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The infrastructures beyond the diversity and redistribution of actors' roles within Living Labs

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Abstract: Living Labs are developing in widely diverse innovation domains. They namely invite to question the various actors' roles and their making processes. Such roles rely on the actions they perform within the innovation process. What are, beyond the methods of participation, the infrastructures (e.g. collaboration platform, communication supports) that help or hinder possibilities for actors to take or make their own roles? Our case study of an agricultural LL in Auvergne-Rhône-Alpes (France) showed that an ambiguity on users' roles was maintained by the created and existing information infrastructures. 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 LivingLab management (because not judged strategical) to the room for manoeuvre and possibilities for expected actors' roles to be built and performed.

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

1 Introduction

The multiple calls for agroecological transition and adaptation of farming practices to climate changes have renewed the concerns about the impacts of agricultural science on farming system transformations. The development of a capacity for innovation is considered to be a means for achieving a transition and reaching climate adaptation objectives. Systemic models of innovation have recently conceptualized it as a distributed process among a diversity of actors. For instance, the “quadruple helix” suggests the binding between university, industry, government, and society in hybrid innovation spaces (Carayannis, 2008). One of the models of innovation practices that have been extensively included in strategic orientations of agricultural research institutes or policy advising reports, is the “LivingLab”. 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 LivingLab generally stands for an organization of actors dedicated to an open-innovation process, and following core principles: a granting of major roles and process ownership to users (often translated into upstream involvement of users in the design and knowledge production activities), and 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 LivingLabs 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 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).

Research in management science and innovation management has characterized actors’ roles in LivingLabs 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, 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 LivingLab), 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). Occasionally, these analyses integrate the processes whereby such roles are established. They have however pointed out a link between the fact that users construct their role as “co-creator”, and the possibilities for radical innovation outputs (Leminen et al., 2015).

These descriptive approaches may suggest that roles are consciously decided for others or oneself, and shed little light on the emergence of these roles in a process involving both the assignment of a place by an(several) organizer(s) of the innovation process, and the construction by actors themselves of their own place in the course of their activity. Such process of renewed roles establishment, supposedly going hand in hand with the process of building a LivingLab, received little attention in previous Living Labs case studies. Our hypothesis is that the building of roles, beyond explicit assignments, results 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. In the case of a Living Lab on a territorial scale, these innovation practices result from the various understandings of what the innovation process within a LivingLab is or should be, as well as from the representations of the concerned territory. As a consequence, we propose to apply the concept of “boundary object” (Star and Griesemer, 1989) to the particular innovation setting associated to an agricultural LivingLab. This concept was developed at first 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. In this way, they maximize the autonomy of each group of actors while allowing communication between them. Boundary objects thus refer both to an interpretative flexibility, and to a minimum knowledge infrastructure (e.g. norms, communication infrastructures, forms of knowledge). They are thus both concrete and abstract, general and specific.

In this study, we apply these concepts to a case study of an agricultural LivingLab developed at a regional scale in Auvergne-Rhône-Alpes Region (France). We analyze more specifically the actual practices of actors within the innovation process and the infrastructures supporting them, during the building of the LivingLab, that we consider as a boundary object. 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 LivingLab? How are these practices related to diverse innovation cultures and representations of the territory¹ concerned by the innovation process? We first present the case study, insisting on the LivingLab structure and main monitoring and experimentation practices of the innovation process embedded in the LivingLab. We underline the diverse interpretations of what this particular LivingLab is or should be according to the actors. Finally, we analyze how some communication infrastructure aspects constitute hindrances for actors' roles making processes (namely farmers' roles).

2 Case study and methodology

The LivingLab that we analyzed, called the “Laboratoire d’Innovation Territoriale Grandes Cultures en Auvergne” (meaning “regional innovation laboratory for arable crops in Auvergne”, hereafter referred to as “LL”), is a structured partnership in the form of an association that now brings together eight major incumbent actors of the regional agricultural innovation system: a private company (linked to an agricultural cooperative), two agricultural and environmental research institutes, an agricultural secondary school, an innovation cluster, the regional advisory services and technical institutes, and a local authority. The idea of this LL emerged in 2016 between representatives of 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 (as they were considered representative of required functions within the innovation network). 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 centers, city councilors, the director of the cluster), but no farmers. This “strategic committee” essentially takes decisions for the LL, referring explicitly to the

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

"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 LL (e.g. organize events and meetings, interact with all stakeholders)(Figure 1). The LL currently supports about ten innovation projects (seven financially), which involve different forms of partnership between academics, farmers, private companies and associations.

