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Abstract: Living Labs are developed in widely diverse innovation domains, based on principles of users involvement and experimentation in 'real-world' contexts, inviting to question the various actors' roles within innovation systems. In the agricultural sector, the implementation of Living Labs may face incumbent routines for experimentation, actors' relationships, and information circulation, as 'users' are mostly farmers already embedded in innovation systems. How, beyond adhesion to inclusiveness principles, the actual practices related to an agricultural Living Lab development make possible to renew or redistribute actors' roles in the innovation process? To address this issue, we realized a case study, following the development of an agricultural Living Lab in Auvergne-Rhône-Alpes Region (France) by one year long immersion and participant observation. Our theoretical approach was to consider the Living Lab as a boundary object supposed to allow actors from different social worlds to work together in a new way, and relying on infrastructures in order to do so. We thus studied the intertwining between various rationales about the innovation model or the territory, the infrastructures on which the innovation process relied, and actors' roles construction. Our findings underline the divergent rationales conserved among the LIT's steering actors, associated with undefined roles, especially for farmers. We further show how these divergent rationales participated in maintaining existing infrastructures of the innovation system, preventing from effectively renewing actors' arrangements and respective roles. Among these, we describe the farmers' workshops, and the information sharing paths, both limiting the ownership of the process by non-incumbent actors. Complementarily to the distinctions of various roles in literature, we contribute to relate potentially neglected aspects of the Living Lab management (because not judged strategical) to the room for manoeuvre and possibilities for enactment of expected actors' roles. We finally discuss the relevant skills and their distribution among actors that our findings suggest for the development of an agricultural Living Lab within an existing innovation system.

Keywords: living labs; stakeholderness; regional innovation system; infrastructures; role making processes; boundary object.

Highlights:

- We develop a framework to study an agro-Living Lab as a boundary object.
- An agro-Living Lab built by incumbent actors of the innovation system is studied through a one-year immersion observation.
- We underline divergent rationales regarding two notions underlying its design: innovation processes and territory.
- Divergent rationales prevent the infrastructures of the innovation system and the arrangement of actors from being questioned.
- We point out the governance issues in such agro-Living Lab in order to create room for redefining the roles of the actors.

1. Introduction

The multiple calls for agroecological transition and climate change adaptation and mitigation have renewed the concerns about the impacts of agricultural sciences on farming system transformations, and how the impacts pathways result from diverse forms of dynamic relations between scientific actors and other stakeholders (Matt et al., 2017). The development of a capacity for innovation is considered to be a means for achieving transitions in farming practices. Systemic models of innovation have recently conceptualized it as a distributed process among a diversity of actors. One of these later ones, that has widely been included in the strategic orientations of agricultural research institutes or policy advice reports is the "Living Laboratory" or "Living Lab". This model is seen as a driver of new forms of experimentation in various European innovation policies and research projects (Ark and Smyrl, 2017). Although no single definition exists (Hossain et al., 2019; Leminen et al., 2012) the term of Living Lab generally stands for an organization of actors dedicated to an open-innovation process, and which follow core principles:

- a granting of major roles and process ownership to direct or indirect users (often translated into upstream involvement of users in the design and knowledge production activities);
- the "real-world settings" in which occurs "co-creation" between scientists, public decision makers, private sector and citizens.
- This model is sometimes identified by the fact that "users" are considered to be "carriers" of the innovation process (Dubé et al., 2014; Janin and Pecqueur, 2017).
- References to Living Labs also suggest the building of new spaces for the co-production of knowledge and experimental environments (Ballon et al., 2005).
- Above all, they highlight faster completion of innovations on the market, and optimized adaptation to the real needs of users in their living conditions.

This model adds to an existing variety of innovation management processes (e.g. real-world labs, transition labs, social innovation labs) that share the same purpose of building "spaces that facilitate explicit experimentation and learning based on participation and user involvement" (Voytenko et al., 2016). However, the anchoring of Living Labs in particular places is seldom addressed as a determinant stake in the Living Lab literature, as argued by Lafontaine (Lafontaine, 2017). The space created varies in definitions from an "experimentation environment" (Ballon et al., 2005), to more specifically a building or an university campus (Evans et al., 2015) or a city district. Territorial aspects are sometimes valued as resources for experimentation and facilitating factors, namely in the case of urban Living Labs for which the concentration of actors (e.g. individuals, private sector organisations, community groups and government), infrastructures, economic and cultural resources are valued (Evans and Karvonen, 2011; McFarlane, 2011). They are also associated to the "sense of place" that is created and intervenes into the local saliency and sustainability of innovations (Frantzeskaki et al., 2018). Recent work on what has been called "agroecosystem Living Lab" underlines the specificities of agricultural Living Labs to be anchored in territories, in "connection with nature and the living system" (McPhee et al., 2021), and in "places" that should be considered broader than farms or agroecosystems given the interactions with larger agri-food systems. Territorial aspects are much more rarely mentioned in terms of already existing realities with which a newly created Living Labs should intertwin (see Santoro and Conte, 2009 for an exception), or as

effects of the implementation of Living Labs on the construction of collectives desired (Lafontaine, 2017), especially in the case of rural Living Labs (Lovell et al., 2018).

The explicit reference to participation and involvement of a large number of actors induce a major challenge: how to organize and establish an innovation process among a large number of heterogeneous participants? In other words, how to ensure that the living lab support the inclusion of a diversity of collective and individual actors? This issue calls for more specific attention on how, within Living Labs, the various actors come to act legitimately, often with roles and expected participation different from the dominant practices in existing innovation systems.

Beyond the case of agricultural living labs and more generally in a cross sectorial perspective, research has characterized actors' roles within Living Labs quite precisely (Leminen et al., 2015; Menny et al., 2018; Nyström et al., 2014; Puerari et al., 2018). These studies identify distinct roles according to specific functions within the innovation process, rather than institutional positions, and underline key roles of intermediaries (e.g. "gatekeeper", "messenger", "facilitator"). They also describe various degrees of "user" or "end-user" involvement by differentiating between the forms of interaction and the phases of the process at which involvement is called for (e.g. design, implementation, evaluation; Menny et al., 2018). Nyström et al. (2014) distinguish, for instance, the "informant" (who brings users' knowledge, opinions, behavior and preferences to the Living Lab), the "tester" (who tests innovations in customers' real-life environments), the "contributor" (who collaborates intensively with other actors to develop new products or services, as in a user-centric design approach), and the "co-creator" (who co-designs the product or service, in a more user-driven innovation process).

Research on innovation in agriculture have underlined that new roles in more collaborative innovation process may require new skills and training, namely for advisors who interact in novel partnerships and are supposed to recognize and manage social processes (e.g. Cristiano et al., 2015). Others have described, in a more processual approach, how the power relations in innovation platforms (developed in an incumbent innovation system) impact on redistribution of actors' roles. Turner et al. (2020), for instance, showed that Innovation Platforms may struggle changing the regime of innovation when "actors use existing power relations and mobilise resources to maintain existing role perceptions."

However, in these different approaches, roles are conceived as consciously decided for others, or as resulting from the deliberate mobilization of resources and power positions for maintaining or building new positions and legitimacies. Thus, little is known about the process through which these various roles emerge and the drivers that engenders a spontaneous or deliberate role setting-up in innovation activities. The process of establishing multiple and more active roles is in line with principles of users' involvement, which is supposed to be focal in the concept of a Living Lab. But it received little attention in previous Living Labs case studies.

