This paper was presented at The ISPIM Innovation Conference – Innovation, The Name of The Game, Stockholm, Sweden on 17-20 June 2018. The publication is available to ISPIM members at www.ispim.org.

Comparing Living Lab(s) and its' competing terms popularity

Teemu Santonen

Laurea University of Applied Sciences,
Vanha maaantie 9, O2650 Espoo, Finland.
E-mail: teemu.santonen@laurea.fi

Abstract: The number of officially certified Living Labs as well as Living Lab research publications have been steadily growing since the launch of European Network Living Labs (ENoLL) over decade ago. So far there has been only few studies which have made an effort to systematically evaluate the Living Lab research domain. As typically in scientific literature, there is no universally accepted definition for Living Lab term and plenty of other rivalling terms have emerged. By using Scopus, Web of Science (WoS) and Google Scholar (GS) as data sources, a popularity-based scientometrics analysis is applied to evaluate Living Lab and rivalling terms popularity and interlinkages. As a result relying only on single database will lead to significant data collection bias and therefore data source triangulation further studies is highlighted. Living Lab research is somewhat isolated research domain and there are only weak links between the competing research streams.

Keywords: Living Lab; Scientometrics, Research community, Scopus, Web of Science, Google Scholar, Citizen Science, Community-based Participatory Research

1. Introduction

Science by definition builds on previous knowledge, which evolves over time, refines and develops knowledge and serves as a foundation for further research. Thus, in-depth understanding of scientific knowledge and it's evolution in specific research themes such as in Living Lab domain is vital. In innovation management research, literature reviews have typically been based on narratives (McLean, 2005) or systematic literature reviews (Becheikh et al., 2006). To a lesser extent do we see more rigorous research methods such as scientometrics (Larivière et al. 2012) or bibliometric analysis (Pritchard, 1969) which are often used to describe similar and overlapping methodologies.

In this study we use scientometrics term, which is defined as a quantitative study of science in order to evaluate current status and/or changes in the output of a scholarly field through time (modified from Van Raan, 1998; Hood and Wilson, 2001). In practice scientometrics study can include a great variety of different kinds of research methods (Santonen and Conn, 2015) and various methodological approaches have been successfully applied to study different kinds of scientific communities (Newman 2001, Morlacchi et. al. 2005, Vidgen et. al. 2007). Prior studies includes also innovation communities such as global open innovation research (Su and Lee 2012) or International Society of Professional Innovation Management (ISPIM) community (Santonen and Ritala, 2014).

These prior studies have demonstrated the usefulness of scientometrics to reveal underlying structures of communities by providing relevant relational information beyond the typical literature reviews (Yan and Assimakopoulos, 2009). However, the more recent research streams such as Living Lab research community, which have only lately gained more interest, are still more or less empirically unchartered as a research community.

The aim of this study is to identify the popularity Living Lab and other rivalling Lab related research streams.

2. What are Living Labs and what are its' competing terms?

2.1 Defining Living Labs

According to the European Network of Living Labs (ENoLL) which is the international federation of benchmarked Living Labs in Europe and worldwide, Living Labs are (later also LLs):

> *"User-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings. They operate as intermediaries among citizens, research organisations, companied, cities and regions for joint value co-creation, rapid prototyping or validation to scale up innovation and businesses. LLs have common elements but multiple different implementations."*

As typically in scientific literature, there is no universally accepted definition for Living Lab term but a prior study by Leminen (2015) analysed about 70 different definitions and concluded that there are four main characteristics or perspectives which define a Living Lab.

First, Living labs operates in real-life or real-life kind of environment which includes virtual reality environments, mock-ups, simulations or other environments which are trying to mimic a real life environment.

Second, Living lab activities engages various stakeholder groups to the different innovation process stages in order to create solutions which are meeting the end-users needs. As a result, Living Lab can also been seen as a Knowledge-intensive business service (KIBS) which Bettencourt et al. (2002) defines as "*an entity whose primary value-added activities consist of the accumulation, creation, or dissemination of knowledge for the purpose of developing a customized service or product solution to satisfy the client's needs"*. Evidently, in the Living lab process, the most important stakeholders are the end-users a.k.a. persons who ultimately uses or are intended use the developed solutions. Expanding the collaboration actor groups beyond the end-users and including also other relevant stakeholders resembles the evolution of co-creation definition. Originally co-creation as a term was mainly describing the collaboration between a firm and its customers, but lately is more and more associated to firm's collaboration with various Quadruple Helix actors (Arnkil et al. 2010).

