab: a specific configuration for innovation

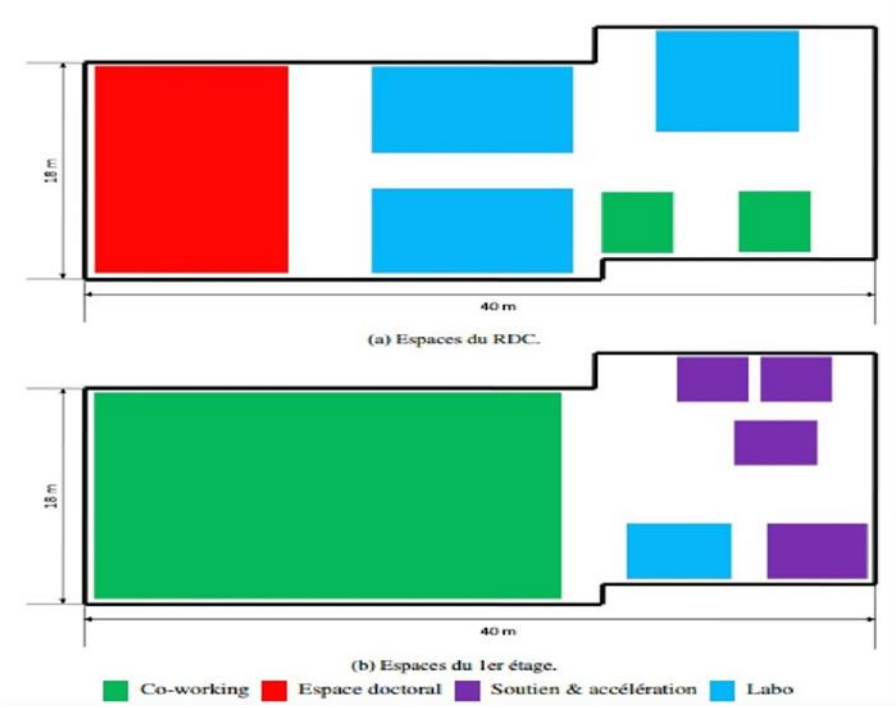
The cross-observation of the Innovation Lab since its creation has allowed us to see a specific configurational structuring adopted in the

architecture of this Lab. In fact, the space of the Lab is configured in four categories of spaces which in turn host four categories of activity, as presented in the architecture below (figure 1).

Figure 1: The configuration of EInnol

Laboratory space
Where testing and prototyping activities take place, allowing Lab staff to implement and validate the prototypes and solutions they develop.
Co-working space
Where teams of entrepreneurs are housed for periods of between 6 and 18 months to work on projects that aim to solve problems arising from the Lab's external environment.
Doctoral space
Where dissertation projects are housed that address the Lab's areas of interest and have a significant technological impact.
Mentoring space
Where innovation support organizations are housed, including innovation accelerators that contribute to the development of prototypes developed in the Innovation Lab.

(Source : Elghazala Magazine/ Septembre 2017 ; p.25)



(Source: Elghazala Magazine/ September 2017; p.25)

Looking at this co-working system, we noticed that the advantage of this configuration is that it provides an environment where project teams (entrepreneurs, researchers, PhD students) can work closely together on solving concrete problems while preserving the interests of each of the stakeholders. Furthermore, the Lab's co-workers claim that the open and collaborative configuration adopted by EInnoL ensures the successful implementation of their innovative projects. One of the project holders adds: "Before coming here I tried to work in two other co-working spaces (Cogite & BIAT Labs), but it was a bad experience because there is just an open space and not collaborative work; so I work alone. On the other hand, here in this Innovation Lab it's quite different, there is a collaborative spirit between the Co-workers. At each stage of the project you will certainly find one or two people who will help you voluntarily and without compensation. Personally, when I came to EInnoL my project idea was vague, thanks to the real Co-working system and the configuration of the Lab my project was improved" (C.B.Z., Project Developer).