In this study, we analyse how the various actors' roles perceptions and actual enactment occurred throughout the development of an agricultural Living Lab in Auvergne-Rhône-Alpes Region (France), developed with an explicit anchoring in a defined geographical territory in terms of experimental sites and value creation (even if innovator actors may come from outside the delineated territory). This research is

based on a strong and long-term immersion in the field and a participant observation methodology. This approach enables us to analyze more specifically the actual practices of actors within the innovation process and the infrastructures supporting them. Our purpose was to query: What practices and infrastructures (e.g. types of events and their management, projects and tests follow-up and evaluation, information circulation), beyond decisions applied by the steering actors, participate in building actors' roles – and particularly farmers' roles – within the Living Lab? How are these practices related to diverse innovation rationales and representations of the territory[1] concerned by the innovation process?

The analytical framework we applied is first presented to describe how we analyse (i) the roles within the innovation process as the outcomes of interwoven rationales about innovation processes and more specifically Living Labs, (ii) the representations of the existing of expected agricultural territory, and (iii) some concrete practices and communication infrastructures. We then present the case study, insisting on the Living Lab's structure and main monitoring and experimentation practices of the innovation process embedded in the Living Lab. We underline the diverse interpretations and rationales about what this particular Living Lab is or should be according to the actors and their representations of the territory. Finally, we analyze how some communication infrastructure aspects constitute hindrances in the enactment of expected or assigned roles (namely farmers' roles).

2 Theoretical and methodological framework

The theoretical inspiration for our study echoes to a school of thought in innovation systems and to Metzger et al. (2017) who "suggest that an outcome of any participatory process is a variegated attribution of the property of 'stakeholderness' (the property of being considered legitimately concerned) to a set of engaged actors at a concrete time and place and in relation to a specific issue or set of issues". Using this paradigm in the particular case of Living Lab, we will thus consider the actors' roles within the Living Lab open innovation process, their enactment and redistribution, as also resulting from the concrete sets of practices and from the existing structures of the innovation system, thus being only partly deliberate and consciously enacted processes.

The Living Lab principles are explicit about users' role in the innovation, who are supposed to be at the center or even leaders of the process. Other actors roles have also received attention, and more and more refined typologies of encountered roles were produce to interpret the actors' actions and coordination (e.g. Nyström et al., 2014; Sopjani et al., 2019). These descriptive typologies are seldom addressing how different roles are being enacted as the outcome of specific aspects of the innovation process. Some authors adopt a more processual approach, recognizing role taking and role making mechanisms, and associating the radical innovation outcomes to situations in which users use resources to make their *co-creator* role (Leminen et al., 2015). The distinctions between various functions provided by these studies is a support in recognizing the categories used by the interviewed actors in our case-study. But they are limited in supporting the analysis of roles as the outcomes of conflicting visions (including about who "users" are),

[1] Territory refers here to a physical and material area combined with the visions and organizations which co-exist on this area.

actual practices for participation and coordination of actors. Yet, it seems all the more appropriate to adopt a constructive approach of these roles, since the development of a Living Lab can be interpreted as an attempt to nurture a niche of innovation practices within an incumbent regime of rules, representations of innovation, and prevailing norms. The anchoring of such new practices thus rely on continuous and emergent interactions between the Living Lab and the incumbent regime, which include power positions but also interactions as they unfold with a variety of actors and non-human actants (Elzen et al., 2012; Pigford et al., 2018).

The concept of "boundary object" (Star and Griesemer, 1989) was developed at first in order to analyse, beyond standardization, what makes possible for diverse actors (administrators, managers, researchers, amateurs, politicians, citizens) to work together. Boundary objects are both abstract and concrete objects, with a structure being common enough for different social worlds to work together, and flexible enough to adapt to their respective constraints. Boundary objects thus refer both to an interpretative flexibility, and to a minimum knowledge infrastructure (e.g. norms, communication infrastructures, forms of knowledge). Considering the Living Lab as a boundary object under dynamic construction between the various actors, we thus anchor our analysis both on the various rationales about what the innovation process and its context are, or their envisioned futures, and the infrastructures on which the actual participation and innovation practices rely. Such approach was advocated and showed relevant in several studies of participatory processes (Felt et al., 2012; Metzger et al., 2017). In fact, we analyse the building of roles through a description of the various rationales about what the Living Lab should be and its connection to the territory, in interaction with an analysis of various infrastructures that constitute the concrete context of innovation practices. We more particularly apply this boundary object concept to underline the difficulties that the Living Lab encounter to effectively become one (i.e. a new setting which would allow the various actors to work in interaction in new fashion), the infrastructures involved acting as hindrances to the articulation of social worlds involved.

Concerning the rationales about what the innovation process is or should be, and about the representations of the territory, our theoretical framework is also inspired by studies on cultures and "imaginaries of innovation" (Pfotenhauer and Jasanoff, 2017), which show how such imaginaries are involved in the appropriation of innovation practice models, and combine "diagnoses" and "cures" associated to the innovation processes in particular contexts. We analysed how discourses and actions within the Living Lab reveal actors' diagnoses about the innovation processes in the particular territory, and cures that the Living Lab and new territory envisioned would represent. Rationales about the Living Lab innovation model are, for instance, expressed in terms of values related to "users" participation, expected performances and features of the innovation process, comparative advantages of a new innovation organization imagined. Rationales concerning the territory are, for instance, rather expressed in terms of experimentation facilities, data production and storage devices, or attractiveness for external innovators.

Concerning the infrastructures that support the practices unfolding within the innovation process, we refer to the concept of infrastructure as proposed by Star and Ruhdeler (1996), corresponding to the often embedded and invisible structures that constitute the backstage upon which actions unfold. These infrastructures are incorporating standards and routines that communities of practice share, and become

visible when not working or constituting a hindrance (such as a broken electricity network). In an innovation process, these infrastructures may be understood as the routines in actors' interactions and communication, the devices and contexts created for particular actions, the material and analytical supports applied in experimental settings.

3 Case study and methodology

The Living Lab that we analysed, called the "Laboratoire d'Innovation Territorial Grandes Cultures en Auvergne" (meaning "territorial innovation laboratory for arable crops in Auvergne", hereafter referred to as "LIT", "Living Lab" referring to the generic model), is a structured partnership in the form of an association that now brings together eight major incumbent actors of the regional agricultural innovation system which has been progressively established before the LIT creation: a private company (linked to an agricultural cooperative), two branch offices of national agricultural and environmental research institutes, an agricultural graduate school, an innovation cluster, the branch offices of agricultural advisory services and technical institutes, and a local authority. In France, the agricultural knowledge and innovation systems are based on both public and private organisations. The Chambers of Agriculture were granted the public responsibility for agricultural extension, and function locally with targeted trainings and farmers groups facilitation (Labarthe, 2009). Besides, farmers cooperatives or private groups also invest in experimental stations and advisory services dedicated to their members. These organisations sometimes connect with applied research institutes and agricultural education organisations mostly within the framework of financed projects, for limited periods (Labarthe and Laurent, 2013). In the region targeted by the LIT, and before its creation, the infrastructures on which the extension and innovation systems relied were representative of these general trends (Mundler et al., 2006): although few farmers with representative functions were participating in various collective activities, but most innovation and extension projects were led independently by the various organizations, with only limited information transfers between them (e.g. on experimentations implemented and results). Our methodology did not allow for a in-depth diagnosis of the local innovation systems and its infrastructures before the implementation of the LIT. We compared the observations to the general trends described before, and used the analysis of specific infrastructures applied by the LIT, and their potential dysfunction, as a means for revealing the dynamics or resistances of particular infrastructures in the local innovation system.