In Leminen's definition, the separation was made between the *third* "approaches, instruments, methods, methodologies" and *fourth* "concepts, conceptualizations and tools" characteristics. Even if there might be slight theoretical difference between the third and

fourth characteristics, it is suggested that at the practical level, they could combined. Especially among the practitioners but also among the scholars, there is constant confusion what is the difference between these terms. Together these last two characteristics describes how a set of different kinds of methods, tools, instruments and techniques via systematic (i.e. not random) procedure, approach, concept, and methodology are combined in order to deliver Living lab services. Therefore, as ENoLL's definition argues, Living labs have common elements, but different implementations. To conclude following shorter definition for Living lab is suggested:

"Living Labs are real-life or real-life kind of environments in which diverse groups actors are together developing and/or testing in a co-creative manner new solutions at different stages of innovation process while utilizing various research methods via systematic research strategy.

2.2 Ever growing "Lab Family" and Other Competing Terms

Plenty of rivalling terms for Living Labs are existing which definitions are grounded on a very similar attributes as the Living Lab definition. These terms include such as urban (living) lab (Steen and van Bueren, 2017), change lab (Desjardins et al. 2001), city lab (Capdevila, 2014), design lab (Binder and Brandt, 2008), DESIS lab (Manzini, 2014), Government lab, Impact lab (Stanley and Zussman, 2016), Innovation lab (Gryszkiewicz et al, 2016), Policy lab (Bailey and Lloyd, 2017), Reality lab, Social innovation lab (Westley and Laban 2015), Fab lab (Mikhak et. al. 2002), Makerspace (Blackley et. al. 2017), testbed (Sherwood et. al. 2010), hackerspace (Guthrie, 2014), or Lab-like initiatives which are applying Living Lab approaches without consciously using any of the above specific terms (Scholl et al., 2017). Furthermore, also terms such as participatory research or more specific community-based participatory research are emphasising an approach in which the community members are full and equal partners in all phases of the research (and innovation) process (Viswanathan et al., 2004). Another similar term is citizen science which is involving citizens via following five types of scientific research projects to address real-world problems (Wiggins and Crowston, 2011): Action, Conservation, Investigation, Virtual, and Education.

As a result of this terminological confusion, various scholars have different understanding what is Living Lab, what kind of activities can and should be included under Living Lab activities, and what is Living Lab interlinkage to other competing terms.

2.3 Evolution of Living Lab Practitioner and Research Community

The number of officially certified Living Labs (LLs) have been steadily growing since the launch of European Netowrk Living Labs (ENoLL) over decade ago. Historically there have been nearly 400 officially recognised LLs across the world and currently there are 170 active Living Lab members in ENoLL. The development and impact evaluation of LLs have been strongly practice based and only lately the number of academic papers on LLs has also started to growth.

However, compared to more traditional innovation research themes, the maturity and evolution of LLs research is still infancy. Typically LL studies have focused on describing the various roles of stakeholders and users, network structures, and innovation outcomes (Leminen, 2015) or describing and mapping LL methodologies (Almirall, et al. 2012). In

practice many of these LL studies have more or less grounded on single or combination of few case studies which is typical approach when a particular research stream is still evolving strongly.

There are only few studies which have made an effort to systematically evaluate the LL research domain as a whole. Among these are such as Ståhlbröst (2008), Schuurman (2015) and Leminen thesis (2015) which all included conceptualizations of the LL. Schuurman et al. (2015) study grounded on Google Scholar and Web of Science databases was partially applying scientometrics methods, but included only articles where "Living Lab" was mentioned in the title. Furthermore, the level of analysis in this study appeared to be somewhat limited, since it was mainly based on the 45 most cited papers instead of all scientific publications covering LL topic. These research strategy selections obviously limits the possibilities for generalization. Currently the most comprehensive bibliometric study in LL domain is very recent study by McLoughlin et al. (2017 and 2018) which is trying to understand how LL research has evolved. Their study was based AIS basket of eight, Scopus and Google Scholar databases while evaluating impact, research trends and the influences of LL research via co-citation analysis. However, this study was omitting ISI Web of Science (WoS) as data source, which in terms of coverage and thematic focus is different comparing to Scopus.

