Living Labs Annotated Bibliography

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In recent decades, researchers have increasingly deployed Living Labs (LLs) as user-centric approaches aided by ICTs seeking to prototype innovations in everyday environments of use. Researchers have applied LLs to various sectors, ranging from agriculture, pedagogy, and urban design (among others). A key challenge for these frameworks is how to set up (despite their very emergence being due to a proliferation of ICTs and their application towards collaboration) distributed collaboration as an asset rather than a hindrance to collaborative learning.

An important factor to doing so is to reinvigorate a sense of place in the communities of practice being co-created, which can be fungible in response to the spaces, places, and actors being enrolled in a given LL framework. As LLs extend into rural areas with RLLs, the stakes of these considerations become even higher. In such cases, matters of trust in the actors involved in designing the LL (whether informed by logic or affect) and their very capacity to act (defined by the duration, degree, and/or maturity of the trust assessments at hand) are paramount, even if literature on LLs has yet to fully conceptualize trust in these frameworks.

What follows groups different areas of the landscape of literature on LLs. Given that the realization of LLs must be so attuned to the actors and situated contexts being enrolled in a project, said literature necessarily lacks a one-size-fits-all methodological primer; rather than seeing this as a point of frustration, this lack invites us as scholars to wander (as it were) around this landscape. We hope what follows can provide more of a map which researchers can use to plan their routes. Citation numbers are from Google Scholar and were last updated in June 2022.

LL Origins and Foundations

One can trace the origins of LLs to different locations and points in time. The diverging and sometimes sector-specific accounts of the origin of LLs highlights the melting pot of LL literature today. Different origin stories indicate which disciplinary streams researchers hail from, how important researchers find different features of LLs, and how researchers conceptualize themselves as part of the overall evolution of LL literature. In this section, we highlight key sources that provide origin accounts of LLs, serve as foundational pieces of LL literature, and give an overview of different theoretical foundations' connections to LLs.

Bajgier, S. M., Maragah, H. D., Saccucci, M. S., Verzilli, A., & Prybutok, V. R. (1991). Introducing students to community operations research by using a city neighborhood as a living laboratory. *Operations Research*, *39*, 701–709. doi.org/10.1287/opre.39.5.701. (71+ citations)

Bajgier et al.'s paper features one of the earliest mentions of a "Living Laboratory." They report on experimental classroom experiments in which university students interacted with their local community to hear firsthand how community members conceptualized places for improvement

in the neighborhood. In mainstream LL literature, Bajgier et al. have received less recognition as a key foundational LL experiment than others, with only a select few scholars consistently citing this paper (most notably, Leminen & Westerlund). But their endeavor embodies many of the features and goals of LLs. Likewise, centering around the improvement of a neighborhood city serves as a precursor for Urban Living Labs (ULLs) and demonstrates the importance of the university, collaborative and interdisciplinary learning, and trial-and-error in ongoing LL efforts.

Leminen, S., & Westerlund, M. (2019). Living labs: From scattered initiatives to a global movement. *Creativity and Innovation Management*, *28*(2), 250-264. doi.org/10.1111/caim.12310. (36+ citations)

Leminen and Westerlund historicize LLs based on a literature review of LL origin sources and interviews with those who worked on early LL projects. They identify five perspectives held by important actors during three phases of LL emergence. This account is one of few longitudinal analyses of LL activities over time and aims to overcome this gap in literature while providing a more cohesive framework under which LLs can be classified as a movement.

We find these authors present a more detailed account of the Living Lab movement than other scholars. Particularly notable is the connection the authors draw between the early activities of Bill Mitchell (an MIT professor referred to by ENoLL members and other mainstream scholars as the founder of LLs) and the proliferation of European LL projects several years later, the latter of which led to direct EU funding of LL projects and the development of the European Network for Living Labs (ENoLL). Leminen and Westerlund provide a detailed analysis of how this process occurred, as Nokia Corporation executives saw the potential of Mitchell's PlaceLab experiments to create value in the business sector through innovation processes that took the context of place into account. Nokia extended these projects into the European research community, catching the attention of EU governments.

Leminen and Westerlund contrast this with early American LLs. Those were more focused on the real-world environments and context of the research at hand and how product innovation could be improved through these considerations. Early European LLs were more likely to include aspects of co-creation and user involvement in innovation processes.

Ballon, P., Pierson, J., & Delaere, S. (2005). Test and experimentation platforms for broadband innovation: Examining European practice. *Available at SSRN 1331557*. dx.doi.org/10.2139/ssrn.1331557. (252+ citations)

Ballon et al. acknowledge that modern societies require broadband innovation that features experimentation with a large variety of technologies, multiple service providers and users, and mechanisms for controlling the societal effects of innovation activities. Thus, the authors develop a test and experimentation platform (TEP) framework, a concept that includes "all facilities and environments for joining innovation including testing, prototyping and confronting technology with usage situations." The framework further establishes six forms of TEPs: "prototyping platforms (including usability labs, software development environments); testbeds; field trials;

living labs; market pilots, and societal pilots." These types are distinguished by their technological maturity to market and their degrees of openness and focus.

The authors identify several rationales for TEPs based on their survey of innovation literature: "increasing policy awareness of the importance of innovation activities for competitiveness; overcoming systemic failures in innovation, and involving users in the innovation process." They further expand upon their typology through a discussion of several innovation projects in Finland, the Netherlands, and the United Kingdom. Ballon et al. conclude by reiterating that their work is grounded in innovation policy considerations and not commercial development, and find that the technologies, products, and services developed from TEPs are 'semi-mature' in terms of market readiness, with the type of TEP being employed affecting commercial maturity.

The authors' TEP framework had significant impact. Many scholars employed and built off the concept. However, users as a group are less of a concern here than for future scholars, with the authors mostly considering them passive participants, the subjects of research. Ballon et al.'s paper also exemplifies how the formative literature conceptualized LLs in different ways. The authors' work is further grounded in innovation literature, not business models. Soon afterward, product development and market value would become key components of LLs.

Eriksson, M., Niitamo, V. P., & Kulkki, S. (2005). State-of-the-art in utilizing Living Labs approach to user-centric ICT innovation-a European approach. *Lulea: Center for Distance-spanning Technology. Lulea University of Technology Sweden: Lulea*. (543+ citations)

Eriksson, Niitamo, and Kulkki provide one of the earliest proposals for LLs in this widely cited paper structured for those unfamiliar with the concept at the time. The authors argue that Europe, and the EU specifically, needs to shift away from research and development (R&D) focused on knowledge creation towards R&D that seeks to address how to tailor specific ICTs to the needs of sectors and groups. Eriksson et al. advocate for LLs as opportunities to bridge the gap between research and innovation, a relationship clarified by Eriksson's claim that "[r]esearch is making knowledge out of money – innovation is making money out of knowledge."

