Living Labs: a forum for enabling co-creation between multi-disciplinary actors in the workplace?

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Living Labs are promoted throughout the EU and beyond as being 'user-centred, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings'. This paper aims to understand what Living Labs are and how they may best be utilised within the context of digitalisation of sociotechnical work. Using a combination of literature study and field studies at two Living Labs within the freight transportation sector, it discusses the potential of Living Labs as a forum for enabling co-creation between multi-disciplinary actors directly in the workplace.

Keywords: Living Labs; co-creation; participatory ergonomics; sociotechnical work, freight transportation.

1. Background and purpose

In recent years, Living Labs have grown in number and popularity, and are being promoted throughout the EU and beyond as a novel approach to research and innovation (see e.g. Almirall & Wareham, 2011; Følstad, 2008; Leminen, 2015; Nesti, 2017). According to the European Network of Living Labs (ENoLL[1]), Living Labs are 'user-centred, open innovation ecosystems, based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings'. At the time of writing (May 2017), ENoLL listed 406 registered Livings Labs in 54 countries worldwide, mainly within the areas of ICT, mobile services and healthcare, and to a lesser extent energy, transport, housing and society at large (see also Nesti, 2017). There is a growing body of literature which aims to describe and support this development, but a common theme is the 'elusive' nature of Living Labs (Quak et al., 2016), and general lack of consensus regarding what they are and how they may best be utilised.

The work described in this paper was conducted as part of the EU Horizon 2020 research and innovation project AEOLIX (Architecture for EurOpean Logistics Information eXchange). AEOLIX has established eleven Living Labs to explore the effects of digitalisation on freight transport operations, and to develop and test a digital ecosystem to facilitate information exchange between various actors in the supply chain or network. The aim of this paper is to investigate what Living Labs actually are and to attempt to identify their potential within the context of digitalisation of sociotechnical

[1] http://www.openlivinglabs.eu/

work in general and freight transportation in particular. This will be done using a combination of literature study and field studies at two Living Labs, a multimodal freight terminal (hereinafter *'the freight terminal'*) and a consumer goods distribution centre (*'the distribution centre'*).

2. Design/methodology/approach

2.1. Literature study

Firstly, a literature study was undertaken to understand the concept Living Lab, to identify central features or characteristics, and to examine potential success factors or barriers for Living Labs. The literature study also considered how Living Labs fit in to the landscape of, and distinguish themselves from, existing participatory approaches to design. The purpose was not to perform a comprehensive literature review, but rather to try to discern the defining features of a 'best practice' Living Lab which may be applied within the context (freight transportation) described above.

Over 60 peer reviewed journal articles and papers from conference proceedings were included in the initial study, of which 15 are included in this paper (see References). These were selected as they represent: critical reviews of the state-of-the-art of Living Labs theory and/or practice (Almirall & Wareham, 2011; Ballon & Schuurman, 2015; Dell'Era & Landoni, 2014; Følstad, 2008; Leminen, 2013, 2015; Nesti, 2017); contributions to the Living Labs concept definition or methodology (Leminen et al., 2012; Nyström et al., 2014; Pallot et al., 2014; Schuurman & Tõnurist, 2017; Westerlund & Leminen, 2011, 2014), or; discussions of Living Labs specifically within the freight transportation sector (de Jong et al., 2016; Quak et al., 2016).

2.2. Field studies

In addition to the literature study, field studies were conducted in two Living Labs, the freight terminal and distribution centre introduced earlier, to reveal the extent to which their various actors share the interpretation(s) found in the literature. Using an explorative research design, field observations, semi-structured workplace interviews and discussions were conducted in order to identify: which actors are represented in the Living Labs; their understanding of the concept; their motivation for participation and anticipated results; and their expectations for how work may be improved by the introduction of new ICT.

These took place on six separate occasions with 17 participants, including a terminal supervisor and assistant supervisor, four terminal operators, three truck drivers, one export planner, one import planner, two system developers and one project manager from the freight terminal, and one transport planner, one technical support developer and one project manager from the distribution centre. Data, including sound recordings of field visits, documentation, written notes and photographs were collected and analysed using coding, categorisation and thematic analysis. The reader should note that the focus was on the 'real life setting' and user perspective of the Living Labs, and several partners and third parties were not included at this stage, namely transport operators, suppliers, customers and other researchers.

3. Results

3.1. Living Labs in theory

What are Living Labs?