As a result it is argued that even if there are few studies which are empirically evaluating LL research community, there are still obvious gaps especially in term of understanding Living lab research relation to other related "Lab streams" as discussed above.

3 Research methodology

3.1 Research design

The popularity-based approach from a comprehensive scientometrics evaluation framework as suggested by Santonen and Conn (2015) was applied in order to identify the relative popularity among the Living lab and other related terms. "Popularity-based" approach (Choi et al, 2011) is analyzing the frequency of authors and research themes which have been derived from the context of the research publication (e.g. keywords or other related meta-terms which are formed based on content analysis). Due the confusion among the "Lab family" the goal of this study is to quantify (RQ1) which "Lab terms" are the most popular and (RQ2) how Living Lab research is interlinked to these other research domains.

3.2 Selection of data sources

When selecting data sources, the following data triangulation approach was applied (Smith, 1975:273; Denzin 1978, p. 291). Some studies suggests that Scopus has more extensive coverage than ISI Web of Science (WoS) (Falagas et al. 2008). Therefore, the data for this study was collected from the both databases. Furthermore, Google Scholar (GS) has been suggested as an alternative or complementary resource to the Scopus and Web of Science since it includes also the local contents, papers in low impact journals, conference proceedings, popular scientific literature, and unpublished reports and teaching supporting materials (Meho and Yang 2007; Aguillo, 2011). In addition Scopus and WoS

have more limited coverage in the management studies than GS (Harzing and Van Der Wal, 2009; Mingers and Lipitakis, 2010). Since LL studies are assumed to be conducted by management scholars, it is possible that Scopus and WoS are not fully able to detect the research trends as good as the more extensive GS.

The unit of analysis in this study is a scientific publication which topically focuses on Living Lab or other rivalling theme as identified in Section 2.2 (i.e. Urban lab, Change lab, City lab, Design lab, DESIS lab, Government lab, Impact lab, Innovation lab, Policy lab, Reality lab, Social innovation lab, Fab lab, Makerspace, Testbed, Hackerspace, Community-based participatory research and Citizen science).

The search terms "Living Lab(s)" as well as semantically closely related Living Labbing, Living Laboratory and Living Laboratories were used as search criteria. Both Scopus and WoS provides various options to target search in a particular database fields. In order to make the results as comparable as possible, in the case of WoS topic search (search from title, abstract, author keywords and keywords plus which consist of words and phrases harvested from the titles of the cited articles) and in the case of Scopus (title, keywords, or abstract) was applied at the first stage. Targeting searches in GS is more problematic than in Scopus and WoS. The only options targeting searches at field level are "only in title" or "anywhere in article". The both these search options are not comparable with prior described Scopus or WoS criteria. Therefore GS search was limited to title, while additional "title-level" search for WoS and Scopus was also applied in order to generate comparable datasets.

4 Results

4.1 Popularity Comparison of Lab Terms at Title-level*

In the Appendix Table 1, the title-level search results are compared between Scopus, WoS and GS for Living lab, Living labs, Living labbing, Living laboratory and living laboratories search terms in order to estimate the impact of different spellings. The Appendix Table 1 includes also popularity comparison of the rivalling terms between the same three databases.

As expected, the GS had the most extensive coverage resulting 1540 publications when all Living lab spelling variations were included in the title. Scopus with 561 publications was the second, while WoS with 419 hits remained the third when search was targeted to only a title. In the case of "Living laboratory" and "Living laboratories" search results, the positions between Scopus and WoS were changed while GS had the most extensive coverage. Living labbing as a term had only a marginal popularity. The spelling (i.e. lab, labs, laboratory or laboratories) has clear impact on result and therefore is highlighted that in future studies search terms should always include all Lab* versions.

