LOW CARBON LIVING CRC

Fifteen Living Labs across Australia

Final synthesis report on CRC LCL project RP3045: Living Lab Director and Coordination

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- originality
- methodology
- rigour
- compliance with ethical guidelines
- conclusions against results
- conformity with the principles of the Australian Code for the Responsible Conduct of Research (NHMRC 2007),

and provided constructive feedback which was considered and addressed by the author(s).

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Acronyms

Living Labs Living Laboratories

Executive Summary

Fifteen Living Laboratories have been developed across Australia over the past 5 years under the auspices of the CRC for Low Carbon Living. The establishment of the Living Labs has been a significant investment and this report outlines the Living Labs and proposes a model and implementation plan for the facility moving ahead. The 15 Living Labs can be categorised into a typology with four types: community-based, embedded; purpose built and urban. The Living Labs have been entered into an open access on-line resource to provide a story map.

Each Living Lab has been assessed in terms of status, scale and economic viability, as well as commercial outcomes (gems and tools). A proposal is made for collating the Living Labs under four regional hubs, using the Adelaide consolidation example, and then developing these into viable entities as outlined below.

With the need for commercial viability in mind a systematic review of the literature on Living Labs business models was made. This allowed an identification of how the 15 Australian living Labs have made progress in terms of ideation and co-creation processes, but also the gaps in bringing stakeholders into the process, as well as venturing and commercialisation.

The emergent model was tested in a workshop with a range of stakeholders where the importance of the following was identified:

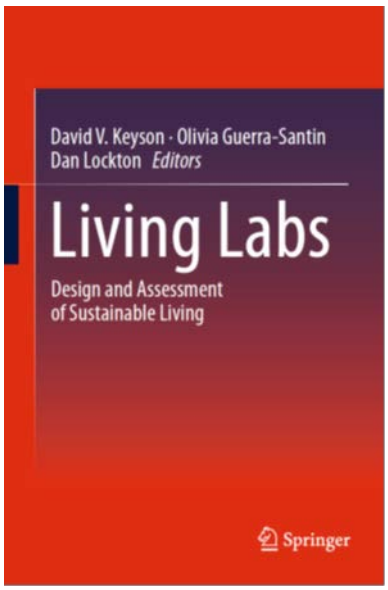
- Clear core value proposition
- Strong commercial structure and funding model
- Diverse range of stakeholders (academic, business, entrepreneurs, investors) in the innovation ecosystem
- Balance of research base and commercial outcomes
- Demonstrated scaling of solutions

Finally, an implementation plan for consolidating the Living Labs is proposed.

Introduction

The CRC LCL is involved in 17 Living Labs, now consolidated to 15, which has been the subject of a project to coordinate, manage and look to the future. During the first five years of the CRC LCL the Living Labs have been under development and there has been a significant investment by the universities with their business and societal partners. As with Living Labs globally this period has seen a significant development of the meaning and concept of the Living Lab and this has resulted in different interpretations and applications. One example is the recent book on Living Labs published by Springer (Figure 1).

Figure 1 Springer published in 2016 a book on Living Labs for sustainable living that provides a collation of early knowledge. Much of this knowledge through methods, co- creation and Living Labs development was being carried out somewhat isolated in each of the Australian Living Labs. Further, the Australian Living labs provide a greater diversity in the typology, with prototyping being the main focus in the Springer book.



During late 2016 and early 2017 site visits were made to the nodes with many interesting conversations with the researchers and also business and societal stakeholders. A typology for the diverse nature of the Australian Living Labs was established and an interactive story map detailing the labs across Australia has been published on-line. In 2017 a systematic literature review of business models for Living Labs was carried out to provide a global benchmark for developing the Australian open innovation network. Finally, on the basis of the work carried out, a key and defining workshop was held in Sydney with business, societal, start-up and academic stakeholders considering how to develop and make the network financially viable

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Fifteen Living Labs: typology, story map and descriptions

Typology

There is a strength in the diversity of LLs across Australia, although for the CRC LCL the LLs are apart. There are an array of meanings, interpretations and methods for the LLs. Early CRC LCL reports have attempted to define the LLs. Perhaps the most contemporary definition of a LL is:

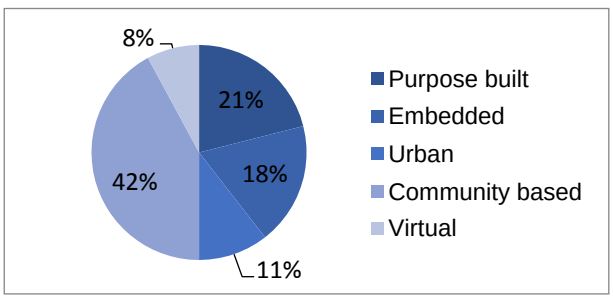
A Living Lab is a real-life place for user co-creation of innovations in knowledge products, services and infrastructures (Burbridge et al 2016)

The strength of the LL network lies in the findings which provide knowledge, insight and experience for low carbon living. All the LLs have in common that they were established to deal with two or possibly three of the following:

- The complexity of socio-technical change,
- Ways to engage with society at large and
- The provision of place and space for experimentation.

After visiting and surveying the LLs in Australia a preliminary typology was defined which divided the Labs into types based on underlying idea, purpose and function. These were community-based, embedded, purpose built and urban. The typology was confirmed in the literature review (Figure 2 and Appendix 2), although with the addition of a fifth type, virtual LL, which as yet does not feature in the Australian Labs.

Figure 2.Typology of global Living Labs according to the systematic literature review (Appendix 2). This figure is not in the review but has been extracted from the data.



Community-based LLs involving community representatives, governance, business and researchers. Community based LLs have a theoretical foundation in the social sciences and represent a space for sharing knowledge and innovation (Figure 3) – they are designed for social innovation. They differ from the other types in not necessarily being defined by a physical boundary, so that while co-creation workshops and prototype development might occur in a specific location, such as universities or communities, innovations are tested by users in a variety of settings.

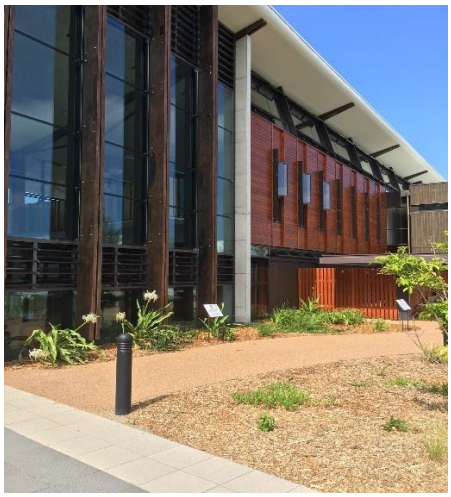
Figure 3 The low carbon schools program provides a space for low carbon innovation with economic savings for schools. A predictive analytics platform has been developed as a commercial outcome for the project.

Embedded LLs provide insight studies in real-life and are based on the early stage of design (Figure 4). These insights can later be used as ideas in the other types of LLs. Embedded LLs are based in existing places, where users can be observed interacting with existing technologies or prototypes.

Figure 4 Insights from Josh's house and the 10 homes are being used to develop interconnected ideas around everyday practice that has a commercial potential in home automation.

Purpose-built LLs which are dedicated buildings for demonstration and testing new materials and technologies (Figure 5). They are defined as a place for co-creation and prototyping. The theoretical foundation for this type of LL lies in three fields of research: design and behaviour, sustainability science and systems and engineering.

Figure 5 The Sustainable Building Research Centre at the University of Wollongong is a contemporary university laboratory with the possibility to co-create and prototype new products and services with built environment practitioners.



Urban LLs which have development, district or city boundaries and are often mixed use, increasingly with dedicated innovation spaces (Figure 6). The theoretical ideas behind the urban type of LL is in urban systems. The commercial outcomes of this LL is in providing entrepreneurial and innovation centres on low carbon living as demonstrations for urban development

Figure 6 The old Mitsubishi factory in Adelaide, Tonsley, is being developed into an urban innovation precinct and is part of the Adelaide Living Laboratory Hub.

Living Lab descriptions

Each of the 15 Living Labs are described below ordered under their distinctive typology. The business details of each lab are presented in Appendix 1. The status for each Lab, as well as outcomes are also considered.