The authors draw from the theoretical streams of co-creation, TEPs, and governance management structures. This source represents another early effort by LL scholars to call attention to key issues unfolding in the Living Lab discourse. The authors conclude that if LL researchers can properly integrate multiple disciplinary fields, innovation techniques, and management structures, then LLs can effectively serve as a microcosm of social, political, and economic life and result in "human-centered systemic innovation."

Niitamo, V. P., Kulkki, S., Eriksson, M., & Hribernik, K. A. (2006, June). State-of-the-art and good practice in the field of living labs. In *2006 IEEE international technology management conference (ICE)* (pp. 1-8). IEEE. DOI:10.1109/ICE.2006.7477081. (322+ citations)

Utilizing several examples of LLs initiatives launched at the time, Niitamo et al. examine key practices for successful LLs. The authors list two important aspects of co-creation that must be

present for LLs to effectively capitalize on the creative potential and knowledge of user groups; LLs must have "the ability to capture ideas and input from the wider population as well as the ability to understand and evaluate technology use within specific situations." Niitamo et al. continue to identify several important considerations for those wishing to construct a state-of-the-art LL, including technological ability and providers, vertical cooperation within the value chain, openness and neutrality, public involvement user involvement, research involvement, and governance models. They conclude by urging scholars to research more and contribute to a field that has a lot of potential and few entries.

Niitamo et al. conceptualize their work as part of the overall literature differentiating TEPs and understand LLs as distinct because of their Public-Private Partnerships (PPP) that allow for open innovation and co-creation between citizens, public authorities, businesses, and researchers. This paper builds from Ballon et al. and assumes the TEP approach while critiquing the framework for not focusing on differences in modeling user contributions based on co-creation or other dynamics, as well as lacking domain-specific focus. Niitamo et al. further incorporate business models and product development into LL discussions.

Pierson, J., & Lievens, B. (2005, November). Configuring living labs for a 'thick' understanding of innovation. In *Ethnographic Praxis in Industry Conference Proceedings* (Vol. 2005, No. 1, pp. 114-127). Oxford, UK: Blackwell Publishing Ltd. doi.org/10.1111/j.1559-8918.2005.tb00012.x. (159+ citations)

This paper is one of the principal articles used to create the growing body of LL literature and demonstrate roots in Science and Technology Studies (STS), a disciplinary stream that prioritizes socio-technical design in the development of Information and Communication Technologies (ICTs). STS theories generally consider the social context innovation takes place within for how it shapes the innovation process and warrants focus by researchers. Pierson and Lievens utilize LLs as a meta-methodology for incorporating STS into the research process through four phases termed "contextualization, concretization, implementation, and feedback." The authors' efforts to include STS in LL construction correspond with theories of co-creation and open innovation being introduced to the field at the time. These theories sought to include the experience of users and other relevant stakeholders in the process, the common goal being to create more effective products that minimize unintended consequences across stakeholder groups.

Pierson and Lievens excel at connecting between emerging relevant LL theoretical streams, an effort that has become less commonplace. Their explicit goal to "bridge the divide between sociological studies and technology design" for continued design through mutual shaping (as "ICT becomes a vehicle for social research, the results of which in turn drive design") is equally distinguishing. Notably, Pierson and Lievens also conceptualize their paper as building upon Mitchell's PlaceLab LLs to extend the concept across larger geographical areas, including neighborhoods, cities, and campuses. Furthermore, they propose that early interaction with users in the design and development phases will improve the creation of subsequent prototypes, also citing the "fuzzy front-end" concept from innovation management literature. While this paper is still often cited by LL scholars, connections to STS theories and phrases are few and far between.

Bergvall-Kåreborn, B., & Ståhlbröst, A. (2009). Living Lab: an open and citizen-centric approach for innovation. *International Journal of Innovation and Regional Development*, *1*(4), 356-370. DOI:10.1504/IJIRD.2009.022727. (498+ citations)

The authors present LLs as a novel type of open and citizen-centric innovation. The authors attribute three key principles to LLs—openness, empowerment, and realism—and identify realism as distinguishing from other innovation processes. The authors note that there is a need within the field to devise toolkits and practices compatible with fulfilling said principles. Bergvall-Kåreborn and Ståhlbröst develop and propose their FormIT methodology to help fill this gap. The FormIT process is described as a "spiral in which the focus and shape of the design becomes clearer, while the attention of the evaluation broadens" to achieve a "holistic view on the use of the system."

Three phases—Generate Needs, Design, and Evaluate—occur in iterative design cycles. The authors detail a SMART Project set within the Botnia LiL, which sought user empowerment through increased communication with public authorities to make suggestions and influence local governance. Key challenges to fulfilling this project included recruiting user groups representative of society and transitioning users from testers of innovations to co-creators of equal standing. The authors conclude that, in the future, FormIT should further be developed to increase its realism principle, as efforts to operate within users' real-world contexts throughout the process and be truly user-driven were not entirely successful.

Almirall, E., & Wareham, J. (2008). Living labs and open innovation: Roles and applicability. *eJOV: The Electronic Journal for Virtual Organization & Networks*, *10*. (337+ citations)

This paper is foundational in explaining the value users can provide to innovation and positioning LLs as an effective means by which to organize user involvement in the innovation. Almirall and Wareham further contend that LL innovations can be extended to the external world through the use of business models and actor networks that capture value. Importantly, the authors note potential limitations of LL innovation processes, noting the paradox between LLs' ability to capture useful insight from users while also requiring broader user participation that limits this process. Scholars have been less willing to engage with the problems Almirall and Wareham identify. As a result, these discussions remain unresolved in the literature.

Nyström, A. G., Leminen, S., Westerlund, M., & Kortelainen, M. (2014). Actor roles and role patterns influencing innovation in living labs. *Industrial Marketing Management*, *43*(3), 483-495. doi.org/10.1016/j.indmarman.2013.12.016. (251+ citations)

Nyström et al. evaluate LLs from the perspective of role theory, positing that actor role-sets impact how innovation occurs within networks. The authors employ an action-based approach, which "suggests that an actor's role is created through actions and that an actor takes an ideal role in an attempt to achieve a goal." The action-based perspective offers an additional theoretical perspective to roles and suggests actors' roles emerge and change during the innovation process.

The authors conclude that for LLs featuring open innovation to work, network structures must feature negotiable roles as actors participate in processes of role-taking and role-making. This simultaneous process occurs as actors enter into their roles and transform them through their actions and goals. These role transitions change both the overall network and others' roles. Nyström et al.'s discussion also recognizes several distinct types of roles associated with LLs, including "role ambidexterity, role reciprocity, role temporality, and role multiplicity." The authors conclude that creating organizational structures that allow actors to easily enter, adapt their roles to changing networks, and take on positions requiring more commitment and responsibility is important for LLs to operate smoothly.