As mentioned earlier, there is a general lack of consensus in the literature regarding the concept Living Lab. There are multiple views of the definition and central features of Living Labs, their aims and purposes, the methodologies which they employ and so on. Although there are many common themes (e.g. Leminen, 2015), there are also a number of controversies between the different understandings of the concept and also between theory and practice (see e.g. Følstad, 2008; Nesti, 2017). It has been argued that the elusive and diffuse nature of Living Labs is a consequence of its adoption as a buzzword in political spheres, and thus its proliferation without a sound theoretical or methodological grounding, and the tendency to fall back on old means of collaboration (Ballon & Schuurman, 2015; Leminen, 2015; Nesti, 2017; Quak et al., 2016).

For example, Living Labs claim to be a new way of *working collaboratively between multi-disciplinary actors in real-life settings*, which is different from test beds, demonstrators and so on (Følstad, 2008; Leminen, 2015; Schuurman & Tõnurist, 2017). However, in practice 'Living Labs' tends to be used as an alternative moniker for these existing forms (as noted by Almirall & Wareham (2011), Quak et al. (2016) and others), and exactly how they are different is unclear. One distinguishing feature is the *awareness of users that they are actively involved as a partner throughout a co-creation process*, rather than an informant or participant at discrete stages of the development process (according to Dell'Era & Landoni, 2014; see also Almirall & Wareham, 2011; de Jong et al., 2016; Leminen, 2013; Nesti, 2017; Pallot et al., 2014; and ENoLL). This user awareness and co-creative focus distinguishes Living Labs from similar approaches within the areas of user-/human-centred or participatory design (Dell'Era & Landoni, 2014; also Pallot et al., 2014), and from traditional research and innovation projects (Leminen, 2015; Schuurman & Tõnurist, 2017; Westerlund & Leminen, 2011). Striking resemblances may be seen to the Scandinavian tradition of cooperative design, but with emphasis on the real-life setting (Ballon & Schuurman, 2015; Dell'Era & Landoni, 2014). However, Følstad (2008) and Nesti (2017) note that, while prevalent in the Living Labs vocabulary, once again actual co-creation plays a much less significant role in their practice than might be expected (also Nyström et al., 2014).

Despite the lack of consensus, several authors maintain that Living Labs *may* successfully facilitate co-creation directly in the workplace, benefiting not only users, but also designers, developers, management, researchers and other stakeholders (Almirall & Wareham, 2011; Dell'Era & Landoni, 2014; Følstad, 2008; de Jong et al., 2016; Leminen, 2013, 2015; Nesti, 2017; Quak et al., 2016; Schuurman & Tõnurist, 2017; Westerlund & Leminen, 2014). Additionally, they suggest methodologies and tools for how this may be achieved (Leminen et al., 2012; Nesti, 2017; Nyström et al., 2014; Pallot et al., 2014; Westerlund & Leminen, 2011).

Towards a 'best practice' for Living Labs?

Nesti (2017) argues that ascertaining 'best practice' for Living Labs is problematic, not least due to their high mortality rate (2017:278-279) - only 59 of the 378 surveyed were active and displayed the 'basic characteristics' of a Living Lab, i.e. user involvement in a

co-creation process (2017:273). This may in turn be dependent on, amongst other things: the rapidly obsolete nature of ICT; political 'sponsoring' of short-term projects; the traditional bureaucratic culture of public administration, and; the lack of commitment and long-term participation by users, particularly when their participation does not lead to tangible outcomes (see also Ballon & Schuurman, 2015; Quak et al., 2016).

Leminen et al. (2012) do not define a 'best practice', but instead provide a framework for 'choosing' a Living Lab type based on the purpose and outcomes one wishes to achieve, and the typical organisational form, available actions and expected lifespan. Four main actor roles (*user, utiliser, enabler, provider*) are usually present in all Living Labs, but the type will be determined by which party is the driving force, and the coordination (top-down or bottom-up) and participation approach used (Leminen, 2013; Leminen et al., 2012). According to Leminen et al. (2012), Living Labs may thus be: *utiliser-driven* (coordinated by e.g. the developer of a product or service); *enabler-driven* (a funder or public authority); *provider-driven* (a university or consultant) or; *user-driven* (by users or communities of users). Nesti's reasons for the mortality of Living Labs (above) indicate that a *user-driven* Lab (i.e. not led by ICT service providers, politicians, public authorities, or arguably researchers) which engages the active, long-term participation of users has the greatest chance of success.