Community-based Living Labs

Improving the carbon footprint of schools

Status assessment: Ongoing with potential to continue

Description: Because many schools are old and inefficient and there is no national benchmark for energy or water efficiency of school buildings this project aims to take the lead in low carbon transitions at schools. This project tracks how a community-led low carbon program is enabling 15 schools in Perth to maximise their operational efficiency and achieve carbon neutrality. This will help schools reduce utility bills and greenhouse gas emissions, as well as improve the health, comfort and wellbeing of students and teachers. It is hoped this school-led approach will also demonstrate community leadership, participation and learning and support a transition to a low carbon future.

Outcomes and Benefits: Total emissions generated by the 15 schools from a 2015 base year was approximately 3,770tCO2-e. Collectively, the 15 participating schools identified more than 590 low carbon actions. More than 200 have been implemented in late 2017. While most schools have reduced their per capita emissions and costs against the baseline, greater reductions are expected by the end of 2017.

How the project addresses scale: Aims to reproduce to Australia wide over coming years

How this project addresses economic viability: Ongoing and looking for further funding from the schools and from other research funding

Yarra Livewell – Developing social norms for low carbon behaviour

Status assessment: Completed with learnings, no continuation proposed

Description: Livewell began in the City of Yarra in inner Melbourne in 2015 as an action research project of the CRC, undertaken through Curtin University and supported by Yarra Council and Yarra Energy Foundation. In 2015 ten Livewell Groups were started and met monthly to help one another reduce their carbon emissions. A series of workshops ran in 2015 providing information on and collected community feedback about ways people can reduce home energy use, waste, divest from high carbon investments, recycle more and have conversations about climate change. The program has been designed to expand more broadly. It has produced a guide on how people across Australia can come together and help each other build low carbon wellbeing.

Outcomes and Benefits: Participants learned new ways to live low carbon lifestyles including advice on draft- proofing or retrofitting homes, switching to energy efficient lights, starting food gardens, switching to lower carbon modes of transport, installing solar panels, switching to green power, sharing resources with neighbours, working out how to calculate their carbon footprint and support other members of the group as they collectively worked towards reducing emissions.

How the project addresses scale: This project has been discontinued after completion

How this project addresses economic viability:
Not considered

Blue Mountains – Reducing the carbon footprint of tourism industries

Status assessment: Ongoing with potential to continue

The tourism industry accounts for 5 per cent of Australia's greenhouse gas emissions. As one of Australia's top tourism destinations, the upper Blue Mountains has been chosen for a pilot project focussed on helping tourism businesses reduce their carbon footprint. Environmental auditors will work with tourism owners to identify opportunities to reduce their emissions from energy, water, waste and purchasing. Education programs will be rolled out at TAFE to upskill tradespeople to implement the review recommendations.

Outcomes and Benefits: The Low Carbon Living – Blue Mountains project is helping businesses and communities reduce their overall carbon footprint. As part of the project 30 businesses involved in a pilot trial have been audited for their energy, water and waste use, advised how to be more efficient in using carbon based resources, assessed on what they've done so far and had their carbon reduction calculated. Businesses have been given, gold, silver or bronze ratings to indicate their achievements. Some have achieved up to 15 per cent reductions in one year. A second part of the project, relevant to visitors and residents, are being encouraged to use resources available on the website to learn how to reduce their own emissions.

How the project addresses scale: This project is planned to roll out into eight regions in NSW.

How this project addresses economic viability: The inclusion of local business and community means this projects remains financially viable.

Embedded Living Labs

10 homes – Case studies of high performance homes

Status assessment: Decommissioned

Description: Ten Western Australian houses with above- standard energy and water efficiency, but varying in design and occupancy, were established as embedded living labs. Over two years sensors recorded energy and water consumption, solar generation and temperature. After a baseline period was established residents were exposed to a behavioural change program with results also collected and analysed.

Outcomes and Benefits: It was found high performance houses used less energy per square metre, but performance among them varied significantly because of differences in PV performance, people's practices and home maintenance. The project highlighted the need for houses to be viewed as a system of practice; incorporating both occupants and their everyday practices.

How the project addresses scale: The 10 homes was a project to understand the behaviour and practice in homes with feed in to other projects eg White Gum Valley. It is now discontinued.