Nyström et al.'s paper is useful for scholars following network and innovation theories. The process of role-taking and role-making described, which requires a degree of flexibility and change to occur in network structure throughout a project, addresses the limitations laid out by Leminen et al. (2012) regarding LL network types. This did not account for how networks may change based on actors' behavior.

Leminen, S., Westerlund, M., & Nyström, A. G. (2012). Living labs as open-innovation networks. *Technology Innovation Management Review*, *2*(9): 6-11. (497+ citations)

Leminen et al. discuss LLs from a network perspective as companies posit that innovation development is becoming more dependent on understanding user needs to achieve a competitive advantage. The authors define LLs as "networks that can help them [companies] create innovations that have a superior match with user needs and can be upscaled promptly to the global market." Leminen et al. conceptualize four LL types: utilizer-driven, enabler-driven, provider-driven, and user-driven. The type of network determines the purpose, value-creation logic, and outcomes at hand. The authors describe their typology in more detail using interviews with participants of 26 LLs in Finland, Sweden, Spain, and South Africa. This understanding of LLs is characterized by the "doing" of the lab (collaborating and networking) rather than achieving specific ends. The authors conclude that understanding who and what drives these networks helps participants comprehend LL characteristics and their own role within it.

Leminen et al.'s paper is one of the most widely cited and versatile articles within LL literature. Many other scholars have utilized the typology developed by the authors, often adapting and expanding upon the original four types as the field has evolved.

Dell'Era, C., & Landoni, P. (2014). Living Lab: A methodology between user-centered design and participatory design. *Creativity and Innovation Management*, *23*(2), 137-154. doi.org/10.1111/caim.12061. (330+ citations)

Dell'Era et al. contribute to the theoretical bases and processes of LLs through an application of design methodologies from computer science. The authors highlight the ability of LLs to guide design research transitions toward participatory design. Participatory design approaches allow researchers to engage actual users in design activities during the concept generation and

development phases to make the innovation process more effective. The authors define LLs as a design approach characterized by real-life testing and experimentation environments and users who collaborate in the innovation process.

LL ties with applied ethnography and lead user innovation strategies fit within this proposed focus on participatory design. Furthermore, LLs are ideal for implementing the Scandinavian Method, a participatory design concept in which users are given physical artifacts as tools to aid in their thinking. The authors propose an LL typology that includes four forms of LLs dictated by two variables. These variables refer to "the type of interaction with the users (open or closed)" and "decisions regarding platform technology (value capturing or value creation)."

Applied Living Lab Work: Reflections and New Theoretical Concepts

The previous section mostly contained entries from the first generation of LLs (roughly 2000-2009). This section begins to transition to those in the second generation (roughly 2010-2019). With added nuance by way of more literature reviews and case studies, theories of space and place, trust, incentives, and motivations began to appear as more evolved LL considerations. Authors likewise begin to reflect on where LL dimensions could stand for further definition in discussing first-generation projects. Third generation work generally comprises work conducted in the current decade, with researchers shifting to intervening at larger scales toward testing more sustainable and competitive societies.

Følstad, A. (2008). Living labs for innovation and development of information and communication technology: a literature review (560+ citations)

Følstad conducts the first notable systematic literature review (SLR) of LL literature, giving shape and formal structure to a field that until that point had continued to grow in popularity and implementation without such critical analysis. Følstad reviews 31 increasingly cited LL papers and offers common definitions and characteristics found within the papers. Følstad finds a high degree of diversity and competing ideas within the literature. Følstad identifies co-creation and user-led innovation, STS, and Human-Computer Interaction (HCI) as the major theoretical foundations of LLs, but also writes that 10 out of the 31 papers featured in the review contained no explicit reference to theoretical streams of literature at all. Følstad notes the lack of methodological advances being made within the field of LLs, encouraging future researchers to branch out from existing approaches to differentiate LLs.

This review's image of LLs paints them as "contextually situated experimentation with new technology" that developed out of technical testbeds used by ICT theorists seeking to include users and idea generation in the experimental phases of innovation. Følstad concludes by mentioning the potential for ethnographic research methods to aid in longitudinal understandings of users and real-life environments. This paper finds a great deal of traction in LL literature for the broad picture of LLs it provides as well as for its conceptual work distinguishing LLs from similar testbed and open innovation concepts.

Niitamo, V. P., Westerlund, M., & Leminen, S. (2012). A small-firm perspective on the benefits of living labs. Technology Innovation Management Review, 2(9): 44-49. (26+ citations)

Niitamo et al. examine the concepts of trust, motivation, and LL longevity from the perspective of small firms as stakeholders. The authors note that small firms are attractive partnerships to larger firms when participating in open innovation activities, as small companies typically make active users and can contribute important input on prototype technologies. From a profit perspective, however, small firms often struggle to make money from participating in open innovation because of these firms' overall fewer resources and limited ability to invest in the adoption of new technologies. The authors note that for small firms to be included in LLs, there must be a strong commitment from upper management at these companies, a project manager to connect new product research and market delivery, and genuine trust between the firm and other partners—especially when the firm is relying on external resources for their involvement.

Dutilleul, B., Birrer, F. A., & Mensink, W. (2010). Unpacking European Living Labs: Analysing Innovation's Social Dimensions. *Central European journal of public policy*, *4*(1). (266+ citations)

Dutilleul et al. discuss the evolution of LLs in Europe and catalogue the social impediments and societal dilemmas that have appeared. This includes barriers emerging from social configurations, motivational factors, and cognitive and background asymmetries between stakeholders in the lab. The social configurations identified by the authors include "innovation systems, in vivo experimental settings, and approaches for involving users in product development processes." After establishing these three dimensions of social configurations of LLs, the authors apply the concepts of contact, communication, and collaboration to each configuration. Some of the additional topics covered by Dutilleul et al. along these concepts include "regional organizations as repositories and diffusers of knowledge, multi-business collaboration considerations, [and] the political-economic assumptions of the [LL] movement." The authors conclude by identifying key points of future LL research, including solving considerations of user needs, knowledge asymmetries, user motivation, and the ethical limitations of experimenting in real-world settings with subjects. They further propose concerns relating to the business and economic side of LLs, such as how to encourage cooperation between competitive businesses in a collaboration, how to measure the actual economic impact of lab activity, and further explorations of the territorial competitiveness concept.