Nyström et al. (2014) further characterise the roles that users may take in Living Labs, namely as *informant, tester, contributor* or *co-creator*. (Although, as noted by Dell'Era and Landoni (2014), there are numerous existing methodologies, under the umbrella of user-centred or participatory design, where the user's role is that of informant, tester or contributor.) Westerlund & Leminen (2011) explicitly link fully-fledged co-creation to a user-driven (as opposed to user-centred) innovation process. The prevalence of co-creation in real-life settings in the Living Labs vocabulary, and the lack of an established methodology to enable this, (see above) suggests that the involvement of the *aware user as co-creator* may be an indicator of a 'best practice' Living Lab.

Living Labs in freight transportation

Freight transportation may be viewed as a complex sociotechnical system, consisting a network of multi-disciplinary actors, and involving 'vehicle technology, ICT applications, regulation, user practices and markets, several networks, such as infrastructure, supply and demand, and maintenance' (Quak et al. 2016:463; also de Jong et al., 2016:16). Quak et al. (2016) consider freight partnerships the current best practice within freight transportation: freight partnerships provide a forum for knowledge sharing, discussion and collaboration between local public and private stakeholders, but seldom lead to tangible outcomes. They argue that Living Labs may go beyond freight partnerships by enabling action and focusing on the implementation of solutions in their real environment. de Jong et al. (2016) emphasise that, due to the systemic nature of freight transportation, one should consider both its high-level strategic characteristics and lower-level tactical and operational aspects, which occur in the workplace and are often overlooked; these become visible and may thus be communicated between actors in Living Lab-style settings. Both de Jong et al. (2016) and Quak et al (2016) include the possibility to have a 'common objective' (de Jong et al., 2016:16) or 'shared ambition'

(Quak et al., 2016:470), to build trust between actors and consider both the individual actor and system level perspective as potential success factors for Living Labs.

3.2. ... and in practice

In the same way that the rhetoric of Living Labs is not necessarily reflected in their practice (Følstad 2008; Nesti, 2017), the two cases which were studied here do not neatly fit easily with the descriptions of Living Labs found in the literature. The awareness of users was noted as a central feature of successful Living Labs (Ballon & Schuurman, 2015; Dell'Era & Landoni, 2014; Leminen, 2103, 2015; Westerlund & Leminen, 2011). However, in the field, it quickly became apparent that the participants were not 'aware users' in the sense described above. With the exception of the two project managers and two system developers who are directly involved in the research and innovation project, none of the participants appeared to know that, thanks to their four colleagues, they were even 'in a Living Lab', thereby rendering redundant the authors' carefully prepared questions! They did (mostly) know that their respective companies or organisations were involved in some sort of project in which some researchers might come and do... something. (This is not necessarily a disadvantage, as will be discussed later.) They were thus content to be interviewed and observed at length, and to discuss both their current work, future plans and expected impacts of digitalisation.

To summarise, in the freight terminal, trailers with mixed goods are imported to and exported from the terminal by road and/or sea; goods are also collected and distributed on a regional and national level, usually by road. The terminal deals mainly with the loading/unloading of the trailers. They communicate primarily with import and export planning departments (which are part of the same organisation) and individual truck drivers, and to a lesser extent with the transport planning department and external logistics operators. In the distribution centre, consumer goods arrive to the warehouse mainly by rail from national/international suppliers, but also by road from local suppliers. Goods are subsequently distributed by road and rail to regional distribution centres across the country, and directly to local shops for retail. Planning of road and rail transport is mainly conducted by separate departments within the distribution centre in collaboration with external road/rail operators, who perform the transport operations.

Participants from both Living Labs identified one central issue as a barrier to successful work: that transportation of goods is inherently dependent on interaction and communication between different actors (e.g. terminal-import-export or distribution centre-train/truck operators) but that the digital tools which support their operations often focus on each part of the supply chain in isolation. For example, in both the freight terminal and distribution centre, the order management system does not adequately communicate with the transport planning system(s), and neither of these communicate directly with the terminal or warehouse where goods are loaded/unloaded or stored. While it is fashionable to talk of 'digital ecosystems', in reality a variety of internally developed Access databases, Excel workbooks, emails, phone calls, whiteboards, printed papers and handwritten notes are used to supplement their digital tools and transfer information between systems and actors (see Figure 1). In the event of delays, deviations or changes of plan, these must be updated and communicated manually, which may ultimately lead to uncertainty, confusion, frustration and lack of trust between actors.

