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Implementing agricultural Living Labs that renew actors' roles within existing innovation systems: a case study in France

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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; stakeholderiness; 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.

44 **1. Introduction**

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

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

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

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

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

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

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

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

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

121 based on a strong and long-term immersion in the field and a participant observation methodology. This
122 approach enables us to analyze more specifically the actual practices of actors within the innovation
123 process and the infrastructures supporting them. Our purpose was to query: What practices and
124 infrastructures (e.g. types of events and their management, projects and tests follow-up and evaluation,
125 information circulation), beyond decisions applied by the steering actors, participate in building actors'
126 roles – and particularly farmers' roles – within the Living Lab? How are these practices related to diverse
127 innovation rationales and representations of the territory¹ concerned by the innovation process?

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

137 **2 Theoretical and methodological framework**

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

146 The Living Lab principles are explicit about users' role in the innovation, who are supposed to be at the
147 center or even leaders of the process. Other actors roles have also received attention, and more and more
148 refined typologies of encountered roles were produced to interpret the actors' actions and coordination (e.g.
149 Nyström et al., 2014; Sopjani et al., 2019). These descriptive typologies are seldom addressing how
150 different roles are being enacted as the outcome of specific aspects of the innovation process. Some authors
151 adopt a more processual approach, recognizing role taking and role making mechanisms, and associating
152 the radical innovation outcomes to situations in which users use resources to make their *co-creator* role
153 (Leminen et al., 2015). The distinctions between various functions provided by these studies is a support in
154 recognizing the categories used by the interviewed actors in our case-study. But they are limited in
155 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.

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

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

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

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

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

199 **3 Case study and methodology**

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

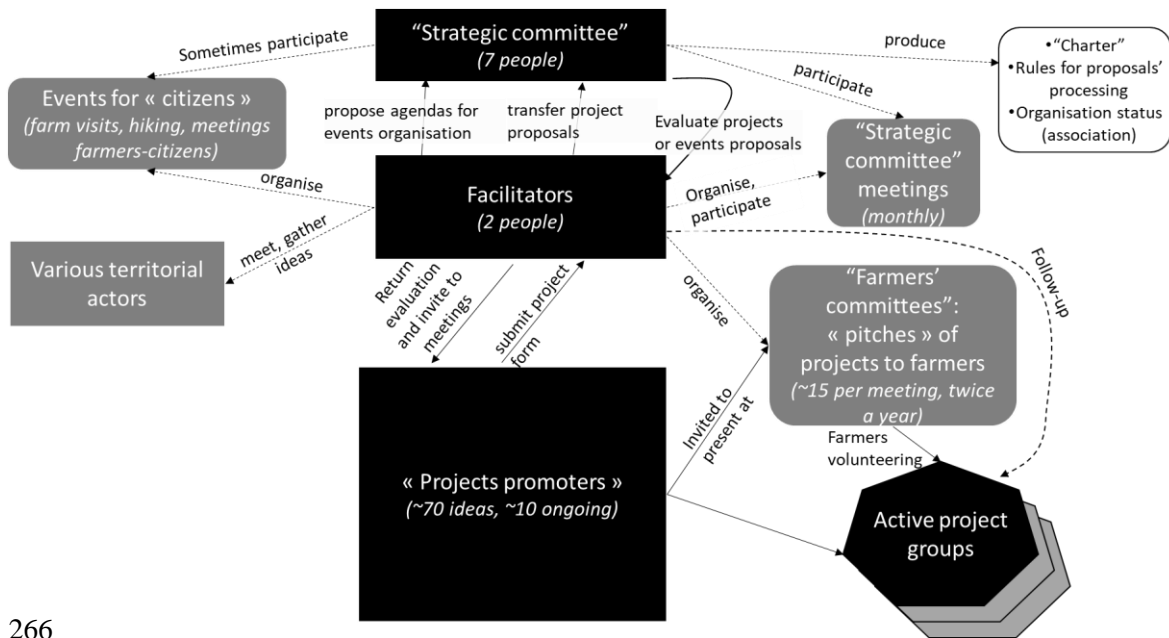
223 The idea of this LIT emerged in 2016 between local representatives of the two research institutes and the
224 private company, in line with a national policy orientation towards encouraging public-private-user
225 partnerships. Soon, the other institutions were invited to join the initiative, in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

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

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

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

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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.