How this project addresses economic viability:
The funding was provided to cover research and instrumentation during the project.

Josh's House – Case studies of high performance homes

Status assessment: Ongoing with potential to continue

Description: Residential housing is a major contributor of greenhouse gas emissions with most emissions being generated during the operation of buildings. Josh's House has shown that High Performance, Zero Emissions Homes are accessible to the volume market, with the learnings being widely shared with industry and the broader community.

Outcomes and Benefits: Josh's House was completed in 2013 to a 10 star NatHERS energy efficiency rating standard. Detailed monitoring of 70 individual channels of data logging are used to assess the performance of the various design features and technologies in place.
The house, which attracts considerable media attention, and its website, have proven popular resources for those looking to find out more about building their own low carbon homes.

How the project addresses scale: The project provides an exemplification of passive solar design and monitoring which has received significant attention across Australia.

How this project addresses economic viability: The project contiunues to attract funding through research and sponsorship.

Purpose built Living Labs

CSR House – The energy, thermal and economic performance of an 8-star energy efficient home

Status assessment: Ongoing with potential to continue

Description: This project monitors and models the energy and thermal performance of the CSR House, which is a purpose built residential living lab rating 8 stars under the NatHERS scheme. The project investigates the costs associated with improved technical performance.

Outcomes and Benefits: Lessons learnt during the design, construction and operation of the house, which is equipped with 140 data collection points, is being used to inform new housing developments. Designed and built by building products company CSR, it incorporates 44 of their proprietary products and has a 45 per cent lower heating and cooling load than a minimum 6 star NatHERS home.

How the project addresses scale: The CSR house

provides a demonstration of building products and their function which allows reproduction at scale in the market

How this project addresses economic viability: The house has an industry sponsor which suggests continuation as long as commercially interesting

Factory of the Future – Swinburne

Status assessment: Ongoing development

Description: Swinburne University of Technology's Factory of the Future provides industry, students and organisations with state-of-the-art facilities to explore conceptual ideas for manufacturing next generation products. It is equipped with advanced visualisation and design tools, immersive virtual reality environments and prototyping facilities.

Outcomes and Benefits: The facility has contributed to Swinburne's history of incorporating industry-based learning, while promoting partnerships between industry and researchers. The factory aims to help the university develop new products, new methods of manufacturing and contribute to more productive, sustainable businesses.

How the project addresses scale: The project aims to provide reproduction of services and products through research and demonstration.

How this project addresses economic viability: As a university facility with industry buy in this provides financial viability

Illawarra Flame House

Status assessment: Fully established

Description: Illawarra Flame House was built by members of the University of Wollongong and TAFE Illawarra Institute as part of their entry into the 2013 Solar Decathlon. They won first place for their design, which retrofitted an existing fibro home into a solar-powered, cost-effective, energy efficient one.

Outcomes and Benefits: Today the house, which is nearby the University of Wollongong's campus, is on public display and can be rented out short-term to visitors. It remains a functioning home that has continued to attract awards since returning from the competition in China, and being reassembled in Australia. Through the website and events, the home aims to inspire Australians to embrace sustainable retrofitting technologies in their own homes.

How the project addresses scale: This is a prize winning project that demonstrates retrofit with autonomous solar design. The project has provided the basis for understanding scale out of technologies into further Prototyping and Urban Living Labs.

How this project addresses economic viability: The project has been fully supported by the University and has income through visitors and research projects.

Sustainable Buildings Research Centre – University of Wollongong

Status assessment: Fully established

Description: The University of Wollongong's Sustainable Research Centre (SBRC) was built as an energy efficient building that doubles as a host space for research and industry collaboration aimed at making buildings sustainable. It is a 6 star green star education design v1 accredited facility. It features ultra-low energy consumption, a solar roof. Rainwater harvesting, natural ventilation, extensive monitoring and building control systems for operating efficiency, locally sourced and environmentally safe construction materials and on-site edible gardens.

Outcomes and Benefits: Since being built in TKKK the SBRC has served as a hub to assist in the rapid decarbonisation of Australia's built environment. A major focus of the SBRC is retrofitting existing buildings. The facility brings together researchers, students and industry to develop, prototype and test sustainable building technologies and designs, carry out experiments, develop architectural and structural design tools to encourage mindfulness of low carbon solutions throughout a project's development, investigates day-to- day behaviour of building occupants, and develops novel control systems, sensor technologies and modelling tools to aid sustainable design.