In the rivalling term popularity comparison, only the testbed (8460 GS hits) and citizen science (2.560 GS hits) terms outperformed the Living lab terms with. Community-based participatory research was the third most popular rivalling term with 1.300 GS hits. Design lab (GS=521 hits) and Makerspace (GS=504 hits) remained in fourth and fifth place. The other remaining terms gained more modest popularity ranging from 272 to 0. Based on above result, evidently the testbed term is substantially outperforming Living Lab but also the "citizen science" gains higher popularity among the scholars. "Community-based

participatory research" a term is also a significant rival for Living lab phenomenon in term of popularity.

A study by Falagas et al. (2008) had suggested that Scopus has more extensive coverage than WoS. To verify this suggestion the Wilcoxon signed-rank test was applied. As a result, GS database has significantly better coverage than Scopus and WoS. However, the statistical difference between Scopus and WoS databases was rejected.

4.2 Total Popularity and Interlinkage of Living Lab and "Lab Family" terms

As indicated above, the GS database included the most comprehensive collection of "Lab family" related publications. Therefore in order to estimate the total popularity of the different Lab* themes, only GS database was used as a data source. Total popularity search results are presented in Table 2. Search terms included all Lab* spelling versions and for each search rivalling Lab* theme, the whole document was searched but excluding patents and include citations. "GS hits" column will report the total number of hits. "Search terms AND Living lab*" column will report all the documents in which Living lab* and rivalling search terms were both included. Finally the relative share of Living lab* document which included also rivalling terms is estimated in (Search terms AND Living lab*) / Living lab* column.

Table 2: Living lab* and rivalling terms total popularity and overlapping

Search terms	*GS hits*	*Search term / LL**	*Search terms AND LL**	*(Search terms AND LL*) / LL**	*(Search terms AND LL*) / Search term*
Living lab*	15 700	1	15 700	100.00 %	100.00 %
Testbed	425 000	27.1	3 040	19.36%	0.72 %
Citizen science	37 200	2.37	479	3.05 %	1.29 %
Community-based participatory research	31 900	2.03	97	0.62%	0.30 %
Government lab*	17 600	1.12	74	0.47 %	0.42 %
Design lab*	17 300	1.10	355	2.26 %	2.05 %
Innovation lab*	17 200	1.10	505	3.22 %	2.94 %
Policy lab*	11 200	0.71	61	0.39 %	0.54 %
Social lab*	9 680	0.62	151	0.96 %	1.56 %
City lab*	7 800	0.50	263	1.68 %	3.37 %
Reality lab*	6 740	0.43	65	0.41 %	0.96 %
Makerspace	6 030	0.38	291	1.85 %	4.83 %
Fab lab*	5 200	0.33	541	3.44%	10.40 %
Change lab*	4 910	0.31	95	0.61 %	1.93 %
Hackerspace	3 760	0.24	262	1.67%	6.97 %
Urban Lab*	3 650	0.23	419	2.67 %	11.48 %
Impact lab*	2 860	0.18	8	0.05 %	0.28 %
DESIS lab*	251	0.02	50	0.32 %	19.92 %

As a result, the testbed research community is overwhelmingly more popular with 425000 GS hits, which makes it over 27 times more popular than Living Lab. Also citizen science with 37200 GS hits (i.e. 2.4 times more popular) and community-based participatory research with 31900 GS hits (i.e. 2.0 times more popular) were over two times more popular than Living Lab. Design lab* with 17.300 GS hits, Innovation lab* with 17.200 GS hits and Government lab* with 17.600 GS hits gained approximately the same popularity being about 1.1 times more popular than Living lab research. All the other remaining terms were less popular than Living Lab.

The relative share of competing term publications, which also included Living Lab* term, was compared (1) to the total number of Living Lab publications and (2) to the total number of competing publications. The relative share will reveal how large share of Living Lab publications includes competing terms and vice versa.

It appeared that only the testbed and Living Lab term were more substantially interlinked in Living Lab research domain. Almost twenty percent of Living Lab publications includes some kind of reference or notation to testbed. On the contrary testbed publications in general do not recognize Living Labs as an important concept, since less than 1% of testbed publications includes Living Lab notation. Living Lab publications including Innovation Lab, Citizen science and Urban Lab reference had ca. 3% share of all Living Lab publications and Design Lab, Makerspace, City Lab, Hackerspace about 2% share. The less popular term appeared to be more strongly associated with Living Lab, since nearly 20% of DESIS Lab publications had Living Lab notation. Living Lab had around 10 to 11 percent share in Urban Lab and Fab Lab research domain.