Other researchers would pick up on Dutilleul et al's identification of social LL dimensions. The concerns the authors discuss lend themselves to social scientific research approaches that are adopted later by authors such as Franz (2015). The paper is also one of the few LL sources that utilize a multi-perspective analysis to consider labs along multiple dimensions.

Franz, Y. (2015), Designing social living labs in urban research, *info*, Vol. 17 No. 4, pp. 53-66. doi.org/10.1108/info-01-2015-0008. (71+ citations)

Franz's SLR focuses on the transition in LL literature from discussions of ICT and user-led innovation theories to those that feature socially-centered research practices. Franz argues that this transformation is the future of LL research, referencing the EU's Lisbon Strategy–which prioritizes innovation's translation into economic growth—as evidence that EU governments will increasingly seek to solve economic and social issues through co-creation and open innovation methodologies that reference social science theories of placemaking, participatory action research, ethnography, and STS theory. To successfully transition LL approaches into such disciplines, Franz proposes a three-phase process in which scholars work to decide which existing terminology should be preserved and which keywords should be adopted from new theories, establish spaces of encounter within LLs that connect experiments to real-world environmental factors, and participate in phases of interaction that integrate social science evaluation process approaches into LLs. Franz describes an LL called Interethnic Coexistence in European Cities (ICEC), applying the concept of spaces to encounter to describe how shared neutral community spaces hosting enticing activities can allow different ethnic groups living within cities to naturally meet and transform the space into a community toward coexistence.

Bergvall-Kåreborn, B., Eriksson, C. I., & Ståhlbröst, A. (2015). Places and spaces within living labs. *Technology Innovation Management Review*, 5(12). http://doi.org/10.22215/timreview/951. (43+ citations)

Bergvall-Kåreborn et al. write about theories of place and space and connect them to LLs. The authors begin by including a detailed review of the literature on place and space theories, providing definitions, comparing and contrasting the two terms, and connecting the concepts to design innovation literature. The authors then make the unique argument that these theories should be incorporated into LL design to generate results that allow researchers to be fully conscious of the variables involved in conducting research in different real-life environments, as well as how these environments may be changed as a result of research. This discussion leads to applications of these theories to the existing characteristics of LLs Bergvall-Kåreborn et al. identify: openness, realism, and influence. The authors highlight the importance of innovative methods as a way to influence how space and place affect research, and call for researchers to consider methods alongside stakeholders and facilitators to make informed planning decisions.

Bergvall-Kåreborn et al.'s paper on theories of place and space within LLs is a foundational LL source explicitly connecting these theories with LL management. Their literature review section brings in theoretical considerations from the fields of geography, anthropology, and sociology. Additionally, we find the retrospective analysis of previous LL papers within a place and space framework a fruitful, increasingly relevant technique for analyzing LL literature. Many papers in the literature sync with space and place paradigms, but do not cite them specifically. Scholars can therefore take up this approach in seeking to standardize LL literature under similar terminologies and theories.

Frantzeskaki, N., Van Steenbergen, F., & Stedman, R. C. (2018). Sense of place and experimentation in urban sustainability transitions: The Resilience Lab in Carnisse, Rotterdam, The Netherlands. *Sustainability Science*, 13(4), 1045-1059. https://doi.org/10.1007/s11625-018-0562-5. (64+ citations)

This paper extends the work of Bergvall-Kåreborn et al. (2015) to not only connect theories of space and place to LL construction but to further draw upon theories of how space and place impact sustainability transitions to conceptualize how space and place can be applied to ULLs focused in sustainability. The authors note a sense of place can be optimized to strengthen ties between the people living in an urban environment and the city itself, motivating citizens to take collective action in developing places with which they identify. Frantzeskaki et al. conclude that transition experiments focused on citizens' understanding of place can create a new and purposeful sense of place through collaborative work in crafting narratives, producing knowledge, and designing meaningful spaces.

Voytenko, Y., McCormick, K., Evans, J., & Schliwa, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. *Journal of cleaner production*, 123, 45-54. https://doi.org/10.1016/j.jclepro.2015.08.053. (528+ citations)

Voytenko et al. conceptualize ULLs, sustainability technologies, and territorial development as aspects of LL literature that are compatible with one another. The authors identify several key characteristics of ULLs that overlap with and differ from other scholars' accounts of LL characteristics. These features include "geographical embeddedness, experimentation and learning, participation and user involvement, leadership and ownership, and evaluation and refinement." Furthermore, Voytenko et al. focus on the city as a geographically embedded location that is the subject of and site for experimentation and clarify their framework can be extended to any territorially-defined space that is manageable in scale. Theories of collective governance and testbed experimentation are prominent in the paper.

The authors differentiate ULLs based on the initiating group and their purpose, with the origin of projects ranging from relatively spontaneous grassroots efforts by local activists and citizens to carefully planned efforts started by city government officials and led by institutions. Voytenko et al. also describe ULLs as a type of "ecosystem" that can be expanded to broader knowledge-sharing networks of LLs, emphasizing the importance of sharing ideas and resources in the field of innovation as well as the connections between sustainability transition literature and agro-ecosystem literature.

Hossain, M., Leminen, S., & Westerlund, M. (2019). A systematic review of living lab literature. *Journal of cleaner production*, 213, 976-988. https://doi.org/10.1016/j.jclepro.2018.12.257. (204+ citations)

Hossain et al. offer a comprehensive literature review of LL literature. They analyze 114 scholarly articles on LLs and report on characteristic concerns and standing gaps within the literature. The review analyzes primary LL publication outlets, keywords, origins, theoretical paradigms, characteristics, design approaches, topics, and challenges. Hossain et al. define LLS

in simultaneously existing as "landscapes, real-life environments, and methodologies." They underscore the importance of business models, heterogeneous stakeholders, governance, temporality, user inclusion, and sustainability within the literary landscape.

This literature review is the most recent we found. It has become widely cited as a helpful resource for scholars looking for a place to begin finding LL sources and understanding how the concept has evolved. The authors discuss previous literature reviews by Følstad (2008) and Franz (2015) and position their work as a natural successor to these papers in its synthesis work.

University Interventions and ULLs

Building from prior discussions of placemaking and specific needs of stakeholders, this section dives into two major types of place-based LLs: campuses as LLs and ULLs. Work in this section discusses how the particular environment of the LL helps shape it. This includes governance structures of the municipality or administrative body at hand. A diverse group of participants must be motivated to dedicate time and energy to transforming organizational structures. Governments and universities are increasingly motivated to invest in shared projects that develop cities while improving citizen livelihoods; ULLs have found particular traction in the EU.