One of the major assets on which the Innovation Living Lab is based is the development of an internal synergy between the actors involved in the implementation and support of innovative projects. To this end, the Innovation Lab provides its co-workers with special purpose spaces such as CWSs, meeting rooms, test labs, a telepresence room and a rest area. This variety is likely to create a climate conducive to innovation and the development of high value-added products. We can then deduce that the structure that guides the work in this Innovation Lab is a collaborative structure dominated by participatory decision-making and the collective participation of all the actors collaborating in the realization of the Smart City project from the upstream phases. This structure leads us back to theory and more specifically to the work of Capdevila (2015) on organizational structures applied in Co-wroking spaces. The author mentioned that innovation Living Labs adopt a Top-Down working structure where decision making is centralized at the Top management, i.e.. To the founding committee of the Lab. The case studied in this doctoral project proves that the Lab's founding committee plays mainly the role of support and backing and not the role of supervision, control and decision making. Indeed, through this in-depth study we have retained that the Top-Down structure generally applies in the start-up phase of the project, i.e. during the period of partner search and selection of the members constituting the Lab co-workers. During this period, the founding committee takes the responsibility to consolidate a network of contacts allowing to extend the visibility of the Living Lab, its marketing and the marketing of its projects in a viral way. To

do so, the committee is obliged to have decision-making autonomy during the selection of co-workers and hosted projects in order to prepare the ground for the acceptance of funding requests. Based on this principle, the founding committee of the Living Lab is mainly concerned with:

- ✓ Evaluation and technological validation of the product/solution it intends to launch;
- ✓ Advice on technical aspects of the project;
- ✓ The identification of new technologies, ideas for new products, opportunities for technology transfer;
- ✓ Research and development applied to technologies not sufficiently developed to be used successfully.

Once the partners have signed the funding agreement and the Co-workers have settled in the Living Lab, the Steering Committee delegates power to the Co-workers and takes on the status of a follower. At this stage, the Co-workers take responsibility for implementing their projects with the support of the partners and the Lab Steering Committee. At this stage, power is decentralized and the structure takes on a bottom-up logic, applying the values of openness and collaboration. Co- workers become more autonomous in their decision-making and relationships. They have the freedom to collaborate and share their knowledge and experience with each other; they are free to ignore the co-working principles and choose to work in autarky. The choice of one of these styles is explained by the degree of commitment of Co-workers to the collaborative project and the collaborative approach adopted by the Lab, which is in line with the vision of Schuurman and companies (2018).

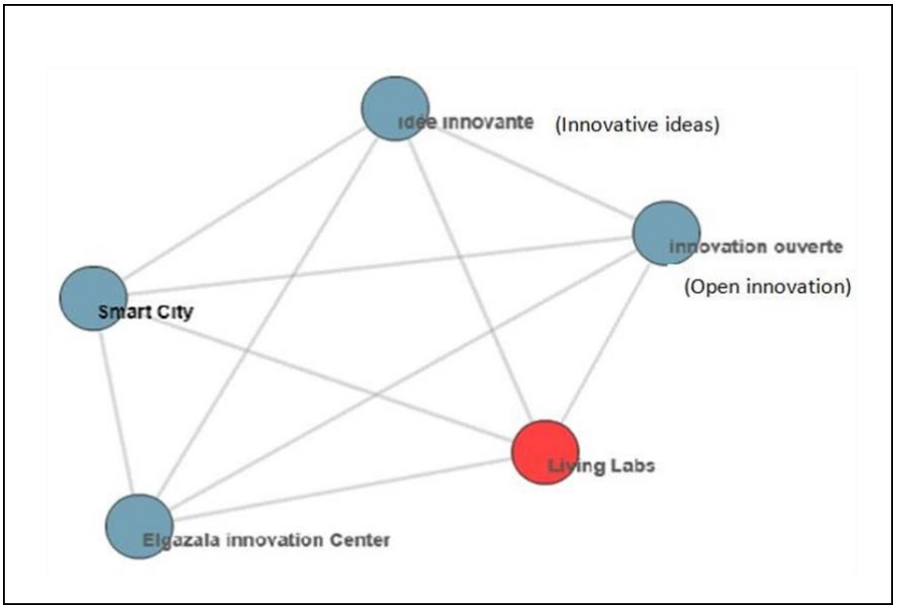
3.3 The Living Lab: an innovative projects incubator

The first objective of this research is to go beyond the simple definition of the Living Lab phenomenon, studying it in depth and analyzing its role in the implementation of Innovation 4.0 and the Co-creation of innovative projects. This led us, from the beginning of the design of this research, to a definition of the Living Lab as a macro level of analysis. We then decided to study it as an incubator for the Co-creation of open innovations using the collaborative participation of all actors in the ecosystem.