We followed an ethnographic approach that is based on the personal and long-term integration into the group studied (approximately one year, from January 2019 to February 2020). This approach allowed us to focus on the processes and transformations of the group of actors concerned (Louvel, 2008). The author led a participant observation following most of the Living Lab events (i.e. steering committee's meetings, events open to all citizens, farmers' committee meetings, specific project groups' activities and meetings, etc). This was combined with semi-structured interviews (with facilitators, strategic committee members, project participants, open events participants, and other local stakeholders), and complemented by documentary analyses (e.g. LL framework notes, "charter", activity reports, projects or proposal evaluations, event attendance lists).

The data analysis does not aim to define a general model of the evolution of an organization such as an agricultural LivingLab. Instead, the intention is to analyse whether, within the LL's specific trajectory, the building of new roles is related to the LivingLab, as a boundary object, and its infrastructures. We 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 LivingLabs (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. Inspired by studies on cultures and "imaginaries" of innovation (Pfotenhauer and Jasanoff, 2017), 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, the types of territorial diagnoses, and the project selection and follow-up procedures. This scope of themes as a basis for our iterative coding corresponded to our intent not to separate the explicit assignment of roles (deduced from general LivingLab 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.

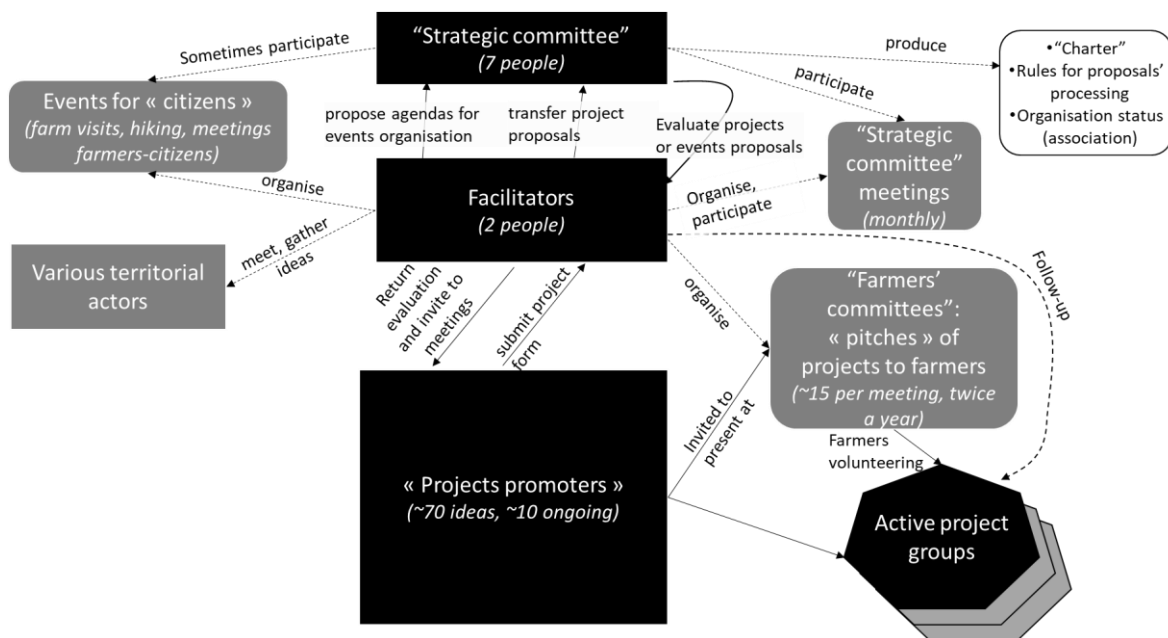


Figure 1 Diagram of the LL’s organization. The categories mentioned with quotation marks are the ones used by the actors. The black rectangles correspond to the groups of actors whose composition is relatively stable in the process. The grey rectangles represent events that are more occasional and without stable collectives. 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.

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

The structure of the LL can be analysed as a 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 LL organizes and standardizes the process for the development of innovations. 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 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 LL’s activities consists in organizing one-off events targeting “citizens” or other “actors of the territory”. These include hikes comprising a farm visit (without an explicit link to one of the LL 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 LL.

In an activity report written by facilitators, the LL’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”.