Van Geenhuizen, M. (2013). From ivory tower to living lab: accelerating the use of university knowledge. *Environment and Planning C: Government and Policy*, *31*(6), 1115-1132. https://doi.org/10.1068/c1175b. (43+ citations)

Van Geenhuizen (2013) contributes to the conversation regarding ULLs through a discussion from the perspective of non-academic stakeholders. The author criticizes previous approaches of the academic community to isolate themselves within university research and effectively separate research from undertakings to translate research into useful information and technologies for the development of society—effectively sealing themselves within an ivory tower. Utilizing the concept of knowledge valorization, van Geenhuizen argues that it is time for universities to collaborate with industry members to accelerate the process of making societal value out of academic research. The author also discusses challenges to university projects focused on developing products for the market, such as regional location, inadequate university institutional structures and incentives for managing such projects, and ineffective communication between the market and researchers designing products.

König, A., & Evans, J. (2013). Introduction: Experimenting for sustainable development? Living laboratories, social learning and the role of the university. In *Regenerative sustainable development of universities and cities*. Edward Elgar Publishing. doi.org/10.4337/9781781003640.00007. (56+ citations)

This book covers various LL topics relating to sustainable research, ULLs, economic and regional development, and universities as LLs. The authors cite EU reports detailing the potential for universities to serve as core stakeholders in developing surrounding cities, explaining how

universities can contribute their expertise and knowledge to society through the use of nearby cities as sites of experimental implementation of research. The authors purport that universities and cities have a shared history together and that universities as landowners have an incentive to introduce regenerative sustainable practices into cities.

Chapters span topics such as universities as "sites for directed social interactions," the "facilitation of learning and coordination among stakeholders," and "which activities, tools, and skills of facilitators help to guide learning processes among multiple independent stakeholders." The book's central argument revolves around theories of governance and institutional policies, arguing a university's institutional characteristics result in "a framework for deliberative community learning processes." Therefore, König and Evans conclude that participatory deliberative processes must be utilized as a method to challenge existing institutional policies and power relationships. This work marks one of the few entries on this list that is not an academic article found in a peer-reviewed research journal and the only entry that is a book.

Purcell, W. M., Henriksen, H., & Spengler, J. D. (2019). Universities as the engine of transformational sustainability toward delivering the sustainable development goals: "Living labs" for sustainability. *International Journal of Sustainability in Higher Education*. DOI: 10.1108/IJSHE-02-2019-0103. (105+ citations)

Purcell et al. (2019) outline the potential of LLs to tie university social responsibility goals with outside stakeholders, including local community partners. The authors discuss LLs as means of transforming university institutions and advocate that universities draw upon existing resources to develop experimental testbeds for specific sustainability projects. The paper includes sections on three university LLs at Plymouth University, England; American University, Bulgaria; and Harvard University, US. These sections describe specific programs and initiatives these universities have developed and cover the range of paths oN-campus LLs can take. While some universities such as American University emphasize partnerships with large companies such as Coca-Cola, Harvard University's governance structure allows for pan-university programs that allow Harvard faculty and students to emphasize local and global connections.

Iyer-Raniga, U., & Junior, R. M. (2020). Urban Living Labs: Explorations in a University Setting. *Quality Education*. doi.org/10.1007/978-3-319-69902-8_27-1.

Iyer-Raniga and Junior present a case study of RMIT in Melbourne, Australia as the university attempts to implement UN Sustainable Development Goals (SDGs) through the introduction of campus LLs. The authors explicitly connect RMIT's LL to specific SDGs 4 on education and 17 on global partnerships in sustainable development. The authors begin with a discussion of SDGs and their importance, outline the compatibility between SDGs and LLs, define LL characteristics, present several existing LL cases, and present findings on RMIT's Living Lab.

This article is one of many that connect ULLs to SDGs, but is the most explicit of articles reviewed here. The authors write primarily from the perspective of the field of education scholars, with LLs framed as a mechanism by which educational experience can be combined

with innovation for positive societal outcomes. Additionally, other case studies the authors draw upon are notably diverse in their geography. While most LL studies come from EU countries, the authors cite papers focusing on LLs in Russia, the Middle East, China, India, and Africa.

Kirrane, M., Kirrane, J., Poland, M., Irwin, S., & Mehigan, P. (2019). Innovative approaches for research-led education: UCC's Green Campus Living Laboratory Programme. DOI:10.33178/LC.2019.33.

Kirrane et al. thoroughly examine benefits and practical challenges involved in starting and completing campus LLs. The authors study the transformation of the University of College Cork's (UCC's) Green Campus Program into a LL to "combine collective student agency and research capability to deliver real and lasting change on the ground." The paper includes threads on sustainability research, participatory action research, and the differences between top-down and bottom-up development approaches. UCC's approach is unique in that the introduction of the LL involved developing a centrally managed program allowing the campus community to submit research proposals. Many of these projects engage the local community, utilize the university as a testbed, and offer academic qualifications for certain students.

Kirrane et al.'s paper, while relatively new and not frequently cited currently, provides a comprehensive and digestible overview of how many campus LLs function within the literature. The authors identify several key challenges that appear throughout the literature, including difficulties working across disciplines in a siloed academic system, finding administrators willing to facilitate the project over time and dole out responsibilities, and working to change how higher education and research universities function from the inside. We particular note one unique focus of ULLs these authors cite: a focus on sustainability research, particularly as this relates to SDGs. Indeed, UCC's program was initiated because of the university's sustainability strategy, which was based on the role of universities and researchers enumerated in Ireland's National Strategy on Education for Sustainable Development.

Diaz, L., & Potvin, A. (2020). EDS Integrated Approach for Sustainability (EDS-IA): Campus as a living laboratory experience. In *Universities as Living Labs for Sustainable Development* (pp. 283-300). Springer, Cham. https://doi.org/10.1007/978-3-030-15604-6_18. (2+ citations)

Diaz and Potvin explore the process of transforming a campus into a LL in this case study of Université Laval in Quebec, Canada, and administrators' attempts to introduce LLs projects to the university over two years. The authors pay significant attention to the SDGs and write from the perspective that innovation occurs within an earth that is a closed cyclical system with environmental limits, necessitating a positive relationship between humans and the environment. This discussion ties into Diaz and Potvin's concept of the EDS Integrated Approach (EDS-IA). This approach refers to the emphasis on three central three pillars—Environment, Development, and Society (EDS)—and promotes interdisciplinary collaboration as well as partnerships with outside stakeholders. EDS-IA tackles environmental issues related to climate change, biodiversity, and water at the level of cities and territories while utilizing governance as a transition mechanism to sustainability. In the study, Diaz and Potvin recount their experiences

with introducing LLs EDS-IA programs to a university setting in which students participated in workshops connecting them with representatives from key services (water, energy, transportation, et cetera) to understand the challenges at hand and propose project-based solutions. The authors also discuss the second year of the project in which they helped to bring LL workshops to partner schools and extend the EDS-IA philosophy that education is essential for reaching sustainability goals. Diaz and Potvin conclude a strong university governance structure provides guidance and coordinates projects between university and private actors.