The idea of this LIT emerged in 2016 between local representatives of the two research institutes and the private company, in line with a national policy orientation towards encouraging public-private-user partnerships. Soon, the other institutions were invited to join the initiative, in order to gather all the representative actors of the local agricultural knowledge and innovation system (as described heretofore). A "strategic committee" is made up of members of these institutions (e.g. the innovation director from the private company, the heads of the research centres, city counsellors, the director of the cluster), but no farmers. This "strategic committee" essentially takes decisions for the LIT, referring explicitly to the "Living Lab method" and aiming to organize support for innovation projects involving "farmers and other users of the territory". To this end, it has adopted a "charter" and has structured the organization of various committees and events intended to involve farmers and citizens. Two full-time facilitators operationally run

the LIT (e.g. organize events and meetings, interact with all stakeholders) (Figure 1). The LIT supported about ten innovation projects (seven financially) at the time of our study, which involve different forms of partnership between academics, farmers, private companies and associations.

One of the authors carried on a participatory observation based on a long-term immersion into the LIT collective studied (approximately one year, from January 2019 to February 2020). He took part to various Living Lab events (i.e. steering committee's meetings, events open to all citizens, farmers' committee meetings, specific project groups' activities and meetings, etc). He did not have any official membership to the LIT's steering groups, nor legitimacy to influence decisions. The observations were combined with semi-structured interviews with each actors' categories (facilitators, strategic committee members, project participants, open events participants, and other local stakeholders), and complemented by documentary analyses (e.g. LIT framework notes, "charter", activity reports, projects or proposal evaluations, event attendance lists). This approach allowed us to focus on the processes and transformations of the community of actors concerned (Louvel, 2008).

Our analysis aims to identify, within the LIT's specific trajectory, the extent to which the building of new roles is related to the Living Lab, as a boundary object. Therefore, it does not aim to define a general model of the evolution of an organization such as an agricultural Living Lab. We choose a qualitative methodology approach and coded the interview transcripts in an inductive and iterative way. First, analytical themes were inspired by the existing categories used to describe actors' roles within Living Labs (Janin et al., 2013; Leminen et al., 2015; Nyström et al., 2014). These were a support to identify the categories used by the interviewed actors to point at partners, and "users" more particularly, and to describe their actions and functions. Concerning the rationales for innovation, we also oriented the coding towards themes pertaining to the diagnosis of a deficit and the related need for new innovation processes, namely regarding the partnerships and the local agricultural innovation requirements and perspectives, knowledge and experimentations. These concerned, for instance, the types of innovation projects and innovators commonly envisioned, and the project selection and follow-up procedures. Finally, the coding of interviews also focused on all discourses related to the territory in terms of diagnoses, identified specificities and problematics, particularities of the existing actors and agricultural innovation dynamics or societal issues. Such focus on specific themes is in line with our intent not to separate the explicit assignment of roles (deduced from general Living Lab principles) from the practices and infrastructures actually implemented. We finally cross-compared the uses and meaning of the most frequent terms and categories used in speech, with those observed in events, written documents and procedure frameworks. We present the results of this analysis in the following section.

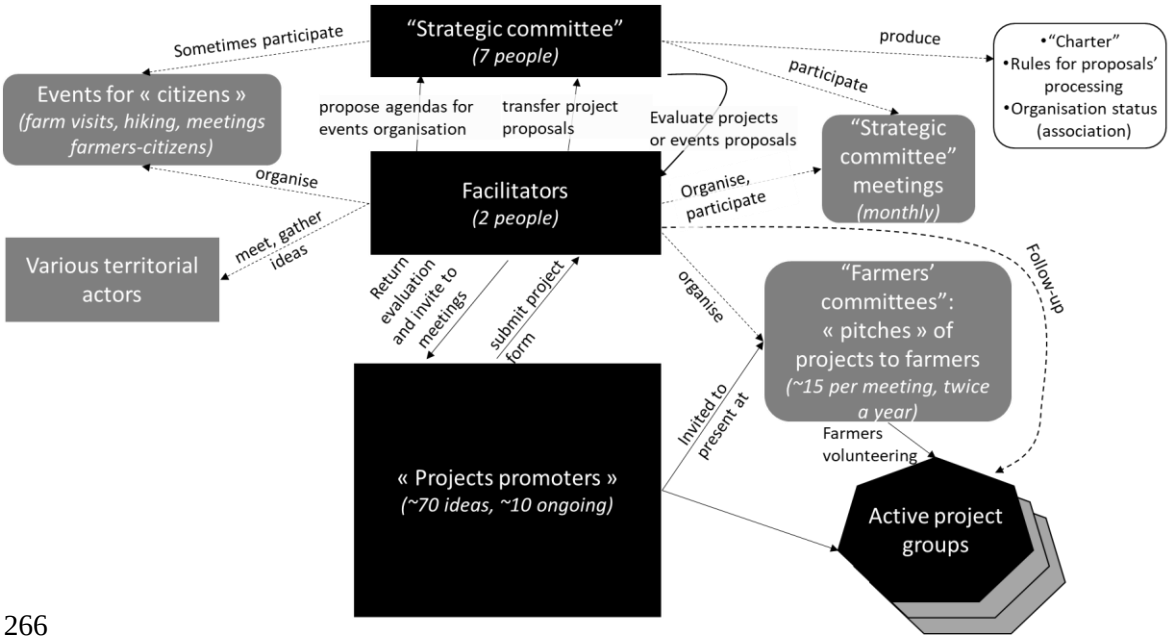

Figure 1 Diagram of the LIT's organization. The terms mentioned with quotation marks are the ones used by the actors. The black rectangles correspond to the groups of actors whose composition is relatively stable in the process. The grey rectangles with round edges represent events that are more occasional and without stable collectives. The grey rectangle "various territorial actors" represent occasional consultation of varying actors. The white rectangle with round edges represents rules and documents stabilising the LIT's functioning. The full arrows indicate actions or exchanges directly related to the evolution of a "project" in the innovation process. The dotted arrows show other forms of production and support for the organization.

4 The various interpretations of what the LIT is or should be and resulting roles

4.1. The formal organisation of the LIT as set out in shared documents and rules

The structure of the LIT can be analysed following the path of innovation proposals and projects throughout various actors' groups and events, as depicted in Figure 1. We first provide a description of this structure of the innovation process and then present the competing interpretations of it by the actors involved.

The LIT organizes and standardizes the process for the development of innovations, in a deliberately different manner than what happens usually on the same territory. It has adopted a "charter", available to people interested in proposing a project, that indicates deliberately broad target themes (e.g. "improving farmers' working conditions", "reducing and/or optimizing the use of plant protection products", "optimizing land management at territorial level") and stresses that "the project must involve farmers and/or other users of the territory from the problematization phase and/or the design and/or prototyping of the innovative solutions envisaged". This "charter" and an "evaluation grid" for project proposals serve as a common reference for each member of the "strategic committee" for the decision to support a given project and allow it to be presented to a "farmers' committee" (Figure 1). This decision is transmitted to the "project leaders" by the facilitators, who invite them to perform a 15-minutes "pitch". The "farmers' committees" bring together farmers without constituting a stable collective (~15 farmers per meeting, only a quarter of whom regularly attend meetings). The potential wide diversity of farmers invited to these