The analysis of the verbatims extracted from the AMIei software proves, as it is presented in the following figure (figure 2), that the concept "Living Lab" is correlated to the concepts "Smart City"; "Innovative Idea" and "Open Innovation". According to the

Co- workers, EInnoL and the configuration they have adopted facilitates the implementation of their innovative projects. Indeed, the location of different actors (Entrepreneurs, researchers, Accelerators, Project owners...) operating in different fields (E-Health, M-Learning, Cyber Security, Building Security) in the same workspace in order to Co-realize an innovative project (Smart products) presents a favorable environment for the generation of innovative ideas and the Co-creation of innovative projects.

Figure n°2: Living Labs & Innovative projects

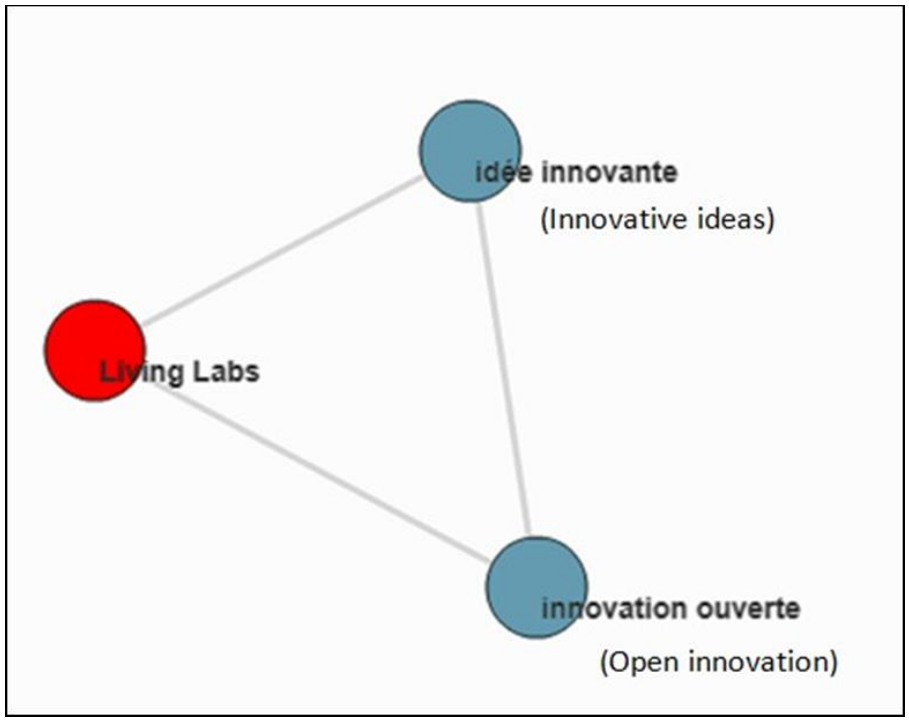


(Source: AMIei software output; NB: analysis is done with French language)

Furthermore, EInnoL is not just a workspace where a series of innovative activities are carried out. On the contrary, it is a space configured to ensure the engagement of all co-workers in the collaborative and open creation of innovative products and services that meet the needs of the global economy in the digital age. This Co-creation dynamic is based, by definition, on the active participation of the different economic actors in the development of innovative systems from the upstream phases (Spagnoli & Van der Graaf 2019). It is applied within EInnoL by engaging the different Co-workers in the Co-creation of innovative products and services that are deployed in the logic of a Smart City. Based on this analysis, we conclude that the configuration of Living Labs plays a fundamental role in the Co-creation of innovative projects. In this work, we move away from the definition of the Living Lab as a simple co-working space and represent it as an incubator configured in a specific way for the Co-creation of innovative projects that are part of the 4.0 generation. This definition seems to be confirmed by the content

analysis carried out with the AMIei software on all the data collected from the Lab's Coworkers (figure 3). This shows that the Living Lab structure is closely correlated with the generation of innovative ideas and the co- creation of open innovations.