5 Conclusions

This study focused on revealing popularity differences between Living lab and its' rivalling terms. By applying data triangulation approach, comparison of three databases – Scopus, Web of Science (WoS) and Google Scholar – revealed a significant popularity differences between Google Scholar and the two other databases.

About data source bias. First and foremost, the results supports the prior studies which in general emphasises the data sources as a possible error source in management studies related literature reviews, but which has not been empirically validated in innovation management domain. It is argued that in further innovation management studies grounded on the bibliometrics or scientometric methods, a data triangulation approach should be always utilized in order to avoid data collection bias. The results do not support Falagas et al. (2008) prior findings, which argued that Scopus has more extensive coverage than WoS.

In the case of the investigated "Lab family" terms, the popularity varied between the terms. However, since this study only evaluated the popularity, it is more than likely that the actual publications are varying between the databases, even if the coverage is somewhat same level. Even if Google Scholar has clearly more limited possibilities to conduct more complex searchers, it is clearly outperforming Scopus and WoS in terms of number of publications. Especially in fast evolving research domains, excluding GS will most likely neglect substantial amount of publications. This observation genuinely questions the Scopus and WoS existence in the future, when open science is gaining more popularity among the scholars due European Union new open science policies.

About theoretical foundation bias. This study should also be a wake-up call for Living Lab scholars, who have in many cases isolated themselves from other rivalling research domains. A brief overview of definitions reveals that the competing terms are including similar attributes, which the empirical results of this study are also partially supporting. The situation is very similar as in the case of radical innovation and its rivalling terms (Santonen et. al. 2016). Since this study did not fully investigated the definition differences between the rivalling terms, it is possible that more in-depth definition comparison will reveal new insights and conclude that the research domains are genuinely different. However, for Living Lab researchers it is strongly suggested that learnings from the other competing research domains, could enable frog leap in Living Lab research.

It is highly likely that especially the testbed, citizen science and community-based participatory research domains could greatly benefit Living Lab research, since they are more mature in term of popularity. Also the research done in design lab and innovation lab domains, which enjoy somewhat similar popularity as Living Lab are among interesting ones. By following suggestions in brainstorming literature, a greater number of publications should lead to greater discoveries due higher volume. Therefore, a systematic evaluation to identify and leverage novel discoveries from other domains and knowledge transfer them to Living Lab community are preferred as a one promising further study stream.

References and Notes

Aguillo, I. F. (2012). Is Google Scholar useful for bibliometrics? A webometric analysis. Scientometrics, 91(2), 343-351.

Almirall, E., Lee, M., & Wareham, J. (2012). Mapping living labs in the landscape of innovation methodologies. Technology innovation management review, 2(9).

Arnkil, R., Järvensivu, A., Koski, P., & Piirainen, T. (2010). Exploring quadruple helix outlining user-oriented innovation models.

Bailey, J., & Lloyd, P. (2017). The introduction of design to policymaking: Policy Lab and the UK government. Annual Review of Policy Design, 5(1), 1-14.

Becheikh, N., Landry, R., & Amara, N. (2006). Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003. Technovation, 26(5), 644-664.

Binder, T., & Brandt, E. (2008). The Design: Lab as platform in participatory design research. Co-Design, 4(2), 115-129.

Blackley, S., Sheffield, R., Maynard, N., Koul, R., & Walker, R. (2017). Makerspace and reflective practice: Advancing pre-service teachers in stem education. Australian Journal of Teacher Education (Online), 42(3), 22.

Capdevila, I. (2014). How Can City Labs Enhance the Citizens' Motivation in Different Types of Innovation Activities?. In International Conference on Social Informatics (pp. 64-71). Springer, Cham.

Choi, J., Yi, S., & Lee, K. C. (2011). Analysis of keyword networks in MIS research and implications for predicting knowledge evolution. Information & Management, 48(8), 371-381

Denzin, Norman K. 1978 The Research Act, 2d ed. New York: McGraw-HI.