How the project addresses scale: The centre is purpose built for testing and prototyping as a contemporary Living Lab on a University Campus.

How this project addresses economic viability: As an example of the new generation of laboratories in a campus environment this project brings in sponsors and is likely to remain economically viable

Urban Living Labs

Adelaide Living Laboratory Hub

Status assessment: Ongoing with potential for expansion.

The four year Adelaide Living Laboratory venture is an action based research project drawing evidence from three key Adelaide development sites at Tonsley, Lochiel Park and Bowden. Each of these sites has been established to meet specific government policy objects, is physically created by the local building and construction industry and includes detailed monitoring by the University of South Australia. The Adelaide Living Laboratory project utilises the expertise and skills of community, industry and university participants to undertake site-specific research to build a stronger evidence base supporting government policy and planning, and industry delivery. The unique program of research is designed to help build a better understanding of low carbon living. Stage 1 of the Adelaide Living Laboratory project explores four research themes: (a) co-creation; (b) integrated energy, water, waste and transport precinct modelling; (c) energy demand management solutions; and, (d) the value proposition for investment in low carbon development.

Outcomes and Benefits: At Lochiel Park a 15 hectare Green Village has been developed, which includes 10ha of open space, forest and wetlands, and energy efficient homes for 150 people. The project has helped residents reduce greenhouse gas emissions, created social capital and fostered a sense of community.

Since its construction in 2012 Tonsley Innovation Hub has brought together entrepreneurs, researchers and incubators to work together on projects that drive productivity, innovation and technology. It's anticipated by 2027 Tonsley will have 110,000 square metres of commercial land use and 130,000 sqm of high-value manufacturing activity.

Bowden Village has been developed as a high density, walkable community within a 16 hectare parcel of urban infill. The $1 billion project is creating a walkable community for 3500 residents, with 15 per cent deemed affordable housing, and a place for 32,000 square metres of commercial space, retail, alternative energy and community green space.

How the project addresses scale: The Adelaide labs have provided a progression from the original Lochiel Park through to the contemporary development at Tonsley.

How this project addresses economic viability: The potential for Tonsley lies in a close partnership with Renewal SA and startups in the venture space.

Broadway – Retrofitting urban precincts to create low carbon communities

Status assessment: Decommissioned

Description: This project aimed to identify pathways to transition existing urban communities to low carbon energy and water using precincts. It acts at a precinct scale and incorporates the University of Technology Sydney, Sydney Institute of TAFE, Frasers Broadway and One Central Park as living laboratories. It also incorporates Brookfield Multiplex, Flow Systems, City of Sydney, AECOM, and Better Building Partnership.

Outcomes and Benefits: Broadway's research aims to better understand existing precincts, create business cases and implement technologies and governance models required to transition to a low carbon community. The project aims to empower stakeholders within communities to drive transitions to low carbon energy and water use, by providing them with the data and processes they need for change. The project's long-term goal is to facilitate improved understanding that will assist precinct stakeholders to create successful low carbon infrastructure. It will do this in part by inducing an urban transition toolkit. Phase 1 of the project so far has identified a number of governance features, business models, technologies and global case studies that may be applicable to precinct transitions. The various stakeholders are examining how to implement this within Broadway.

How the project addresses scale: This was an urban scale governance project that created lessons around the difficulties of bringing business and societal stakeholders together.

How this project addresses economic viability: No continuation.

Greater Curtin

Status assessment: Potential innovation precinct but still to be realized.

Project period: 2016-2022

Overview: Greater Curtin is a masterplan to turn the 114 hectare campus of Curtin University of Technology, located six kilometres east of Perth CBD, into a city of innovation. It aims to deliver on four key network strengths: being an epicentre of research and innovation, a creative capital, an important visitor destination and urban economy, and a hub for businesses and community groups.

Outcomes and Benefits: There is scope for Greater Curtin to be a precinct scale living lab where technology and research are visible and accessible to everyone.