events intends to create new spaces for projects presentations and discussions, as the previous collectives were mostly corresponding to groups of farmers facilitated by an advisor or a hired technician. The project "pitches" must explicitly state the interest for the project leader to involve farmers and the expected form of this involvement. At the end of meetings, a questionnaire can be handed out for farmers to indicate their willingness to be informed or to participate in the various projects. Ongoing projects are followed up by one of the two facilitators, but without any specific formal monitoring procedure. The dotted line in Figure 1 suggests this unequally performed follow-up, and the difficulty for facilitators to gather information on each project's progress. It also shows that facilitators are the only ones supposed to carry out this follow-up, and no member of the "strategic committee" officially interacts directly with the project leaders. Finally, another part of the LIT's activities consists in organizing one-off events targeting "citizens" or other "actors of the territory". Such events did not have exact equivalents within the LIT's territory before its implementation, at least not with the same target audience and status in the innovation process. These include hikes comprising a farm visit (without an explicit link to one of the LIT projects); and farm visits followed by discussions during a lunch at the farm, allowing for interaction between farmers and other actors. Members of the "strategic committee" rarely participate in these events, which are not related to "farmers' committees". We emphasize, with that description, that the structuring of innovation process relies not only on operating rules stated in documents (e.g. "charter", "evaluation grid", internal framing notes), but also on the way information circulates between the different groups of stakeholders and events organized within the LIT. Some infrastructures allowing this circulation of information were pre-existing (e.g. the contact lists and paths of e-mail diffusion used by the agricultural advisory services), and some were deliberately built for the LIT's activities (e.g. regular meetings on a new format that correspond to the "farmers' committees"; one-off events gathering local inhabitants, farmers, private actors and researchers).

4.2. Diverging rationales for the LIT innovation model and the territory

The first elements of our theoretical framework make possible to reveal five types of rationales (concerning the Living Lab innovation model and the territory) associated to diverging actors' roles, which we more specifically illustrate concerning farmers' roles (Table 1). In this section, we describe and illustrate each rationale with collected discourses and other data.

The first one is revealed, for instance, in an activity report written by facilitators, in which the LIT's ambition was explained as follows:

"*Concretely, the project consists in creating a space for the reception and emergence of projects aimed at designing, evaluating and disseminating innovative solutions (products, services, etc.) inspired by the principles of agro-ecology, in a process of co-creation with farmers and in connection with the other actors of the territory*"[2].

The LIT's website sums up this ambition with the idea of "making its territory an area of excellence in pioneering arable crops in Europe". These statements reflect the generic characteristics of Living Labs (public-private partnerships, co-creation with users, experimentation in real conditions), and constitute a

[2] All discourse translations are ours.

basis on which the leaders and members of the strategic committee find ways to work together. This common basis appears in the "charter" or in the internal framework notes on the formalization of the process described above. The use of the term "excellence" is significant, and corresponds namely for the private company to the desire to build and maintain a "leader" position, and to secure recognition of what is "differentiating" in a competitive innovation world:

"*What is interesting in this is to be able to claim a place as a leader. And the leadership position will obviously be achieved through scientific work on robotics, autonomy, etc., but as far as innovation is concerned, we will be all the stronger if we can go as far as innovation*" ("strategic committee" member, researcher).

"*There is one thing [that competitors] do not have and that we have, and that is the fact of being a cooperative, and having this link with the customers of the business. So I thought the Living Lab is great, because it's a way to stand out from our competitors, it's a modern, efficient way to innovate*" ("strategic committee" member, from private company)

This reference to a leadership position is not unrelated to the fact that this LIT was proposed in 2016 by the Ministry of Agriculture as one of the "pilots" at national level (explicitly pointed out in the LIT's 2017 annual report). These interpretations of the interest of the LIT envision it as an accelerator and a demarcation factor in a competitive world of innovation (i, Table 1).

The Living Lab model is also associated with a desire for efficient innovation organization, based on a new methodological mastery with an emphasis on farmers as partners to whom innovation processes are open. The farmers' involvement would have value in and of itself to promote innovation projects. This is also consistent with the vision of the LIT as an alternative mechanism for obtaining project financing, legitimized by "access" to farmers (ii, Table 1). For example, the city counsellors view in the LIT a vehicle for financing projects that promote SMEs in the region. A service project based on the use of weather data, led by a start-up previously supported by a local incubator, is now funded by the LIT on the basis of proposed experimentation with farmers. In these first two visions of the LIT, the possibilities of an "access" to farmers are highlighted, although farmers' role is not defined clearly in terms of practices, but rather passively as resources.

A corollary to the desire to demarcate and make effective the innovation associated with the take-up of the Living Lab model, is a desire to increase attractiveness for innovators. This time, it appears less explicitly in the documents produced by the LIT than in the way of thinking about tools and confidentiality rules for innovation. An actor in the private company (who participated in the writing of the LIT framing notes) expresses the ambition to create an "*attractive tool, which allows carriers to come and test an idea in the territory*". This ambition is specified in the form of a "digital infrastructure" project for the territory, which appears, and is sometimes expressed, as a transposition of the concept of "smart city":

"*Behind the word smart-city, there is the idea of aggregating data and then delivering them as food for thought to those who want to use them to do things. The idea was to transpose this idea of smart city to a much larger and different space that was an agricultural territory*" (member of the "strategic committee", private company).

The desire for high-performance tools is therefore closely linked to the hope of attracting innovators of excellence and ensuring not to "harvest second-division innovations" (“strategic committee” meeting, 10-9-2019). The vision of the LIT as a means of developing the attractiveness and value of the territory (iii, Table 1) is revealed here. The farmers or local citizens are not priority actors in the emergence of innovative technologies or ideas, which is perceived as exogenous. They rather act on the possibility of validating either the relevance of specific innovations for particular uses, or their integration into practices. Thus, the potential co-creation boils down to producing the modalities of such integration.

The visions of the LIT that we have described above conceive an imagined territory (i.e. equipped with attractive infrastructures, valued for an increased capacity for innovation and “access” to farmers), resulting in an unspecified theme in the “charter”. However, disagreements among the “strategic committee” members appeared when they examined the first project proposals received, and the existing territory became a subject of negotiation between the normative visions of the LIT. For instance, a sociotechnical and agronomic diagnosis of this territory was advocated by the member of the “strategic committee” representing the graduate school of agronomy as a way of defining an "identity" of the LIT around key issues, while others feared a risk of reducing the scope for attractiveness and of imposing directionality. This desire to define the "identity" of the LIT was also linked to a diagnosed specificity of the territory: a limited social acceptance of agricultural practices. This is also what guides the organization of events dedicated to "citizens", for which the second facilitator was recruited. According to the representative of the graduate school of agronomy, these events were organized so that farmers and "*the inhabitants of the territory will also, one day, be project leaders*". It is thus a vision of the LIT as a driving force for the rebuilding of links between various actors in the territory (iv, Table 1) that appears. The territory becomes both a place where tensions between agricultural professionals and other inhabitants are structuring elements of the identity of the LIT, and a space that must be "appropriated" by a larger number of actors. The roles assigned to farmers by this vision of the LIT are then, at a minimum, those of communicators on the lived realities of the agricultural profession, and potentially, those of being a source of proposals (in consultation with other citizens) for the orientation of desirable innovations.

In fact, the events dedicated to "citizens" are considered by others, namely research and engineering representatives, as ways of building the acceptability of the technologies developed within the LIT. This is reflected in a question by a representative of research institute to the facilitator, regarding a hiking route: "Does it pass next to a plot where new sensors are installed?”. Acceptability is more widely associated with the testing of prototypes with farmers as the main activity of the LIT. Thus, another member of the “strategic committee” representative of research institute sees this as a way to avoid the refusal of a technology proposed by scientists:

"*If you present something that does not yet work well, you are wasting your time and credibility. If, on the other hand, you manage to implement systems or equipment that are already functional, you will be able to validate concepts, and validate the concept with witnesses that will not be direct users. The LIT must be able to allow that. I don't see how we can do without it. To develop the technique, you don't need the LIT, clearly*".