Figure n°3: The Living Lab: an innovative projects incubator

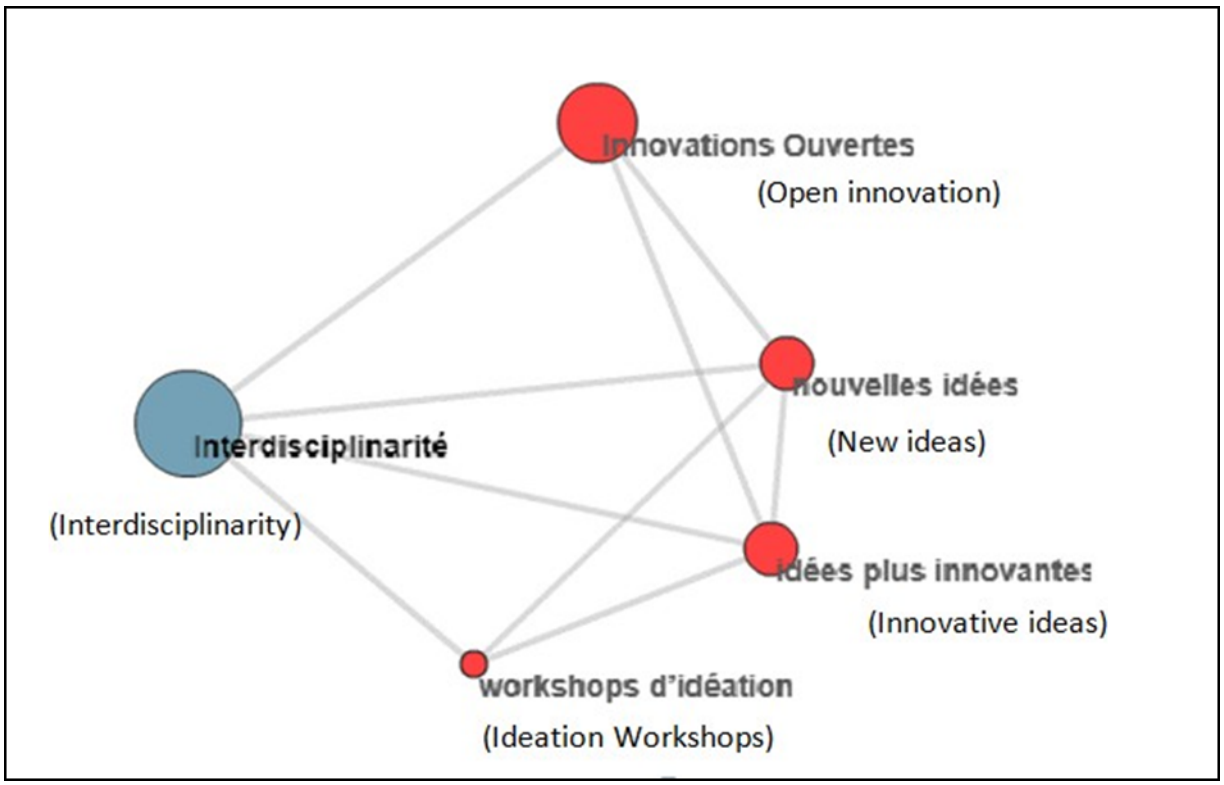


(Source: AMIei software output; NB: analysis is done with French language)

3.4 Diversity of disciplines for better innovative co-creation:

A correlation analysis was carried out on the nine interviewees, resulting in a network of interrelated concepts related to interdisciplinarity. As shown in the figure below (figure 4), interdisciplinarity is directly related to "innovative idea" and "creative spirit". This is explained by the role of interdisciplinarity in the development of the creative spirit of the Coworkers through sharing activities and informational exchanges that take place during the ideation workshops arranged within the Living Lab. Indeed, these workshops are organized in such a way that they ensure the participation of different Coworkers operating in different fields in order to collect more diversified information. The interaction between this information can generate further innovations ensuring the development of innovative projects.