The LL’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 LL (public-private partnerships, co-creation with users, experimentation in real conditions), and constitute a 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 LivingLab 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 LL was proposed in 2016 by the Ministry of Agriculture as one of the “pilots” at national level

(explicitly pointed out in the LL's 2017 annual report). These interpretations of the interest of the LL envision it as an accelerator and a demarcation factor in a competitive world of innovation (i) (Table 1).

The LivingLab 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 LL as an alternative mechanism for obtaining project financing, legitimized by "access" to farmers (ii, Table 1). For example, the city councillors view in the LL 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 LL on the basis of proposed experimentation with farmers. In these first two visions of the LL, 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 LivingLab model, is a desire to increase attractiveness for innovators. This time, it appears less explicitly in the documents produced by the LL 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 LL 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 LL as a means of developing the attractiveness and value of the territory (iii) is revealed here. The farmers 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 LL 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 LL. 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 LL 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 LL 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 LL as a driving force for the rebuilding of links between various actors in the territory (iv, cf. 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 LL, and a space that must be "appropriated" by a larger number of actors. The roles assigned to farmers by this vision of the LL 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 LL. 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 LL. 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 LL 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 LL, clearly".

These other interpretations of organized interactions with farmers and other citizens reflect a vision of the LL as a vector for the facilitated appropriation of new technologies and practices (v). 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-agricultural inhabitants.

Table 1: Summary table of the normative visions of the LL and the farmers' roles they suggest

Normative visions of a LL	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) favoring 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 flexibility in interpretations of what the LL is by the various actors is large. 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, we rather underline it in our analysis to show the difficulty to build the LL, and the related indeterminacy of actors' roles. But the hindrances for the processes of roles making within the LL are not only related to these diverse visions and roles implied for users. As we show in the next section, they also reside in the functioning of infrastructures that the LL is building or trying to transform, with limited success.

The communication infrastructures as hindrances to new roles making

As an organisation aiming to transform the ways various actors related to the agricultural sector work and innovate together, the LL is both using previously existing modes of communication and information sharing, and trying to create new spaces or devices for such sharing. Analysing the LL 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 LL innovation process.

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. 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". Ideas promoters mostly understood these "farmers committees" as meetings of the actors in charge of steering the activities of the LL, whereas the members of the actual "strategic committee" were seldom more than one present. Agricultural advisors and intermediaries interpreted these meetings as information points on

progresses made within the living lab, 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 relevant information. Meanwhile, the members of the "steering committee" regularly underlined the "farmers' committees" as a key element of the applied "living lab methodology". Such misunderstanding was a hindrance for these committees to renew the modes of communication between the actors in presence. 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 (every new edition of this event was in new places, with new presenters), which may have contributed to the poor identification of its identity. 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 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!" (our translation).

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.

Communication channels and their entanglement into the hierarchy of actors in the pre-existing innovation system

Another 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 visitors¹, 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 LL 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

¹ The functions of a physical space within a LivingLab can be discussed regarding widely diverse aspects. Here, we simply underline its absence as a constraints 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.

gatekeepers' roles within the advisory system were thus conserved, and largely limited the ownership farmers could develop regarding the LL and the innovation projects conducted within it.

The LL's animators only lately got aware of this incomplete distribution of information due to a control by incumbent intermediaries within the territory. Intermediary actors of the existing agricultural innovation system were, at first, not particularly attributed a position within the LL. Their way of controlling the information from the LL 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 LL was targeting, and their possible interest in interacting with it. Significantly, a meeting organised between the LL facilitators and few of these intermediaries in July 2019 gave rise to lengthy discussions to clarify what can be considered as an innovation "project" within the LL, revealing the weak connection intermediaries had with the LL until then.

The same type of hindrance to the redistribution of roles between actors was observed in relation to the embedded circulation of information through the farmer cooperative and towards large publics. For instance, when animators had to organize the hike around a farm (one of the LL's events targeting "citizens"), they had to identify a farmer agreeing to welcome the event. In relation to this aim, they contacted the farmer cooperative, and were referred to the communications officer who is classically in charge with the dissemination of information to the general public. As usual, he therefore selected a farmer with strong communication skills, and brought the classically used information panels to the event. In addition, he complemented or reoriented the farmer's discourse on his practices during the farm visit. Again, with the intention of building new arenas for actors encounters and collective deliberation, the LL's facilitators faced (without noticing) the embedded channels of communication structured within the main farmer cooperative in the region (and the related control on the visibility of their practices for the general public). The farmer's appropriation of his own posture during the event was limited by the described elements of this pre-established communication strategy.