These other interpretations of organized interactions with farmers and other citizens reflect a vision of the LIT as a vector for the facilitated appropriation of new technologies and practices (v, Table 1). The role assigned to farmers is then strictly related to their profession, and not to their citizenship in the territory. A solution presented is relevant according to the advantages for the practice, and not for the coherence with a vision of the territory carried out with non-farmer inhabitants.

Table 1: Summary table of the rationales for the Living Lab model, the territory, and the farmers' roles they suggest

Normative visions of a Living Lab	Representations of the territory	Suggested roles for farmers
(i) accelerator and demarcation factor in a competitive world of innovation	Foresight: place of excellence and leader Particularity not related to existing initiatives and issues	Efficiency factors: their participation has a value in itself to differentiate the innovation method
(ii) alternative means of obtaining project financing, legitimized by "access" to farmers	Carrier of an innovation ecosystem: local entrepreneurs, a cooperative that "gives access" to farmers	Efficiency factors: their participation has a value in itself to differentiate the innovation method
(iii) a means of developing the attractiveness and value of the territory	Foresight: infrastructures (digital, relational) favouring the testing of exogenous innovations	Confidential receivers: bearers of expectations and needs, testers of relevance and possibility of adaptation in practice.
(iv) driving the rebuilding of links between various actors in the territory	Carriers of socio-professional tensions	Agricultural citizens: promoters of initiatives and innovation projects
(v) a vehicle for facilitating the take-up of new technologies and practices	Demonstration site: support of a proof of concept with direct and indirect users	Prototype acceptors: interested in interacting from functional technologies

The variations between the actors' interpretations of what the LIT is are significant. It goes along with a diversity of roles suggested for types of actors, as we illustrate it more particularly concerning farmers. This is particularly clear between the visions (iii) and (iv), opposing the roles of farmers as receivers of technologies, with those of farmers as promoters, jointly with other citizens, of innovation directionality. When the interpretative flexibility of boundary objects is more often described as what make possible for different social world to work in coordination, in our analysis, underlying such flexibility is meant to show the difficulty to build the LIT, and the related indeterminacy of actors' roles. But the hindrances for the processes of roles making or renewing within the LIT are not only related to these diverse visions and roles implied for users. They also lie in the functioning of the infrastructures that the LIT is relying on, building or trying to transform, with limited success. Indeed, the lack of alignment and explicit staging of the various rationales described hereabove did not allow for a coordinate questioning of existing infrastructures (for instance, the ones supporting the circulation of information among the agricultural actors within the territory such as mailing lists, newsletters, etc.), nor for coherent vision for the new infrastructures intended, which we describe in next section. In fact, we underline how this lack of questioning or coherent and explicit building of communication infrastructures hindered the processes of roles renewing, especially regarding farmers' roles. We describe some statically functioning aspects but in contrast with what the steering actors intended.

5 The communication infrastructures involved in the enactment of actors' roles within the LIT

As an organisation aiming to transform the ways various actors related to the agricultural sector work and innovate together, the LIT is both using previously existing modes of communication and information sharing (either being aware of them or not), and trying to create new spaces or devices for such sharing. Analysing the LIT as a boundary object also enables us to account for the inertia and impact of communication infrastructures on role making processes. To illustrate this, we select three aspects of such infrastructures' inertia or unquestioned impacts for the LIT innovation process.

5.1. The "farmers' committee" and their status from various actors' points of view

Expected to be open arenas for innovation projects deliberation starting with ideas either from scientists or other promoters, the "farmers committees" faced several failures in transforming the infrastructures for communication that it relies on or corresponds to. The novelty of the type of meeting intended was poorly argued by the organizers, compared to the existing similar events within the regional agricultural innovation system. It could happen, independently from the LIT, that a stabilized group of farmers and their advisors would invite an expert (e.g. a researcher, a research and development agent from a company) to present his or her work. Although, these were more confined to the specific farmers' group activities, and not explicitly targeting deliberation on innovation projects. The status of "farmers committees" was interpreted differently by the various actors participating in these events, and was never made completely clear by the "strategic committee". The promoters of new project ideas mostly understood these "farmers committees" as meetings of the actors in charge of steering the activities of the LIT, whereas the members of the actual "strategic committee" were seldom more than one attending these events. Agricultural advisors and intermediaries interpreted these meetings as information points on progresses made within the LIT. They were thus either enjoining farmers to behave mostly as receivers and potential judges of relevance of already designed ideas, or being sent by their farmers' group to collect potentially relevant information, reflecting the traditional functioning of the advisory infrastructure in the territory. Meanwhile, the members of the "steering committee" regularly underlined the "farmers' committees" as a key element of the applied "living lab methodology", that is targeting an active and decisive participation of farmers into the innovation development. Such misunderstanding was a hindrance for these committees to renew the modes of communication between the actors in presence, that is to build a completely new and effective infrastructure. It was partly due to the channels of communication used to publicize the events, and the poorly specified description of what it was intended to be. First, no specific place was used, which may have contributed to the poor identification of its identity and purpose (every new edition of this event was in new places, with new presenters). Second, the invitation wording for these events was shortly describing the goals, but not the status of such meeting in relation with the existing development and innovation farmers groups, nor the diversity of actors expected to be present and their institutional affiliation. Invitations to the farmers mentioned:

> "*The project promoters are waiting to meet you and to talk to you, so that their projects can evolve according to your needs! This will be an opportunity for you to get to know innovative projects in your area and to make your contribution!*".

This made explicit the fact that farmers were expected to give their impression on solutions presented and express their own needs, assigning them to an informant role or potential tester role rather than to the one of a co-creator.

As a result of these various aspects, the organization of "farmers' committees" was facing the inertia of infrastructures it was relying on, thus failing to create a new one, namely a new arena for multi-actor projects deliberations. The different rationales for the LIT described before would not translate the same way in the organisation of such “farmers’ committees”, and as these differences were kept implicit, the organization and modalities of these committees was not a straightforward task for the two facilitators. In fact, it was never clear to them whether these temporary events were thought to be “epistemic spaces of participation” in Felt’s sense, that is places “where co-investigation take place” (Felt et al., 2012), or spaces of representation, of exchanging data and information, of feedback.

5.2. Communication channels and their entanglement into the organization of the incumbent knowledge and innovation system’s actors

The reason for the misunderstanding about the “farmers’ committees” described above relates to the communication channels used to circulate information. As no specific physical place was built to welcome the Living Lab partners and visitors[3], the communication strategies and technologies were decisive in the sense that they not only determine who access information, but also contribute to reproduce power relations and role distributions existing within the prevalent innovation system. Such impacts of information paths on the opportunities for modifying the innovation process appear clearly when tracking the information dedicated to farmers and “citizens”: invitations and newsletters were addressed by the LIT facilitators to the regional advisory services, in addition to the few farmers and project promoters already added to their own contact lists. The regional advisory services could spread the information to intermediaries and advisors or other partners, but do not have access to the farmers contacts, thus transferred information to the various districts’ services. These more local services eventually filtrated information judged of interest for the farmers they are in contact with. The *gatekeepers’* roles within the advisory system were thus conserved, and largely limited the ownership farmers could develop regarding the LIT and their active integration into innovation projects conducted within it.