How the project addresses scale: The university precinct model with innovation provides a large potential to provide a complete innovation ecosystem.

How this project addresses economic viability: The procurement process for the first stage has taken time and the viability is likely to emerge in the future.

Swinburne Innovation Precinct

Status assessment: Potential innovation precinct but still to be realized.

Overview: Swinburne University's Innovation Precinct, located seven kilometres from inner city Melbourne, in Hawthorn, was launched in 2016. It brings together entrepreneurs and researchers to collaborate, solve problems and scale up commercial technology and services. It incorporates Design Factory Melbourne, the Factory of the Future, and the Digital Innovation Hub.

Outcomes and Benefits: The precinct aims to be a model for boosting Australia's lagging innovation output, in part by incorporating a culture of innovation throughout the university campus. The business incubator aims to support at least 10 to 15 start ups each year. It collaborates with the Italian Polytechnic University of Turni's Innovation Enterprise and Business Incubator, has a strategic research partnership with CSIRO, and helped facilitate major funding grants.

How the project addresses scale: The university precinct model with innovation provides a large potential to provide a complete innovation ecosystem.

How this project addresses economic viability: This will emerge with time.

White Gum Valley – Facilitating uptake of low carbon homes in new precinct developments

Status assessment: Development precinct which is recognised as demonstrating solar-storage innovation.

Description: The White Gum Valley (WGV) project follows the development process from construction through to occupancy of a 2.2 hectare medium density, 80 dwelling infill development. It is a precinct-scale project involving diverse building typologies, climate sensitive considerations, as well as urban greening and water management strategies. Partners on the project include LandCorp, Curtin University, Josh Byrne & Associates, City of Fremantle.

Outcomes and Benefits: It is expected there will be a 60 per cent reduction in typical operational greenhouse gas emissions across WGV's various dwelling types, due to a suite of relatively affordable initiatives. Research involves monitoring different dwelling types to assess design performance, as well as the impact of technology choice and occupant behaviour on energy use and carbon emissions. The project is also exploring the inter- relationship between developers, local government, builders and home buyers to determine low carbon aspirations and outcomes, as well as how these can better align.

How the project addresses scale: This showcase provides a range of developments where battery storage systems are key components. There is a need to scale out the results and this is the topic of one PhD student.

How this project addresses economic viability: A range of built environment stakeholders are involved and alsofunding is provided by CRC LCL, as well as CRC for Water Sensitive Cities and ARENA.

Beyond White Gum Valley – Community battery storage

Status assessment: Potential innovation precinct at scale but still to be realized.

Description: Beyond WGV builds on previous examples of battery storage integration and various commercial and governance models researched as part of previous CRCLCL projects) It aims to further advance and develop these practices on a district-size scale, by developing and implementing a large, community-size battery storage project in a new housing development in the City of Fremantle.

How the project addresses scale: This project provides an upscaling of the WGV project and is in the early planning stage where an affect can be made on this development which is a long term enterprise.

How this project addresses economic viability: This project is in the formative stages with the collation of partners.

Identified commercial outcomes of the 15 Living Labs: gems and tools

The 15 lab open innovation network provides a range of practical tools that are either developed or can be developed and that are based on the knowledge generated in 2.3. These include:

- Measurement technologies and the interpretation of data generated through the existing Living Labs.
- Mixed (qualitative and quantitative) methods to assess the importance of the interaction between humans and technology.
- Co-creation methods and process.
- Rating schemes, predictive analytics and a low carbon readiness index.
- Systems of practice for the home and assessing the relevance of achieving low carbon living through automation.
- Approaches to enabling community engagement.
- Demonstration of new technologies.
- Business models for the economic viability of Living Labs.

Detailed impacts and outcomes of each of the Living Labs are detailed in Table 1.

Proposed consolidation of Living Labs into four Open Innovation Hubs

It is proposed that four open innovation hubs are formed to allow the implementation of the viable business model based on the findings in chapters 3 and 4. These are:

- Adelaide Living Laboratory hub – including Lochiel Park, Bowden and Tonsley
- Perth Living Laboratory hub – including Low carbon schools programme, Joshs house, Greater Curtin, WGV and beyond WGV
- Melbourne Living Laboratory hub – including Swinburne Innovation Precinct and Factory of the Future
- Wollongong and Sydney Living Laboratory hub - including CSR house, Illawarra Flame and SBRC

The aim will be to retain the investment and learnings while developing the business model outlined in the following chapters.