Information exchange and evaluation tools applied in a cropping systems testing 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 collectives of farmers, 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, LL's "strategic committee" member from the agricultural advisory services). The project was then integrated into the LL. 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 [collective] 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 initially envisaged role of the farmers as conveyors of reasoning on the practices implemented and the discussions within the 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 LL's “strategic committee”, and were followed-up only loosely by the facilitators (Figure 1). A LL “Process Framework Note” does indeed indicate that when research and innovation processes are ongoing in project groups, “the LL [“strategic committee”] is not intended to interfere in the development of projects”.

Discussion and conclusion

We analyzed the LL as a boundary object, describing how the LivingLab innovation model was taken over by a diversity of actors over the course of its implementation, and by paying attention to the articulation between strategic choices and infrastructures supporting specific informational and experimental actions. As the LivingLabs are models of innovation practices supposed to introduce or renew the partnerships and ways of working together between academics, private actors, governmental actors, and users or citizens (Hossain et al., 2019; Leminen, 2013), it appeared appropriate to study a specific LivingLab as an object supposed to coordinate the activities of these actors and potentially renew or redistribute their roles. We confirm that the actors' roles within the Living Lab cannot be conceived of as decreed by the steering actors, more especially when the Living Labs develops within an existing innovation system, as it was the case concerning the regional agricultural context studied. More particularly in agricultural LivingLabs, the farmers are expected to become co-creators, or co-designers, but these roles' evolutions, even if intended, face the established ways of working within the existing innovation system, namely regarding the farmers-advisors encounters, the circulation and ownership of information through advisory services, the experimentation tools and methods. 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 LivingLabs' actors 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).

We insisted on the communicational infrastructures concerned by the implementation of an agricultural LivingLab, and the hindrance they could constitute regarding role making processes, or for farmers to take co-creators role. This underlines the interest of studying LivingLabs as processes progressively building new norms for coordination, and the difficulties that may appear for transforming infrastructures, as it was proposed for other boundary objects, 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 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 LivingLab actors before its implementation. Some actors (for instance, members of the "steering committee") were used to interacting and working together, which may have softened the encounter of antagonistic visions or interpretations of the LL, and made it possible to get around them by adopting classical roles and agreements to do so. The LivingLab was supposed to introduce new ways of working together between actors who, for a part only, already coordinated their work within the innovation system. This made the potential for LivingLabs 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 LivingLabs (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 roles.

Hence, public policies fostering the establishment of LivingLabs in the agricultural sector should also support specific competencies and the building of or deep changes in infrastructures that would be required to enhance the pluralistic encounter of innovation cultures. Assessment indicators, for instance, should reach beyond apparent partnerships created and numbers of innovations reaching a market.

First, competencies and new legitimized arenas for discussing the innovation's directionality might be required, namely to identify tensions and antagonisms in several areas within LivingLabs: among the farmers' roles assigned by different normative visions of LivingLabs; between these expected roles and those that the organization of the innovation produced; and finally between the new ways of coordinating or working together and ways of working 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 a classical function 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 LivingLab model in its various interpretations among the LL'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).

Secondly, this weak connection between strategic choices regarding the organizing of innovation process, and experimentation within each project, calls for extending the scope of what "experimentation" stands for. Experimentation in LivingLabs 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 the

analysis in this case study shows that a collective innovation (and research) approach involves different levels of experimentation. Such process might be seen as shaping both innovations and regulation rules or deliberative mechanisms. One level of experimentation is the one of the LivingLab as a whole, and concerns the processes by which the actors structure the mode of innovation. As we have shown, the development of the LivingLab 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 or 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 reconfigured. All this can 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 formed around the development of a given 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. 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". The extension of the scope of activities covered by the term "experimentation", in particular to the negotiation of knowledge production objectives, the construction of interventions and mechanisms, and the use or interpretation of observations, seems appropriate here to give a better account of the role making by the involved actors.

This contribution adds to the roles' diversity and dynamics within Living Labs innovation processes. Complementarily to studies which specify and refine distinctions of various roles, we contribute to relate potentially neglected aspects of the LivingLab management (because not judged strategical) to the conditions for the expected actors' roles to be built and performed. Besides, it might moderate 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 Living Lab infrastructures. We point operational aspects of the Living Lab management, usually unrelated to role mechanisms, whereas appearing to be decisive for supporting an effective building role redistribution.

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