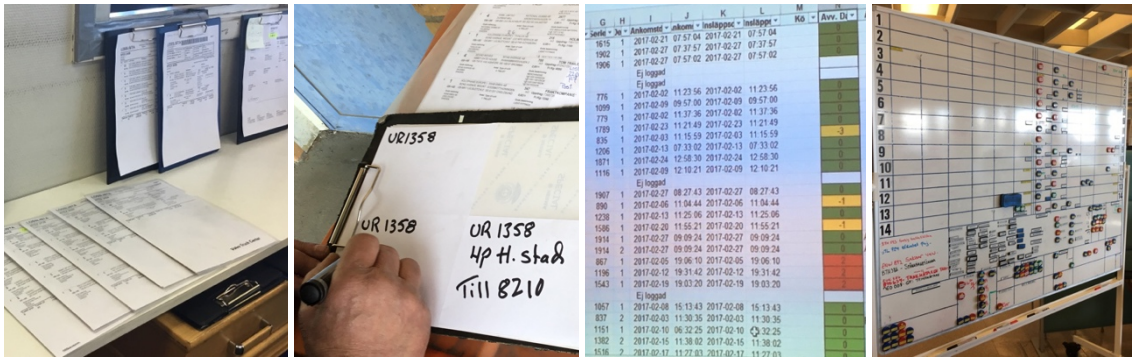

Figure 1. Some typical planning tools in the 'digital' freight transportation ecosystem.

All involved, on user and management levels, saw the need for an improved ecosystem given that the current situation is unsatisfactory and unsustainable, both in terms of efficiency and productivity, but also in terms of worker satisfaction and well-being. Indeed, the freight terminal and distribution centre had both, independent of the research project, already engaged resources to digitally bridge the gaps in the flowof information and communication. The distribution centre was utilising internal technical support and the freight terminal had partnered with a local IT developer in what may in essence be described as co-creation between users, management and developers.

The research project (whether or not one recognises it as a Living Lab) offered primarily extra resources to bolster this improvement work, but also the possibility to gain access to external data and share information with other logistics actors. For the project managers and system developers, the inclusion of researchers was seen as a condition for obtaining the extra resources, but which might potentially provide fresh insights into new ways of working, or external validation of the ongoing development work. For the terminal workers and others on the 'sharp end', the researchers' role was often unclear, but was taken as an opportunity to raise concerns about the lack of communication between actors and their respective work systems.

4. Discussion with practical implications

We proposed earlier, based on the literature, a 'best practice' for Living Labs, namely a way of working collaboratively between multi-disciplinary actors in a real-life setting, which is user-driven, and in which users are aware that they are actively involved as a partner throughout a co-creation process. However, we have seen, both in the literature and field studies, that in practice many Living Labs do not display these characteristics; our participants in the freight terminal and distribution centre are not 'aware users', nor can one say that their Living Labs are 'user-driven'. But this does not necessarily exclude them from being considered actual (or even 'good') Living Labs. Given the complications encountered when defining the concept or practice, we suggest that a static, ostensive description of what Living Labs *are* is not only elusive, but potentially unhelpful. Instead, we recommend a dynamic, performative view of what they *may be* and how they *may be utilised* in order to successfully facilitate co-creation between multi-disciplinary actors in the workplace (after all, they are *Living* Labs).

Additionally, since we a primarily concerned with Living Labs in the context of digitalisation of sociotechnical work, such as freight transportation, we emphasise the

importance of a *systems perspective*. We have seen that problems arise when partial digitalisation at a local level hinders rather than supports interaction and communication at a system or network level, necessitating ad hoc solutions to bridge the gaps. Actors who collaborate to solve their problems at a local level must also take account of the dependencies and potential impacts upon the wider system, and vice versa. Indeed, the failure of most innovations in the freight sector are 'rooted in the fact that supply chains are complex systems' (de Jong et al., 2016:16), since 'no single stakeholder has a complete image of the system, nor what the effects and rebound-effects of actions, policy measures or other interference are or will be' (Quak et al., 2016:464).

Firstly, Living Labs may be *emerging entities*. Neither their composition, activities or expected outcomes need necessarily be well-defined at the start of the collaborative process (as in the freight terminal and distribution centre, also Pallot et al., 2014; Westerlund & Leminen, 2011), provided they are grounded in a common objective or shared ambition to solve a real-world problem (de Jong et al., 2016; Quak et al., 2016). Living Labs which are initiated by a recognition of user need, or *user-need driven*, (e.g. the perceived need to reduce the manual effort required to supplement the 'digital ecosystem', Figure 1) may more successfully engage and maintain active user involvement, thus being more sustainable (also Nesti, 2017; Ballon & Schuurman, 2015).