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

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

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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.

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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

291 events intends to create new spaces for projects presentations and discussions, as the previous collectives
292 were mostly corresponding to groups of farmers facilitated by an advisor or a hired technician. The project
293 "pitches" must explicitly state the interest for the project leader to involve farmers and the expected form of
294 this involvement. At the end of meetings, a questionnaire can be handed out for farmers to indicate their
295 willingness to be informed or to participate in the various projects. Ongoing projects are followed up by
296 one of the two facilitators, but without any specific formal monitoring procedure. The dotted line in Figure
297 1 suggests this unequally performed follow-up, and the difficulty for facilitators to gather information on
298 each project's progress. It also shows that facilitators are the only ones supposed to carry out this follow-
299 up, and no member of the "strategic committee" officially interacts directly with the project leaders.
300 Finally, another part of the LIT's activities consists in organizing one-off events targeting "citizens" or
301 other "actors of the territory". Such events did not have exact equivalents within the LIT's territory before
302 its implementation, at least not with the same target audience and status in the innovation process. These
303 include hikes comprising a farm visit (without an explicit link to one of the LIT projects); and farm visits
304 followed by discussions during a lunch at the farm, allowing for interaction between farmers and other
305 actors. Members of the "strategic committee" rarely participate in these events, which are not related to
306 "farmers' committees". We emphasize, with that description, that the structuring of innovation process
307 relies not only on operating rules stated in documents (e.g. "charter", "evaluation grid", internal framing
308 notes), but also on the way information circulates between the different groups of stakeholders and events
309 organized within the LIT. Some infrastructures allowing this circulation of information were pre-existing
310 (e.g. the contact lists and paths of e-mail diffusion used by the agricultural advisory services), and some
311 were deliberately built for the LIT's activities (e.g. regular meetings on a new format that correspond to the
312 "farmers' committees"; one-off events gathering local inhabitants, farmers, private actors and researchers).

313 *4.2. Diverging rationales for the LIT innovation model and the territory*

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

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

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

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

² All discourse translations are ours.

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

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

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

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

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

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

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

365 The desire for high-performance tools is therefore closely linked to the hope of attracting innovators of
366 excellence and ensuring not to "harvest second-division innovations" ("strategic committee" meeting, 10-9-
367 2019). The vision of the LIT as a means of developing the attractiveness and value of the territory (iii,
368 Table 1) is revealed here. The farmers or local citizens are not priority actors in the emergence of
369 innovative technologies or ideas, which is perceived as exogenous. They rather act on the possibility of
370 validating either the relevance of specific innovations for particular uses, or their integration into practices.
371 Thus, the potential co-creation boils down to producing the modalities of such integration.

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

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

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

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

408 **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

409
 410 The variations between the actors' interpretations of what the LIT is are significant. It goes along with a
 411 diversity of roles suggested for types of actors, as we illustrate it more particularly concerning farmers.
 412 This is particularly clear between the visions (iii) and (iv), opposing the roles of farmers as receivers of
 413 technologies, with those of farmers as promoters, jointly with other citizens, of innovation directionality.
 414 When the interpretative flexibility of boundary objects is more often described as what make possible for
 415 different social world to work in coordination, in our analysis, underlying such flexibility is meant to show
 416 the difficulty to build the LIT, and the related indeterminacy of actors' roles. But the hindrances for the
 417 processes of roles making or renewing within the LIT are not only related to these diverse visions and roles
 418 implied for users. They also lie in the functioning of the infrastructures that the LIT is relying on, building
 419 or trying to transform, with limited success. Indeed, the lack of alignment and explicit staging of the
 420 various rationales described hereabove did not allow for a coordinate questioning of existing infrastructures
 421 (for instance, the ones supporting the circulation of information among the agricultural actors within the
 422 territory such as mailing lists, newsletters, etc.), nor for coherent vision for the new infrastructures
 423 intended, which we describe in next section. In fact, we underline how this lack of questioning or coherent
 424 and explicit building of communication infrastructures hindered the processes of roles renewing, especially
 425 regarding farmers' roles. We describe some statically functioning aspects but in contrast with what the
 426 steering actors intended.