Table 1 Impacts and outcomes of the living labs

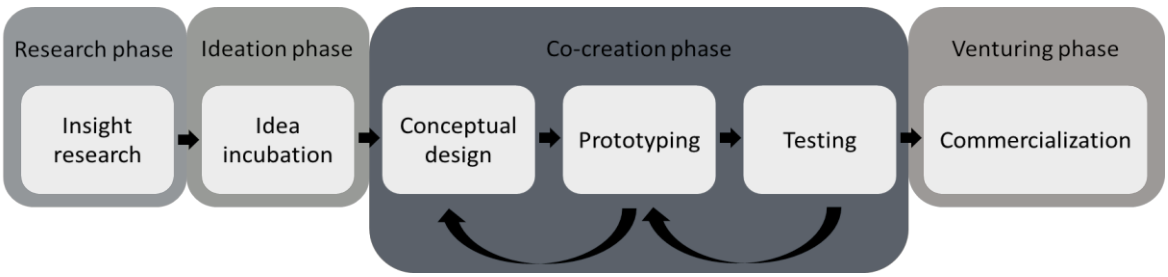
Typology	Short name	Publication impact - Nº journal articles on Scopus	Innovation	Outcomes - business and societal
Community based	Schools	0	Schools engagement in low carbon savings	Climate Clever start-up. Large scale uptake.
	Livewell	1	Community engagement for low carbon awards	-
	Blue Mountains	2	Energy, water and waste inventory for low carbon award system	Roll out of concept across NSW
Embedded	10 Homes	5	System of practice for energy and water	Implementation of peer-to-peer energy and water trading across Fremantle
	Josh's House	0	Demonstration home for zero carbon and alternative water living	
Purpose built	CSR house	0	Demonstration of CSR innovation products	Show home for improving low carbon buildings
	faculty of future	0	Commencing	Innovation and entrepreneurship for business and the university
	Illawarra Flame	1	Winner of the Global Solar Decathlon for a two-bedroom home	A living example of refurbishment to a low carbon building
	Sustainable Building Centre	5	Innovation and learning hub for prototyping for built environment	A sustainable centre as it attracts significant societal funding
Urban	Adelaide LL Hub	13	Lochiel Park near zero carbon development as a precinct exemplar	Implementation of learnings across Adelaide into Bowden and Tonsley innovation hub
	Broadway	0	Effort to work with different stakeholders in an urban environment for low carbon transition	-
	Greater Curtin	1	Major university development for bringing business, venturing and entrepreneurship into	Still under development
	Swinburne Precinct	0	Huge potential for innovation for bringing together entrepreneurs, academia, business and society	Under development
	WGV	5	Governmental model for solar-battery storage on strata. Practice and behavioural studies	On site demonstration and testing of innovation with residents and a large business and society
	Beyond WGV	0	Planning of innovation roll-out at scale	Full peer-to-peer trading of renewable energy and alternative water in a major Fremantle precinct

Systematic Literature Review of Living Labs best practice

Through a systematic literature review (Eon and Morrison 2017) we were able to ascertain that the 15 Australian Living Labs were in the same situation as Living Labs globally (Appendix 2). The initial government funding needs a longer term investment and the identified processes and outcomes need to build on the base of ideation, co-creation, knowledge and typologies.

The Living Lab lifecycle (Figure 8) can vary across projects depending on the Living Lab initiator, in Australia this has tended to be research driven in association with stakeholders. Living Labs that are coordinated by researchers tend to conduct insight research as a first step, looking to obtain an understanding of baseline practices and user needs before moving on to the development of new concepts (Herrera, 2017). Living Labs that are initiated through businesses and already have a prototype may start at the testing stage, using real-life places to trial the new technology and obtain user feedback that will either validate the innovation or cause it to be reviewed (Hyysalo & Hakkarainen, 2014). Users can also initiate the innovation process by exposing their needs and designing new concepts that are then prototyped and tested with the support of other stakeholders (Salminen & Konsti-Laakso, 2016). The last phase of the lifecycle is the commercialisation of successful innovations, which is usually but not necessarily carried out by the business partner(s) involved in the Living Lab. Venturing and commercialisation has not been an integral feature of the Australian Living Labs.