The LIT’s animators only lately got aware of this incomplete distribution of information due to a control by incumbent intermediaries within the territory and the existing infrastructure for information diffusion among farmers and advisors. Intermediary actors of the existing agricultural innovation system were, at first, not particularly assigned a position within the LIT. Their way of controlling the information from the LIT may be interpreted less as a mistrust than as the classic way of maintaining their position and legitimacy towards the farmers they advise and their other partners. They were mostly unaware of the types of innovation the LIT was targeting, and their possible interest in interacting with it. Significantly, a meeting organised between the LIT facilitators and few of these intermediaries in July 2019 gave rise to

[3] The functions of a physical space within a Living Lab can be discussed regarding widely diverse aspects. Here, we simply underline its absence as a constraint for opportunities to actors who do not know each other, and were not in contact previously, to exchange contact information without using the existing contact lists and databases.

lengthy discussions to clarify what can be considered as an innovation "project" within the LIT, revealing the weak connection intermediaries had with the LIT until then. More generally, among the “strategic committee”, the members were mostly representing large organisations (e.g. research centres, graduate school, farmers cooperative and a private group), and as such, they were expected to relay information to these organisations in order to promote the expected setup of new innovation practices and new actors’ legitimacies and roles among these organisations. But until late stages in the building of the LIT, discussions among this “strategic committee” showed disappointment about the fact that the LIT was hardly known within these organisations, and that no clear and common way of circulating useful information was setup.

The same type of hindrance to the redistribution of roles between actors was observed in relation to the embedded circulation of information through the farmers cooperative and towards large audiences. For instance, when facilitators had to organize a hike throughout fields within a farm (one of the LIT’s events targeting “citizens”), they had to identify a farmer agreeing to welcome the event. In relation to this aim, they contacted the farmers’ cooperative, and were referred to the communications officer who is classically in charge with the dissemination of information to the general audience. As usual, he therefore selected a farmer with strong communication skills, and brought to the event the information panels classically used by the cooperative agents. In addition, he complemented or reoriented the farmer’s discourse on his practices during the farm visit, in line with the classical communication strategy from the cooperative. This pre-existing communication infrastructure from the cooperative was not questioned regarding its effects in terms of which farmers get integrated into the organized events. Again, with the intention of building new arenas for actors encounters and collective deliberation, the LIT’s facilitators faced (without noticing their impacts) the embedded channels of communication structured within the main farmers’ cooperative in the region (and the related control on the visibility and acceptability of their practices for the general audience). The farmer’s appropriation of his own posture during the event was limited by the described elements of this pre-established communication strategy.

5.3. Information exchange and evaluation tools applied in a cropping systems trial project

In 2015, an agriculture and environment project officer from the regional advisory services started a project dedicated to the design and testing of cropping systems on several farms dispatched locally. The project promoter's intention was to carry out experiments on cropping systems with existing farmers’ groups, in order to encourage the dissemination of practices, and with "*the idea that the farmer should be in a collective dynamics to be able to reason and set up an innovative cropping system*" (project promoter, LIT’s “strategic committee” member from the agricultural advisory services). The project was then integrated into the LIT. Farmers were assigned a role combining the acceptance and dissemination of cropping system prototypes with, to a certain extent, the production of these prototypes and their implementation for tests. The organizers saw the benefits of experimentation on farms as in the fact that it "*encouraged the application of techniques and commitment to change, and stimulated relations between advisors and farmers*” (ibid.). They specified that this would “*make farmers aware of the importance of a multi-year approach*” (comment in a project promotional video). The anchoring in existing collectives directly reflected this expected role of farmers in the adoption and dissemination of cropping systems

whose proof of concept would be made, even if they were somehow considered as participants in their design and testing. Moreover, for advisors, the objective was primarily to produce long-term agronomic and economic assessments of cropping systems. Therefore, the technicians and advisors applied classical methods in terms of data collection and processing. Data were collected from the farmers when it came to describing practices (e.g. seeding rates, tillage) and agronomic or economic results. They were produced by the advisors when it came to observations on the soil, auxiliary fauna and crop conditions. The “technical committee” (project's team of advisors) therefore equipped itself with a "*protocol guide*" in which "*it is framed, it is all written, there are the recommendations*" (project promoter). These protocols were dedicated to informing evaluation or diagnostic tools that were discussed (in the choice of indicators and evaluation methods) within a meeting of the "technical committee" in which farmers did not participate. The final assessments which resulted from such tools were planned to be discussed with the farmers but these one had no voice to decide the purpose of such discussion which the “technical committee” decided to orient towards "long-term" evaluations.

Thus, even if farmers were directly involved in the experimentation on cropping systems, the rigor of the data collection protocols, along with the advisors’ focus on long-term assessments, did not allow for the farmers’ observations, choices and changes in decision-making rules to be fully integrated into the production of knowledge from the experimental process. By contrast, however, farmers wished to progress in the mastery of innovative practices that interested farmers. As one farmer explained:

> *"we’ve been working on these themes for a number of years now, with the [group] working on them. And we wanted to go deeper to acquire more knowledge and be a little more specialized in these techniques”.*

As one advisor regretfully explained:

> "*it's complicated to do an analysis before 2-3 years are up. But on the other hand, we could again discuss the means used, and that has not yet been done. [...] All we do with farmers is to observe in the field. I don't know how involved they feel in the end*."

Yet the annual review process proposed by this advisor was still hampered by the organization of the project (i.e. relying on the existing teams of local advisors and their usual ways of working with farmers). Therefore, in this particular project, the role originally envisioned for the farmers as conveyors of reasoning on the practices implemented and the discussions within their collectives, was finally reduced to that of operators and receivers of final assessments. This was due to the practices of experimentation (farmers’ absence in the “technical committee”, the protocols defined upstream, the poor tracking of choices and reasoning applied by farmers) and the information circulation tools and infrastructures they relied on (evaluation models, classical forms of farmer-advisors encounters). Interestingly, this type of organizational and informational process, at the heart of experimental practices of each project, was not directly monitored by the LIT’s “strategic committee”, and were followed-up only loosely by the facilitators (Figure 1). A LIT “Process Framework Note" does indeed indicate that when research and innovation processes are ongoing in project groups, "the LIT [“strategic committee”] is not intended to interfere in the development of projects".

6 Discussion

Living Labs can be associated to open systems of innovation where a keystone is the inclusion of diverse actors. In such plan, the main added value compared to non-open innovation systems depends on the challenge of enabling the various and multiple actors' involvement as well as the dialogue among them. We analyzed the LIT as a boundary object continuously under construction, describing how the Living Lab innovation model was taken over by a diversity of actors over the course of its implementation, and by paying attention to the articulations between different strategic choices, guided by diverse rationales on the innovation model and the territory, in interaction with infrastructures supporting specific informational and experimental actions. As the Living Labs are supposed to introduce or renew the partnerships and ways of experimenting together between academics, private actors, governmental actors, and users or citizens (Hossain et al., 2019; Leminen, 2013), it appeared appropriate to study a specific Living Lab's construction as a process which purpose is to support renewed coordination or redistribution of roles. Our findings confirm that the actors' roles within a Living Lab (and particularly actors for whom roles are made explicit such as "users" in Living Labs) cannot be conceived of as decreed by the steering actors, but rather result from multiple interaction processes, both intended or emergent, and explicit or underlying and un-noticed. More particularly in agricultural Living Labs, the farmers are expected to become co-creators, or co-designers (McPhee et al., 2021), but these roles' assignment and taking, even if intended, face the established ways of working within the existing innovation system, for instance regarding the farmers-advisors encounters, the circulation and ownership of information through advisory services, the experimentation tools and methods.