However, users may not have the knowledge or resources to initiate or drive a Living Lab collaboration (Leminen, 2013; Leminen & Westerlund, 2012). Figure 1 illustrates how users typically utilise the available resources to solve their problems. Likewise, Section 3.2 describes how organisations which recognise the user need may utilise either internal or local resources, initiating co-creation on an organisational/local level (see also Westerlund & Leminen, 2011). Such a *top-down and bottom-up* approach may be seen as the embryo of a Living Lab, although to be successful, it may become an *open, expanding network*. While the starting arena may be users in their workplace, a sociotechnical systems perspective implies that the 'Living Lab' may expand to address the network of actors and systems which impact upon and are affected by its potential outcome (e.g. throughout the supply chain) (de Jong et al., 2016; Quak et al., 2016). Likewise, it may require augmentation by parties who enable the co-creation to materialise by providing additional knowledge and resources (e.g. designers, developers, policy makers) (Leminen, 2015; Leminen et al., 2012; Pallot et al., 2014). We also suggest that, while researchers may initially seem superfluous in this context, they (i.e. we!) have an important role to play in developing tools and methodologies to enable actors to see beyond the local to the whole system perspective.

5. Conclusions

This paper concludes that Living Labs may potentially be a valuable forum for enabling communication and co-creation between multi-disciplinary actors in the context of increasing digitalisation of sociotechnical work. One common feature, identified in both the literature and field studies, may be crucial to their success: the willingness of actors to actively engage in such a forum, combined with the expectation that participation will benefit their future work. Furthermore, the open and emerging nature of Living Labs enables them to be tailored to the needs and goals of their participants, thereby improving the chances of success.

References

Almirall, E. and Wareham, J. (2011). Living Labs: arbiters of mid- and ground-level innovation. *Technology Analysis & Strategic Management, 23*(1), 87-102.

Ballon, P. and Schuurman, D. (2015). Living labs: concepts, tools and cases. *info, 17*(4). doi: 10.1108/info-04-2015-0024

de Jong, G., Tavasszy, L., Bates, J., Grønland, S. E., Huber, S., Kleven, O., . . . Schmorak, N. (2016). The issues in modelling freight transport at the national level. *Case Studies on Transport Policy, 4*(1), 13-21.

Dell'Era, C. and Landoni, P. (2014). Living Lab: A Methodology between User-Centred Design and Participatory Design. *Creativity and Innovation Management, 23*(2), 137-154.

Følstad, A. (2008). Living Labs for Innovation and Development of Communication Technology: A literature review. *Electronic Journal for Virtual Organisations and Networks, 10*, 99-131.

Leminen, S. (2013). Coordination and Participation in Living Lab Networks. *Technology Innovation Management Review, 3*(11), 5-14.

Leminen, S. (2015). Q&A. What Are Living Labs? *Technology Innovation Management Review, 5*(9), 29-35.

Leminen, S., Westerlund, M. and Nyström, A.-G. (2012). Living Labs as Open-Innovation Networks. *Technology Innovation Management Review, 2*(9), 6-11.

Nesti, G. (2017). Living Labs: A New Tool for Co-production? In Adriano Bisello, Daniele Vettorato, Richard Stephens & Pietro Elisei (Eds.), *Smart and Sustainable Planning for Cities and Regions: Results of SSPCR 2015* (pp. 267-281). Cham: Springer International Publishing.

Nyström, A.-G., Leminen, S., Westerlund, M. and Kortelainen, M. (2014). Actor roles and role patterns influencing innovation in living labs. *Industrial Marketing Management, 43*(3), 483-495.

Pallot, M., Kalverkamp, M., Vicini, S. and Nikolov, R. (2014). An Experiential Design Process and Holistic Model of User Experience for Supporting User Co-creation. In European Commission (Ed.), *Open Innovation Yearbook 2014* (pp. 22-39). Italy: European Union.

Quak, H., Lindholm, M., Tavasszy, L. and Browne, M. (2016). From Freight Partnerships to City Logistics Living Labs – Giving Meaning to the Elusive Concept of Living Labs. *Transportation Research Procedia, 12*, 461-473.

Schuurman, D. and Tõnurist, P. (2017). Innovation in the Public Sector: Exploring the Characteristics and Potential of Living Labs and Innovation Labs. *Technology Innovation Management Review, 7*(1), 7-14.

Westerlund, M. and Leminen, S. (2011). Managing the Challenges of Becoming an Open Innovation Company: Experiences from Living Labs. *Technology Innovation Management Review, 1*(1), 19-25.

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