Figure 4: The interdisciplinarity for the Co-creation of innovative ideas



(Source: AMIei software output; NB: analysis is done with French language)

The emergence of a new concept from the empirical and which does not belong to the predefined analysis grid forces us to return to the theory in order to find explanations that reinforce the results of the empirical.

In their study on global knowledge communities in innovation Living Labs, Brinks & Schmidt (2015) argued that the first point that distinguishes these innovation spaces from companies is interdisciplinarity. These authors presented Living Labs as new spaces of creativity and innovation adopting new structures based on interdisciplinary collaborations. These innovation spaces are then characterized by a heterogeneity of professional backgrounds and rapid access to their cognitive bases, which presents social fluctuations and interdisciplinary constellations as constitutive elements of innovation Living Labs (Brinks & Schmidt, 2015). Yet, "the effectiveness of Living Labs in facilitating interdisciplinary collaboration and innovation generation in these Labs has not yet been sufficiently studied" (Brinks & Schmidt, 2015, p.14). In this vein, Ingrid et al, (2015), have also argued that "the coworking space is a step towards

innovation viewed from the perspective of openness, sharing, Co-creation and interdisciplinarity" (Ingrid et al., 2015, p.9).

Furthermore, in their report on openness and collaboration in scientific research, De Vaujany and colleagues (2019) recommended that with the current trend towards global digitalization, new working structures have emerged adopting Coworking principles. So, to cope with this digitalization, nations need to adopt sustainable development strategies based on interdisciplinarity and collective intelligence. They insisted on the development of interdisciplinarity and the mixing of activities in order to increase collaboration and openness to the outside world and respond to global complexity (De Vaujany et al., 2019). This interdisciplinary openness and collaboration will, therefore, increase synergies between different fields and disciplines, ultimately leading to innovative digital co-creations.

Conclusion:

As a result, we consider that the Living Lab structure plays a fundamental role in the co-creation of innovative ideas and projects. This is happening in the case where the Innovation Lab is configured in a way that ensures the commitment of all economic actors in the innovation process from the upstream phases. Through this studied case we retain that the success of a collaborative innovation project is strongly linked to the organizational structure adopted within the Living Lab. A structure that promotes knowledge sharing; because it is through the social-cognitive interactions between co-workers, the innovative ideas emerge and the innovative projects are realized.

Similarly, we arrived through this study to fill the theoretical gap on the role of the Living Lab structure in the co-creation of innovative ideas and the realization of innovative projects. Hence the configuration of Living Labs must be done in a way that ensures the integration of all economic actors in the same space of working.

Also, we have highlighted the place of interdisciplinarity in the effectiveness of creativity and innovation within Living Labs and the role it plays in the success of innovative projects. We admit then that the success of innovation Living Labs depends on the interdisciplinary collaboration that emerges in these spaces by putting at the disposal of the Coworkers a heterogeneous library rich in diversified and complementary information. The mixing and complementarity between these different disciplines will provide a new knowledge base based mainly on the optimal use of collective intelligence and whose mission is to improve the

synergies between Coworkers and the birth of innovative Co-creations that respond to digital needs.

Finally, starting from the qualitative character of this paper which serves to understand in depth the phenomenon of Coworking within innovation Living Labs, our paper remains specific, generating particular results. Indeed, the use of a single embedded case study helps us to understand the operating system of an exclusive model, but we remain far from generalizing the results obtained. To do so, we are obliged to move towards generalization by studying multiple cases whose objective will be to validate the role of interdisciplinarity in the Co-creation of open and collaborative innovations. This places our paper as a starting point for further in-depth research on the Coworking phenomenon.

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