6.1. The challenge of creating new roles for the actors of a Living Lab within an existing innovation system

In the agricultural sector, innovation systems are deeply anchored in the centralized and standardized functioning of advisory organizations, technical institutes, research institutes, and their respective interactions (Labarthe et al., 2014; Röling and Engel, 1991). Bringing together the actors in Living Labs' does not mean that they will easily reach an alignment of interests and prospects for innovation, and raises challenges for building a place in areas where organizations, institutions, and clusters already exist (Santoro and Conte, 2009). Yet, the Living Lab literature have seldom studied the impacts of contexts in which they are implemented, and rather explored the "sense of place" that such innovation models may build (Frantzeskaki et al., 2018). The influence of contexts on the particular implementations and outcomes of new agricultural innovation arrangements was previously studied for Innovation Platforms (Cullen et al., 2014; Turner et al., 2020) or co-innovation processes (Botha et al., 2017; Ingram et al., 2020; Vereijssen et al., 2017). Co-innovation methods are highly dependent on institutional (Klerkx and Leeuwis, 2009a), social and cultural contexts (Botha et al., 2017; Neef and Neubert, 2011), which correspond to routines, specific knowledge systems and relationships that influence actors' expectations and motivations for engaging in participatory processes. Co-innovation processes have also been shown to very concretely depend on the existing innovation systems, in terms of established facilitation activities and experimentation usual practices (Ingram et al., 2020). These studies have insisted on the existing expert knowledge, on the dependencies to discourses and issues already addressed, and on the difficulties for

framing new complex problems, which are influent contextual factors that researchers and co-innovators may become aware by means of reflexive monitoring methodologies and adaptive management (van Mierlo et al., 2010). Our findings suggest that less emphasis should be placed on epistemic or relational issues, and more on the infrastructures on which concrete innovation practices are based. We underline the difficulty for the actors involved and steering the Living Lab process to identify and make explicit the underlying structures that shape the outcomes of the new innovation arrangements. In this regard, the "farmers' committees" were particularly illustrative, as they were supposed to be the events were the integration of farmers occurred. The invitation wording, organization and facilitation were sometimes object of discussion within the "strategic committee" (for instance, regarding the presence of advisors who may intervene in place of farmers), but not adaptively defined and made explicit for an active integration of farmers. Farmers participating were those who accept the role they were proposed in these events. More active integration could happen within specific innovation projects, but this process was then less followed by the LIT's facilitators, as the example described in section 5.3 shows.

6.2. The little attention paid to infrastructures as a hindrance to effectively construct new actors' roles

We insisted on the dialogue and communicational infrastructures concerned by the implementation of an agricultural Living Lab, and the hindrance they could constitute regarding the operationalization of intended roles redistribution among actors. This underlines the interest of studying Living Labs as processes progressively building new norms for coordination, and the difficulties that may appear for transforming infrastructures. The confrontation with existing infrastructures was studied in various new participatory arrangements, such as biodiversity databases with amateurs' contributions (e.g. Meyer, 2009). Interestingly, in our case study, the difficulties encountered for establishing new roles for farmers came from the poor attention and transformation efforts dedicated to the communication infrastructures, rather than their conscious use and positioning by the diverse actors. This uncontrolled and involuntary aspects of the context are what we insist on with this particular analysis of infrastructures, which contrasts with studies that investigated more conscious and directed mobilization of resources, such as analyses of power and conflict staging in Innovation Platforms that either maintain power position preventing from regime modifications or lead to evolutions in roles perceptions (Cullen et al., 2014; Turner et al., 2020). The poorly noticed or voluntary impacts of infrastructures we studied is in line with their embeddedness and invisibility as generally described (Leigh Star, 2018). Moreover, the under-questioned need for transformation of basic functioning within the agricultural networks of actors may have resulted from acquaintances and work habits shared by a part of the Living Lab actors before its implementation, which echoes previous findings on implementations of co-innovation methods (Eidt et al., 2020; Ingram et al., 2020). Some actors (for instance, members of the "steering committee") were used to interacting and working together, which may have smoothed the encounter between antagonistic visions of the LIT, and made it possible to get around them by adopting classical roles and agreements to do so. This made the potential for the LIT to actually redistribute roles, and particularly to reconsider farmers' roles within the innovation process, even more relying on the accurate monitoring of implementation practices and transformation of in-depth habits structuring experimentation for agroecological transition (e.g. existing methods for cropping system evaluation, communication paths and gatekeepers within advisory services,

farmers' ways of interacting with private and advisory services). In that sense, our study adds to the descriptive analysis of actors' roles within Living Labs (Leminen et al., 2015; Menny et al., 2018; Nyström et al., 2014) by relating the role-making mechanisms to normative visions of innovation and experimentation habits and other communicational infrastructures, and by nuancing the independence and room for maneuver actors may have to make new roles in the process, either their own or others'.

The fact that the diverging rationales observed within the Living Lab actors regarding the intended innovation process and the territory were mostly kept implicit, and not staged within the Living Lab, contributed to the poor attention attributed to the need for restructuring the activities and infrastructures. For instance, the misunderstanding from various actors about what were the "farmers' committees", their objectives and particularities in comparison to usual meetings, came lately as a discussed issue within the "strategic committee" also because of poor alignment between its members rationales about what "farmers' committees" should be (e.g. regarding the legitimacy of advisors to participate, the type of discussions and ways to collect the expressions of interest). Namely, we could recognize patterns of differentiating ambitions that were observed elsewhere in participatory processes by Sundqvist (2014), opposing the "heating up" – introducing participation to open up issues for broader debate -, and "cooling down" – utilizing participatory arrangements as means to efficiently containing debates on a particular issue. Our findings are in line with studies of participatory processes by Metzger et al. (2017), who showed " how conflicting rationalities for stakeholder engagement were difficult to reconcile in practice, and pointed to the relevance of taking into account the wider institutional infrastructures in which stakeholder participation methods were employed". In this perspective, the enactment of stakeholders, and their effective roles within the collaborative process, can never be taken as given, and is more "a ubiquitous outcome of any kind of participatory arrangement" (ibid.).

6.3. Skills and their distribution among actors for addressing these infrastructures issues?

But if the ubiquitous social processes and infrastructures existing in a prevalent innovation system determine the possibilities to shape roles perceptions and redistributions, how can the Living Lab actors more purposively act in order to reach these outcomes? Our findings suggest that new skills and new legitimized arenas for discussing the innovation's directionality might be required, namely to identify tensions and antagonisms in several areas within Living Labs: among the farmers' roles assigned by different normative visions of Living Labs; between these expected roles and those that the effective innovation process produces as it unfolds and implement particular deliberation and experimentation practices; and finally between the new ways of coordinating or working together and those that the existing infrastructures maintain. This, for instance, underlines the key function of the two "facilitators" in our case study. Figure 1 shows their central position in the circulation and translation of the innovation "imaginaries" that the members of the "strategic committee" express. Pfotenhauer and Jasanoff (2017) suggest that "an imported innovation model should be understood as part of a collectively held imaginary of sociotechnical progress that accompanies a complementary diagnosis of a deficiency in the receiving environment". Thus, in addition to acting as a bridge between distinct knowledge systems, which is one of the classical functions identified for intermediate actors in innovation systems (e.g. "knowledge brokers", Klerkx and Leeuwis, 2009), they are at the heart of the operational translation of the Living Lab model as