427 **5 The communication infrastructures involved in the enactment of actors' roles within the LIT**

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

434 *5.1. The "farmers' committee" and their status from various actors' points of view*

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

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

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

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

476 *5.2. Communication channels and their entanglement into the organization of the incumbent*
477 *knowledge and innovation system's actors*

478 The reason for the misunderstanding about the "farmers' committees" described above relates to the
479 communication channels used to circulate information. As no specific physical place was built to welcome
480 the Living Lab partners and visitors³, the communication strategies and technologies were decisive in the
481 sense that they not only determine who access information, but also contribute to reproduce power relations
482 and role distributions existing within the prevalent innovation system. Such impacts of information paths
483 on the opportunities for modifying the innovation process appear clearly when tracking the information
484 dedicated to farmers and "citizens": invitations and newsletters were addressed by the LIT facilitators to
485 the regional advisory services, in addition to the few farmers and project promoters already added to their
486 own contact lists. The regional advisory services could spread the information to intermediaries and
487 advisors or other partners, but do not have access to the farmers contacts, thus transferred information to
488 the various districts' services. These more local services eventually filtrated information judged of interest
489 for the farmers they are in contact with. The *gatekeepers*' roles within the advisory system were thus
490 conserved, and largely limited the ownership farmers could develop regarding the LIT and their active
491 integration into innovation projects conducted within it.

492 The LIT's animators only lately got aware of this incomplete distribution of information due to a control by
493 incumbent intermediaries within the territory and the existing infrastructure for information diffusion
494 among farmers and advisors. Intermediary actors of the existing agricultural innovation system were, at
495 first, not particularly assigned a position within the LIT. Their way of controlling the information from the
496 LIT may be interpreted less as a mistrust than as the classic way of maintaining their position and
497 legitimacy towards the farmers they advise and their other partners. They were mostly unaware of the types
498 of innovation the LIT was targeting, and their possible interest in interacting with it. Significantly, a
499 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.

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

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

525 *5.3. Information exchange and evaluation tools applied in a cropping systems trial project*

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

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

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

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

559 As one advisor regretfully explained:

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

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

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

596 *6.1. The challenge of creating new roles for the actors of a Living Lab within an existing innovation*
597 *system*

598 In the agricultural sector, innovation systems are deeply anchored in the centralized and standardized
599 functioning of advisory organizations, technical institutes, research institutes, and their respective
600 interactions (Labarthe et al., 2014; Röling and Engel, 1991). Bringing together the actors in Living Labs'
601 does not mean that they will easily reach an alignment of interests and prospects for innovation, and raises
602 challenges for building a place in areas where organizations, institutions, and clusters already exist (Santoro
603 and Conte, 2009). Yet, the Living Lab literature have seldom studied the impacts of contexts in which they
604 are implemented, and rather explored the "sense of place" that such innovation models may build
605 (Frantzeskaki et al., 2018). The influence of contexts on the particular implementations and outcomes of
606 new agricultural innovation arrangements was previously studied for Innovation Platforms (Cullen et al.,
607 2014; Turner et al., 2020) or co-innovation processes (Botha et al., 2017; Ingram et al., 2020; Vereijssen et
608 al., 2017). Co-innovation methods are highly dependent on institutional (Klerkx and Leeuwis, 2009a),
609 social and cultural contexts (Botha et al., 2017; Neef and Neubert, 2011), which correspond to routines,
610 specific knowledge systems and relationships that influence actors' expectations and motivations for
611 engaging in participatory processes. Co-innovation processes have also been shown to very concretely
612 depend on the existing innovation systems, in terms of established facilitation activities and
613 experimentation usual practices (Ingram et al., 2020). These studies have insisted on the existing expert
614 knowledge, on the dependencies to discourses and issues already addressed, and on the difficulties for

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

628 *6.2. The little attention paid to infrastructures as a hindrance to effectively construct new actors’ roles*