Desjardins, A., Hauser, S., McRae, J. A., Ormond, C. G., Rogers, D., & Zandvliet, D. B. (2015). Harnessing Youth Activism with/in Undergraduate Education: A Case Study of

Change Lab. In EcoJustice, Citizen Science and Youth Activism (pp. 349-361). Springer, Cham.

Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, web of science, and Google scholar: strengths and weaknesses. The FASEB journal, 22(2), 338-342.

Gryszkiewicz L., Toivonen T., Lykourentzou J., (2016) "Innovation Labs: 10 Defining Features" Stanford Social Innovation Review (3 November 2016), online: <https://ssir.org/articles/entry/innovation_labs_10_defining_features>

Guthrie, C. (2014). Empowering the hacker in us: a comparison of fab lab and hackerspace ecosystems. In 5th LAEMOS (Latin American and European Meeting on Organization Studies) Colloquium, Havana Cuba (pp. 2-5).

Harzing, A. W., & Van Der Wal, R. (2009). A Google Scholar h-index for journals: An alternative metric to measure journal impact in economics and business. Journal of the Association for Information Science and Technology, 60(1), 41-46.

Hood, W., & Wilson, C. (2001). The literature of bibliometrics, scientometrics, and informetrics. Scientometrics, 52(2), 291-314.

Larivière, V., Sugimoto, C. R., Cronin, B. (2012). A bibliometric chronicling of library and information science's first hundred years. Journal of the American Society for Information Science and Technology, 63(5), 997-1016.

Leminen, S. (2015). Living Labs as Open Innovation Networks-Networks, Roles and Innovation Outcomes. Aalto University publication series, Doctoral dissertations 132/2015.

Maccani, G., McLoughlin, S., Prendergast, D., & Donnellan, B. (2017). Positioning living labs within action design research: preliminary findings from a systematic literature review. In Designing the Digital Transformation: DESRIST 2017 Research in Progress Proceedings of the 12th International Conference on Design Science Research in Information Systems and Technology. Karlsruhe, Germany. 30 May-1 Jun.. Karlsruher Institut für Technologie (KIT).

Manzini, E. (2014). Making things happen: Social innovation and design. Design Issues, 30(1), 57-66.

McLean, L. D. (2005). Organizational culture's influence on creativity and innovation: A review of the literature and implications for human resource development. Advances in Developing Human Resources, 7(2), 226-246.

McLoughlin, S., Maccani, G., Prendergast, D., Donnellan, B., & LERO, N. (2018), Living Labs: A Bibliometric Analysis. Hawaii International Conference on System Sciences (HICSS)

Meho, L. I., & Yang, K. (2007). Impact of data sources on citation counts and rankings of LIS faculty: Web of Science versus Scopus and Google Scholar. Journal of the Association for Information Science and Technology, 58(13), 2105-2125.

Mikhak, B., Lyon, C., Gorton, T., Gershenfeld, N., McEnnis, C., & Taylor, J. (2002). Fab Lab: an alternate model of ICT for development. In 2nd international conference on open collaborative design for sustainable innovation (pp. 1-7).

Mingers, J., & Lipitakis, E. A. (2010). Counting the citations: a comparison of Web of Science and Google Scholar in the field of business and management. Scientometrics, 85(2), 613-625.

Morlacchi, P., Wilkinson, I. F. and Young, L. C. (2005). Social networks of researchers in B2B Marketing: A case study of the IMP Group 1984–1999. Journal of Business-to-Business Marketing, Vol. 12, pp. 3–34.

Newman, M. E. (2001). The structure of scientific collaboration networks. PNAS, Vol. 98, pp. 404–409.

Pritchard, A. (1969). Statistical bibliography or bibliometrics?. Journal of documentation, (25), 348-349.

Santonen, T., Conn, S., (2015) Research Topics at ISPIM: Popularity-based Scientometrics keyword analysis, in Huizingh, Eelko; Torkkeli, Marko; Conn, Steffen; Bitran, Iain (ed.). The Proceedings of The XXVI ISPIM Innovation Conference. 14-17 June, Budapest, Hungary.