expressed by the various LIT's actors. The discomfort in the indeterminacy of this function and the lack of support or skills to carry it out was apparent: the two facilitators torn between the need to "boost" the projects and support their carriers or to encourage the emergence of collective projects anchored in the particularities of the territory; and they struggle with choices related to the implementation of events (e.g. choice of speakers, wording of invitations). Moreover, the "citizen events" were not organized and monitored in such a way as to be directly linked to the flow of project proposals and their evaluations, which would have been required to build a new infrastructure supporting projects dynamics. These events were only occasionally attended by the "strategic committee" members, and the facilitators were not equipped methodologically or materially to facilitate these events and build on their outcomes (e.g. facilitation tools, recording). Existing descriptions of the large range of functions fulfilled by intermediaries show the multiple skills required, as well as adaptive management capacities (Kilelu et al., 2014; Klerkx et al., 2010). Our findings suggest that, in relation to actors' roles revealing and redistribution, another field of capabilities relates to the following up of projects, not only to identify new demands and bridge various knowledge or build on multiple social capitals, but also to interpret the ubiquitous effects of how things are done concerning for instance deliberative spaces, trials, projects management, communication to different publics. Whether these skills and responsibilities are to be granted to one type of actors within the process is questionable. For instance, the very refined typologies of actors' roles within Living Labs provided by previous empirical studies (e.g. informant, tester, co-creator, enabler, gatekeeper, etc., Nystrom et al. 2014) could support discussions among all actors to make explicit roles perceptions and expectations, and translate them in very concrete consequences in innovation practices.

Such distribution of the responsibility to unravel the effect of infrastructures, work habits, and experimental cultures, is also a proposal in reaction to the weak connection found in our case study between strategic choices regarding the organizing of innovation process, and experimentation within each project. We discuss the need it may call for extending the scope of what "experimentation" stands for in Living Labs, and its relation to actors' roles building. Experimentation in Living Labs has often been associated with the testing of prototypes or solutions in controlled forms through the search for "real-world experiments" (Caniglia et al., 2017), with a definition of experimentation that refers to "intervention" for the production of "evidence". But our findings show that a collective innovation (and research) approach within Living Labs involves different levels of "experimentation". One level of *experimentation* is the one of the Living Lab as a whole, and concerns the processes by which the actors structure the mode of innovation. As we have shown, the development of the Living Lab depends on communication channels to link with the inhabitants and stakeholders of the local area in which it operates, adjustments of objects (e.g. charters, framing notes, events organization rules, physical of virtual exchange platforms or devices) that stabilize procedures, choices of the means to observe and monitor the ongoing innovation process. All these aspects rely on infrastructures which already pre-exist and which have to be partly reconfigured. Developing a Living Lab by managing interventions on these aspects of local reality with uncertain outcomes can finally be read as *experimental*, in the sense of a progression under uncertainty and a testing of devices to respond to assumptions related to the innovation process. A second level of *experimentation* concerns collectives gathered around the development of a particular innovation. Beyond the testing of hypotheses or prototypes as concrete interventions, the roles' making processes observed here are based on the identification of the

knowledge to be produced, the production of the phenomena to be observed, or even the "craft" (Jouvenet, 2007) devices to produce and observe phenomena: for instance, the protocols for observing biodiversity in the experimentation of cropping systems, or crop choices that sometimes deviate from the initial plan. The involvement of actors in the experimental process, such as farmers here, raises the question of the appropriation and ownership of this production of new modalities for the experiment, the inclusion of these emergent practices. But allowing them to "talk back" is more than "just tapping into user creativity or fostering technology acceptance through consumer feedback" (Engels et al., 2019). Laurent and Tironi (2015) propose that in order to understand an experimentation process in which users participate, "one needs to extend the scope of who is innovating, explore the various ways of acting in situations of social and technical innovations, and examine whom the experiments have value for". This is in line with the analysis by Gamache et al. (2020), who propose that "citizen-centric living labs" are best suited in the case of agri-food systems transitions, in which the experimentation corresponds to "building representations of the complexity of the issues at stake through action and insightful reflexive self-evaluation by the actors leading the initiatives". The extension of the scope of activities covered by the term "experimentation", in the case of agricultural Living Labs, should include the ongoing tensions between the rationales for the innovation process, the territory and its particularities, and the infrastructures on which rely the various actors' experiences of the new innovation arrangement. As another recent case study in France shows (Fèche et al., 2021), this calls for an attention to the reconfigured ways in which legitimacy of the experiment is built, namely more in relation to territory and local anchorage, and through the integration of multiple rationalities that allow for more alterity. Reflexivity all along the collective enquiry and confrontation of the Living Lab process with to dominant socio-technical norms are also part of what the experiment necessarily includes according to these authors (ibid.).

7. Conclusion

In an agro-ecological transition context, networking and innovation are key issues (Warner, 2007). Agricultural Living Labs constitute a novel and promising initiative to renew the rural social networks and to foster innovation. This research focused on this novel dynamic carried by agricultural Living Labs and its contribution adds to the roles' diversity and dynamics within Living Labs innovation processes. The literature on Living Labs have refined typologies of roles, especially for "users", without relating their construction or redistribution to the specificities of innovation processes within Living Labs. Our research shows that the building and redistribution of actors' roles within a Living Lab, beyond explicit assignments, result from the multiple forms of interactions within the innovation process, supported not only by written or oral statements and shared rules, but also by strategic choices, network structure, events organization and follow up methods.

Thus, complementarily to studies which specify and refine distinctions of various roles, we contribute to relate neglected aspects of the Living Lab management and implementation to the conditions for the expected actors' roles to be built and enacted. To this aim, we applied an analytical framework to a case-study, combining the rationales held by actors about the Living Lab innovation model, the representations of the particular agricultural territory, and the existing and often under considered infrastructures on which

the collaborative processes rely. This approach moderates the assumptions about the actors' capabilities to use resources and enter in a role-making form of action to build more contributing and promoting roles, as if autonomous from the existing innovation system infrastructures. In so doing, we point operational aspects of the Living Lab management, usually unrelated to role mechanisms, whereas appearing to be decisive for supporting an effective roles redistribution.

Hence, we emphasize some contextual aspects that should be considered for appropriation of the Living Lab model. More particularly, the infrastructures involved in information circulation, in collective trials and projects management, in farmers-advisors encounters, should be questioned and diagnosed, in the same way as actors' knowledge systems, social relations, and power positions which others have underlined (Ingram et al., 2020; Turner et al., 2020). Besides, the roles redistribution within Living Labs should not be seen as a completely deliberate process, but more as the outcome of the implementation of new innovation arrangements that we proposed to consider as dynamic, largely subject to emergence and uncertainties, and as a collective experimental process.

Contributors Roles (CRediT)

Q.T.: Conceptualization, Investigation, Data collection and curation, Writing- Original draft preparation, Writing - Review & Editing. **M.Ca.**: Conceptualization, Writing - Review & Editing. **M.H.**: Conceptualization, Writing - Review & Editing. **M.Ce.**: Conceptualization, Writing - Review & Editing.

Acknowledgements:

We acknowledge the support received from the Agence Nationale de la Recherche of the French government through the program ''Investissements d'Avenir'' (16-IDEX-0001 CAP 20-25), and from Limagrain. We are grateful to all the actors who devoted time to our observation and interviews, in particular within the "Laboratoire d'Innovation Territorial Grandes Cultures en Auvergne". This work has also benefited from exchanges within the IDEAS (Initiative for DEsign in Agrifood Systems) research community.

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