Schuurman, D., Baccarne, B., De Marez, L., & Mechant, P. (2012). Smart ideas for smart cities: Investigating crowdsourcing for generating and selecting ideas for ICT innovation in a city context. *Journal of theoretical and applied electronic commerce research*, *7*(3), 49-62. DOI: 10.4067/S0718-18762012000300006. (344+ citations)

Schuurman et al. present a case study of Ghent Living Lab in Belgium and discuss its effort to utilize crowdsourcing methods toward developing ideas and city governance. The authors provide background on smart cities as it relates to discussions of sustainable and participatory citizen community development. These theories connect with STS perspectives that see mutually shaping between society and technology. Smart cities are differentiated from other city concepts because of the present focus on user-centered digital technologies that can be implemented to improve citizens' daily lives while contributing to sustainable development. The article also draws on crowdsourcing as a method for involving users in ICT-based innovation and concludes that crowdsourcing successfully capitalizes on the ideas and feedback of users within a LL model. The authors deem LLs as a way researchers, businesses, and governments can structure their approach to smart city development through inclusion of user feedback in ICT innovation.

This entry scholarship is notable as a precursor to ULL research that developed throughout the second generation of LL literature. The paper demonstrates some of the theoretical foundations leading up to ULLs. While this paper focuses on smart cities and crowdsourcing with ULLs as a framing device, other papers frame ULLs as a distinct concept with roots in these concepts, whether those concepts are explicitly discussed in the literature review or not.

Steen, K., & Van Bueren, E. (2017). The defining characteristics of urban living labs. *Technology Innovation Management Review*, *7*(7). http://doi.org/10.22215/timreview/1088. (138+ citations)

Steen and van Bueren work to identify distinguishing characteristics of ULLS and standard LLs before evaluating whether 90 sustainable urban innovation projects based in Amsterdam could be classified as ULLs. The authors purport that such analysis is necessary due to ambiguities and inconsistencies surrounding LL definitions and classifications in the literature. Furthermore, the authors note many LL papers are structured around one empirical case study identified as a LL. These papers often include analyses of the case as a LL without referencing a definition. Steen and van Bueren present their own nine defining characteristics of LLs along four dimensions: aim, activities, participants, and contexts. The results of the analysis indicate that only 12 of the 90 projects in consideration meet all nine criteria, with the rest of the projects often failing to

meet the “development” and “co-creation” criteria. Steen and van Bueren conclude the work of LL scholars and funders should be to identify which contexts would be best suited for making the effort to incorporate these two characteristics.

This paper succeeds at pointing at gaps within the literature. It directs LL scholars towards refining the methodologies associated with the field while expressing perceived limitations of the LL concept as a whole. This entry also exemplifies the perspective that ULLs are distinguished solely by their urban location—which necessarily complicates the considerations and relationships involved—but not being a different kind altogether.

Nesti, G. (2017). Co-production for innovation: the urban living lab experience, *Policy and Society*, *37*(3), 310-325. doi.org/10.1080/14494035.2017.1374692. (136+ citations)

Nesti explains the development process of ULLs and presents three unique characteristics of ULLs. Nesti charts the rise of co-production between communities and local governments in cities as a method of developing new services and technologies that better benefit both groups. Benefits of co-production for these groups include more efficient services, personalized outputs tailored to needs at lower costs, a renewal in trust in the democratic process by citizens, and increases in overall social capital. Nesti positions ULLs as a “methodology based on co-production and aimed at coping with policy challenges occurring at the local level.” Nesti’s three features of ULLs include incorporation of the quadruple helix multi-stakeholder approach, methodologies based on experimentation within real-world settings, and utilizing ICTs as solutions to problems and tools in research processes. The author concludes by comparing ULLs to the Smart City Strategy in the municipality of Turin, “aimed at developing a model of urban development based on the promotion of environmental and social sustainability.”

Puerari, E., De Koning, J. I., Von Wirth, T., Karré, P. M., Mulder, I. J., & Loorbach, D. A. (2018). Co-creation dynamics in urban living labs. *Sustainability*, *10*(6), 1893. DOI:10.3390/su10061893. (122+ citations)

Puerari et al. focus on co-creation dynamics in ULLs. They consider motivations, incentives, and relationship with a given project. The authors mostly focus on citizen groups participating in ULLs based in their city of residence. They note that unique social relationships, networks, backgrounds, and spatial contexts of this group affect whether citizens can successfully interact with other citizens and stakeholders in the LL. Puerari et al. conceptualize three user groups in ULL based on the degree of citizen involvement: the core group, inner circle, and outer circle. Thereafter, the authors examine how formal and informal placement into these groups affects motivations and incentives, reporting the benefits of being a member of the core group—achieving a sense of ownership over the co-creation process and lab activities—are difficult to transfer to the other user groups less closely tied to the lab. Furthermore, the authors note that projects focused on the social and economic development of the city often had users participate for collective benefits, while those focusing specifically on product development included users seeking individual benefits (compensation and personal fulfillment).

This entry can combine theories of co-creation, actors, networks, and LL management processes with ULL literature. Puerari et al. also include theories of motivation and trust found in open innovation literature. This combination of ideas allows for a unique and specific view of how stakeholder networks and user incentives are complicated and enriched within urban settings.

Leminen, S., Rajahonka, M., & Westerlund, M. (2017). Towards third-generation living lab networks in cities. Technology Innovation Management Review, 7(11): 21-35. doi.org/10.22215/timreview/1118. (75+ citations)

Leminen et al. build upon the work of numerous LLs, sustainable development, innovation networks, and governance scholars to develop a conceptual framework of third-generation ULLs as collaborative innovation platforms. The authors define third-generation LLs as: "platforms with shared resources, which organize their stakeholders into a collaboration network(s), that relies on representative governance, participation, open standards, and diverse activities and methods to gather, create, communicate, and deliver new knowledge, validated solutions, professional development, and social impact in real-life contexts." Key to this approach to ULLs is the use of a platform-based operating method, which the authors argue allows city municipalities to adopt a governance model based on development goals (adopting a "coordinator" role) and emphasizing "digitalized participatory urban development." This participation approach is conceptualized into four archetypes: 1) the city as a provider, 2) the city as a neighborhood participator, 3) the city as a catalyst, and 4) the city as a rapid experimenter. The authors conclude that cities are ideal for adopting several kinds of collaborative innovation modes at once and that cities that adopt provider and catalyst roles are primed to establish LLs with long-term provisions and significant citizen involvement.