629 We insisted on the dialogue and communicational infrastructures concerned by the implementation of an
630 agricultural Living Lab, and the hindrance they could constitute regarding the operationalization of
631 intended roles redistribution among actors. This underlines the interest of studying Living Labs as
632 processes progressively building new norms for coordination, and the difficulties that may appear for
633 transforming infrastructures. The confrontation with existing infrastructures was studied in various new
634 participatory arrangements, such as biodiversity databases with amateurs’ contributions (e.g. Meyer, 2009).
635 Interestingly, in our case study, the difficulties encountered for establishing new roles for farmers came
636 from the poor attention and transformation efforts dedicated to the communication infrastructures, rather
637 than their conscious use and positioning by the diverse actors. This uncontrolled and involuntary aspects of
638 the context are what we insist on with this particular analysis of infrastructures, which contrasts with
639 studies that investigated more conscious and directed mobilization of resources, such as analyses of power
640 and conflict staging in Innovation Platforms that either maintain power position preventing from regime
641 modifications or lead to evolutions in roles perceptions (Cullen et al., 2014; Turner et al., 2020). The poorly
642 noticed or voluntary impacts of infrastructures we studied is in line with their embeddedness and
643 invisibility as generally described (Leigh Star, 2018). Moreover, the under-questioned need for
644 transformation of basic functioning within the agricultural networks of actors may have resulted from
645 acquaintances and work habits shared by a part of the Living Lab actors before its implementation, which
646 echoes previous findings on implementations of co-innovation methods (Eidt et al., 2020; Ingram et al.,
647 2020). Some actors (for instance, members of the “steering committee”) were used to interacting and
648 working together, which may have smoothed the encounter between antagonistic visions of the LIT, and
649 made it possible to get around them by adopting classical roles and agreements to do so. This made the
650 potential for the LIT to actually redistribute roles, and particularly to reconsider farmers’ roles within the
651 innovation process, even more relying on the accurate monitoring of implementation practices and
652 transformation of in-depth habits structuring experimentation for agroecological transition (e.g. existing
653 methods for cropping system evaluation, communication paths and gatekeepers within advisory services,

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

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

676 *6.3. Skills and their distribution among actors for addressing these infrastructures issues?*

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

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

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

733 knowledge to be produced, the production of the phenomena to be observed, or even the "craft" (Jouvenet,
734 2007) devices to produce and observe phenomena: for instance, the protocols for observing biodiversity in
735 the experimentation of cropping systems, or crop choices that sometimes deviate from the initial plan. The
736 involvement of actors in the experimental process, such as farmers here, raises the question of the
737 appropriation and ownership of this production of new modalities for the experiment, the inclusion of these
738 emergent practices. But allowing them to "talk back" is more than "just tapping into user creativity or
739 fostering technology acceptance through consumer feedback" (Engels et al., 2019). Laurent and Tironi
740 (2015) propose that in order to understand an experimentation process in which users participate, "one
741 needs to extend the scope of who is innovating, explore the various ways of acting in situations of social
742 and technical innovations, and examine whom the experiments have value for". This is in line with the
743 analysis by Gamache et al. (2020), who propose that "citizen-centric living labs" are best suited in the case
744 of agri-food systems transitions, in which the experimentation corresponds to "building representations of
745 the complexity of the issues at stake through action and insightful reflexive self-evaluation by the actors
746 leading the initiatives". The extension of the scope of activities covered by the term "experimentation", in
747 the case of agricultural Living Labs, should include the ongoing tensions between the rationales for the
748 innovation process, the territory and its particularities, and the infrastructures on which rely the various
749 actors' experiences of the new innovation arrangement. As another recent case study in France shows
750 (Fèche et al., 2021), this calls for an attention to the reconfigured ways in which legitimacy of the
751 experiment is built, namely more in relation to territory and local anchorage, and through the integration of
752 multiple rationalities that allow for more alterity. Reflexivity all along the collective enquiry and
753 confrontation of the Living Lab process with to dominant socio-technical norms are also part of what the
754 experiment necessarily includes according to these authors (ibid.).

755 **7. Conclusion**

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

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

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

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

784 **Contributors Roles (CRediT)**

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

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