Santonen, T., Normann Kristiansen J., Gertsen, F., (2016) Increased Variation or Higher Fences? Understanding Typological Evolution in Radical Innovation Management, The XXVII ISPIM Innovation Conference – Blending Tomorrow's Innovation Vintage, Porto, Portugal on 19-22 June 2016

Santonen, T., Ritala, P. (2014). Social Network Analysis Of The Ispim Innovation Management Community In 2009–2011. International Journal of Innovation Management, 18(01).

Schuurman, D., De Marez, L., & Ballon, P. (2015). Living Labs: a systematic literature review. In Open Living Lab Days 2015.

Scholl, C., Agger Eriksen, M., Baerten, N., Clark, E., Drage, T., Essebo, M., & Seravalli, A. (2017). Guidelines for Urban Labs. Accessed 10.5.2018, https://muep.mau.se/bitstream/handle/2043/23224/GUIDELINES%20270617.pdf?sequence=2&isAllowed=y

Sherwood, R., Gibb, G., Yap, K. K., Appenzeller, G., Casado, M., McKeown, N., & Parulkar, G. M. (2010). Can the production network be the testbed?. In OSDI (Vol. 10, pp. 1-6).

Smith, H. W. (1975) Strategies of Social Research: The Methodological Imagination. Englewood Cliffs, NJ: Prentice Hall.

Stanley, A., & Zussman, T. (2016). Strengthening networks and building relationships to increase the impact of global development research.

Steen, K., & van Bueren, E. (2017). The defining characteristics of urban living labs. Technology Innovation Management Review, 7(7).

Ståhlbröst, A. (2008). Forming future IT: the living lab way of user involvement (Doctoral dissertation, Luleå tekniska universitet).

Su, H. N., & Lee, P. C. (2012). Framing the structure of global open innovation research. Journal of Informetrics, 6(2), 202-216.

Van Raan, A.F.J. (1998), (Ed.) Special Topic Issue: Science and Technology Indicators. Journal of the American Society for Information Science, 49 : 3–81.

Vidgen, R., Henneberg, S. and Naudé, P. (2007). What sort of community is the European Conference on Information Systems? A social network analysis 1993–2005, European Journal of Information Systems, Vol. 16, pp. 5-19.

Viswanathan, M., Ammerman, A., Eng, E., Garlehner, G., Lohr, K. N., Griffith, D., & Webb, L. (2004). Community-based participatory research: Assessing the evidence: Summary.

Westley F., Laban S. Social innovation lab guide. 2015. https://uwaterloo.ca/waterloo-institute-for-social-innovation-and-resilience/projects/social-innovation-lab-guide (accessed May 10 2018

Wiggins, A., Crowston, K. (2011). From conservation to crowdsourcing: A typology of citizen science. In System Sciences (HICSS), 2011 44th Hawaii international conference on (pp. 1-10). IEEE.

Yan, J., & Assimakopoulos, D. (2008). The small-world and scale-free structure of an internet technological community. International Journal of Information Technology and Management, 8(1), 33-49.

Appendix 1:

Table 1: Popularity comparison of "Lab*" and rivalling terms based on title search

	Scopus	*Web of Science*	*GS*
L1. Living lab*	561	419	1 540
L2. Living lab OR Living labs	473	334	1 430
L3. Living lab	295	196	857
L4. Living labs	182	141	586
L5. Living laboratory OR Living laboratories	86	101	211
L6. Living laboratory	67	71	171
L7. Living laboratories	19	30	43
L8. Living labbing	-	1	1
RIVALLING TERMS			
R1. Testbed	6 832	5 409	8 460
R2. Citizen science	819	729	2 560
R3. Community-based participatory research	657	693	1 300
R4. Design lab	148	127	521
R5. Makerspace	56	39	504
R6. Innovation lab	40	29	272
R7. Government lab	118	94	171
R8. Fab lab	32	17	163
R9. Social lab	25	53	100
R10. Reality lab	18	20	90
R11. Change lab	23	20	81
R12a. Urban Lab*	27	30	80
R12b. Hackerspace	22	15	80
R13. Impact lab	7	6	44
R14. City lab	14	17	43
R15. Policy lab	12	14	42
R16. DESIS lab	-	1	6
R17. Lab-like	-	1	-