Leminen et al.'s perspective is unique to LL literature in its focus on how cities can function as more than just enablers of innovation for users, as cities can serve several different roles. The authors utilize various collaborative innovation and platform theories not included in many other places in the literature, demonstrating another instance in which LL scholars adopt theories from a particular theoretical stream without full integration.

Agroecosystem LLs and RLLs

This section provides an overview of LL literature centering on rural environments and agricultural systems. These Rural Living Labs (RLLs) capitalize on the benefits of rural citizens' and farmers' input into design while providing underserved communities with technology and networking opportunities. RLL scholars have tied these experiences to a variety of other LL concepts, including issues of motivation and incentives, trust, context, characteristics of real places, and social and economic development. Recently, agroecosystem LLs have also emerged. This term captures these projects' goal of benefitting the entire ecosystem when conducting LL projects. These initiatives often closely align with goals of current ULLs; governments invest in LLs that improve overall viability and quality of life of areas through research in sustainability.

Schaffers, H., Cordoba, M. G., Hongisto, P., Kallai, T., Merz, C., & Van Rensburg, J. (2007, June). Exploring business models for open innovation in rural living labs. In *2007 IEEE International Technology Management Conference (ICE)* (pp. 1-8). IEEE. (148+ citations)

Schaffers et al. detail seven projects launched by C@R and funded by European Union states. They discuss how LLs can be introduced into rural areas through the use of business models that support open innovation and establish collaborative partnerships for rural development. The C@R RLLs provide human-centric rural innovation environments that lead to sustainable stakeholder partnerships and strategic development of regions. The LL business design model, which includes cooperative actor roles and captures the overall value created from a project, offers criteria for evaluating if a project "stimulates the creation of sustainable partnerships, provides an environment for new business development, and exploits opportunities for network synergies." The C@R projects analyzed focused on four areas of collaborative innovation, including "rural enterprise incubation, open communities, collaborative governance, [and] collaborative fishery." The authors identify several sources of synergy in the strategies formulated for rural development: shared policy objectives and rural challenges, a common understanding that RLLs are environments for innovation that support rural development, economies of scale and scope through exchanges in technology and infrastructure, and stakeholder networks that give access to large knowledge bases.

Schaffer et al.'s reporting provides an account of an initial iteration of RLLs describing how ICT and business design concepts were utilized for projects that, while sometimes developing ICT products for market, were united by a shared goal to stimulate economic and social growth in rural communities. These projects existed prior to ULLs. Still, after the initial C@R projects and their offshoots, there was a large gap in time before RLLs were written discussed in the literature. The C@R projects were notable for the inclusion of Sekhukhune Living Lab in South Africa, one of the few LLs being discussed at the time not based in Europe or North America.

Guzman, J. G., Schaffers, H., Bilicki, V., Merz, C., & Valenzuela, M. (2008, June). Living labs fostering open innovation and rural development: Methodology and results. In *2008 IEEE International Technology Management Conference (ICE)* (pp. 1-8). IEEE. (43+ citations)

Guzman et al. also provide observations and analysis of the C@R project. The authors clarify the initiative is based on principles of open service-oriented architecture to develop collaboration services and applications. C@R's approach tailors each collaboration to the specific rural situation and creates RLLs featuring "user-driven ICT-based innovation geared towards economic and social development in rural areas." This framework includes three key elements: "drivers and conditioners (shaping stakeholder interest and motives), living labs innovation and decision-making processes, and impacts and value creation of the living lab." The authors detail case studies of how C@R LLs implemented business models, responded to challenges, and worked toward long-term sustainability. This discussion highlighted the three-step model put in place by the Homokháti Lab to generally phase out EU funding while building trust with local farmers and eventually receiving private funding for business incubation.

Schaffers, H., Guzman, J. G., Merz, C., Cunningham, P., & Cunningham, M. (2008). An action research approach to rural living labs innovation. *Proceedings of the Cunningham and M. Cunningham (Eds), Collaboration and the Knowledge Economy: Issues, Applications, Case Studies. IOS Press*, 617-624. (40+ citations)

Schaffers et al. discuss their experiences studying ICT-oriented RLLs based on open innovation for strategic rural community development, conceptualizing this process under a "resource" and "process" view and drawing on human-centric and systemic innovation. The authors argue for the introduction of an action research approach as a method of guiding while concretely implementing RLLs. The authors recommend several strategies to use when implementing an action research approach, such as "to target key stakeholders (decision-makers), improve rural innovation culture, create early end-user involvement in rural areas, [and] create business models for effective partnerships." The authors conclude that combining "agile development with the cyclic approach of action research" is key to successfully gaining knowledge and using it as a catalyst for improved social and economic outcomes.

Wolfert, J., Verdouw, C. N., Verloop, C. M., & Beulens, A. J. M. (2010). Organizing information integration in agri-food—A method based on a service-oriented architecture and living lab approach. *Computers and electronics in agriculture*, *70*(2), 389-405. DOI:10.1016/j.compag.2009.07.015 (205+ citations)

Wolfert et al. connect the benefits of ICT and information integration to agri-food systems, citing data warehousing, e-content, context-sensitive searchers, and decision support systems as examples of these advantages. To support their claim, Wolfert et al. apply their method to a LL in the Dutch arable farming sector, concluding that LLs can combine "different methodologies into a design approach for information integration, based on a sound architecture," which "leads to ICT that follows the business processes in real life and thus enhances appropriate information sharing to support a knowledge-based economy."

Habibipour, A., Lindberg, J., Runardotter, M., Elmistikawy, Y., Ståhlbröst, A., & Chronéer, D. (2022). Rural Living Labs: Inclusive Digital Transformation in the Countryside. *Technology Innovation Management Review*, *11*(9/10), 59-72. doi.org/10.22215/timreview/1465.

Habibipour et al. utilize a design science research methodology (DSRM) to study RLL capacity to support user-centric digitization of rural areas through an analysis of a DigiBy project in northern Sweden. They view RLLs as containing components of traditional LLs and ULLs, but instead of being conceptualized as an environment or context, the authors solely understand RLLs as "an approach that facilitates the processes of DT" in the form of piloting and experimentation as part of the overall innovation process. Habibipour et al. also engage with a quintuple helix conception of RLLs in which the physical environment that the study is taking place is understood as a fifth stakeholder. This framework allows the authors to consider the interests, perspective, and unique character of the land that is distinct to rural environments.

Zavratnik, V., Superina, A., & Stojmenova Duh, E. (2019). Living labs for rural areas: Contextualization of living lab frameworks, concepts and practices. *Sustainability*, *11*(14), 3797. DOI:10.3390/su11143797

Zavratnik et al. write about RLLs in the context of creating environments that promote equal opportunities and conditions for those living in rural communities. The authors connect rural development to the Smart Village concept, which advocates for bottom-up approaches that integrate information and ICT solutions, and argue that RLLs can serve as building blocks that utilize local assets and strengths to implement Smart Villages. They also discuss a variety of RLLs since the end of the C@R initiative, including LiveRUR, MedLab, and CentraLab, which have built upon the advantages of circular economies to establish entire ecosystems that utilize natural rural environments and stakeholder synergies. The authors argue RLLs should improve the social and cultural environment of communities, with economic and technological development occurring after these transformations. They draw upon five areas of social innovation that researchers should focus on: "new services in rural areas; new education courses; ecological farming; formation of local action groups; and electronic and social innovations." Zavratnik et al. also particularly prioritize the trust, input, and expectations of rural community members themselves.

McPhee, C., Bancerz, M., Mambrini-Doudet, M., Chrétien, F., Huyghe, C., & Gracia-Garza, J. (2021). The Defining Characteristics of Agroecosystem Living Labs. Sustainability 2021, 13, 1718. doi.org/10.3390/su13041718. (14+ citations)

McPhee et al. analyze LLs' potential as sites for place-based experimentation focusing on sustainable development and innovation within agri-food systems. They capitalize on agri-food's adoption of terms such as actors, relationships, resources, and activities along with innovation models and processes to synthesize agri-food, territorial development, sustainability, and LL discussions. McPhee et al. cite discussion of agri-food LLs at the G20 Meeting of Chief Agricultural Scientists (G20 MACS) and subsequent investments by the Canadian and French governments as instrumental in the rise of agri-food LLs. McPhee et al. bring attention to the definition developed by an international working group of scientists, who found that agroecosystem LLs are "transdisciplinary approaches involving farmers, scientists, and other interested partners in the co-design, monitoring, and evaluation of new and existing agricultural practices and technologies on working landscapes to improve their effectiveness and early adoption." McPhee et al. further identify characteristics common to both ULLs and agroecosystem LLs to investigate commonalities between ULLs and this emerging kind, declaring these LLs distinct in their 1) focus on sustainability, 2) unique connection to space and place, and 3) the high degree of complexity resulting from the numerous and diverse stakeholders involved in such projects. The authors emphasize, in particular, the place-based uniqueness of agroecosystem LLs. They propose a typology based on how the complexity of an LL's environment subsequently affects every other aspect of the project.

McPhee et al.'s paper is particularly helpful in linking agriculture, environmentalism, agri-food networks, and LLs conceptually as sources of innovation. The authors' work can thus combine

many theoretical threads underpinning LLs—theories of place, territorial governance, trust, and incentives—and provide a solid foundation for future work in agroecosystem applications.

García-Llorente, M., Pérez-Ramírez, I., Sabán de la Portilla, C., Haro, C., & Benito, A. (2019). Agroecological strategies for reactivating the agrarian sector: the case of Agrolab in Madrid. *Sustainability*, *11*(4), 1181. DOI:10.3390/su11041181. (21+ citations)

García-Llorente et al. contribute to both the growing agroecosystem LL literature and the body of empirical case studies analyzed by LL scholars. The researchers describe their experiences introducing the Agrolab project in rural Madrid as part of an effort to reactivate the agrarian sector in these communities. They further identify the motivations of the participating groups and the socioecological and agroecological strategies employed to increase trust and land tenure dynamics as well as reactivate abandoned or underused lands. The LL enhanced participation and collective action within the agrarian sector by offering long-term support through the peer group and agroecological trainer through meetings and assemblies. These meetings established spaces for the diffusion of knowledge and experiences regarding agroecological topics and helped build organic farmer networks for further innovation and experimentation. The authors conclude that despite challenges faced by the project, agroecosystem LLs—especially in conjunction with regional governments—can assist in agroecological transitions as farmers seek innovative solutions for agricultural, food, environmental, and social concerns through the facilitation of new organizational models that organize the provision of goods and services.

Toffolini, Q., Capitaine, M., Hannachi, M., & Cerf, M. (2021). Implementing agricultural living labs that renew actors' roles within existing innovation systems: A case study in France. *Journal of Rural Studies*, *88*, 157-168. DOI:10.1016/j.jrurstud.2021.10.015f. (2+ citations)

Toffolini et al. write about agroecosystem LLs through the lens of actor-network theory, looking at how LLs can renew and/or redistribute actors' roles throughout the innovation process. They do so through a case study of an agricultural LL in France in which the authors observed incumbent routines, divergent rationales among steering actors, and undefined roles maintained the existing infrastructure of the innovation system and prevented actors from renewing their roles and relationships. The authors conclude actors' roles do not directly result from the decisions of steering actors, but from multiple intentional and unintentional interactions that are uncertain in nature and should be seen as a collective experimental process. The building and redistribution of actors' roles in the lab are supported by "strategic choices, network structure, events organization, and follow-up methods." Toffolini et al. suggest "the infrastructures on which concrete innovation practices are based" are more significant to these factors than epistemic or relational issues. They conclude that context – particularly the "infrastructures involved in information circulation, in collective trials and projects management, and in farmers-advisors encounters" – should be emphasized along with considerations of actor roles.

Gamache, G., Anglade, J., Feche, R., Barataud, F., Mignolet, C., & Coquil, X. (2020). Can living labs offer a pathway to support local agri-food sustainability transitions? *Environmental Innovation and Societal Transitions*, *37*, 93-107. doi.org/10.1016/j.eist.2020.08.002. (21+ citations)

Gamache et al. weigh the advantages and challenges of LLs in agroecosystems. The authors are explicitly against LLs seeking to develop products for the market, arguing such frameworks are not adequate to support sustainability transitions. They conduct a bibliometric mapping of LL litaterature and advocate citizen-centered LLs are more compatible for "using experimentation as a form of governing transitions, grounding the latter in co-creation between diverse actors." Gamache et al. advocate for the creation of Common Living Labs (CLLs). These labs center on the "construction, management, and sharing of commons," and support "the acquisition of experience and individual empowerment to act on the future of a territory." Finally, Gamache et al. contribute the idea that co-evolution of agroecosystems will require involvement of nonhuman actors as subjects in laboratories—allowing LLs to fully take on the meaning of "living" and include all living organisms.

Gamache et al.'s ideas align with several other recurring LL themes. Movement away from projects prioritizing market value and business interest and an emphasis on the land and nonhuman subjects as stakeholders of equal value has occurred over the last few years. Meanwhile, emphasis on environments as entire systems and the promotion of not just the input of local citizens, but a commitment on improving their lives, have become increasingly common.