Figure 8 Living Labs lifecycle stages (adapted from Katzy and Bucker, 2015)



CRC LCL business and society stakeholders specifically identify a lack of knowledge and willingness in the construction industry which hinders the adoption, uptake and utilisation of knowledge and innovations in services and products. They also express a lack of understanding, which may be a perception, amongst researchers of the practical implications of their generated knowledge. The stakeholders wish to demonstrate, prototype and mainstream high performance services and products for low carbon living in our cities and regions, in other words create business out of the CRC LCL.

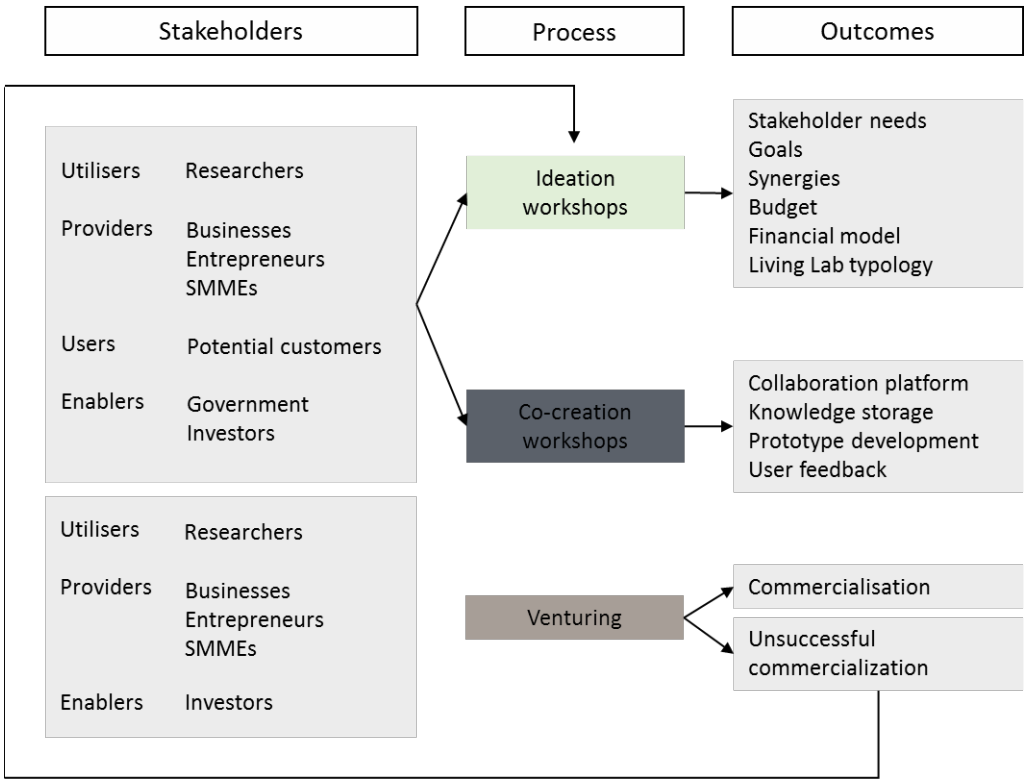
However, the Australian Living Labs have generally been initiated by projects in the CRC LCL where the ideas have been researcher initiated, although with commitment and financial support from business and society. The result is that the Living Labs have skewed towards the research and ideation phase of Figure 8. The central co-creation process was not at the time sufficiently developed for proper implementation at the early planning stage of the LLs, which is to be expected as co-creation is a recent development internationally in the literature.

Co-creation workshops should be the genesis of the LLs and their projects, providing a place for the co-production of knowledge and ideas which reflect the tacit knowledge process of business and society and the structured knowledge process of academia. Researchers and business should bring their own ecosystems and the co-creation workshops should be well planned and build on specific societal challenges.

Studies in European LLs have shown that if co-creation is a neutral learning platform where trust is built then the outcome can be challenging but relevant for both society and research. Co-creation is a process that requires valuable time and effort and if this is to be successful then sufficient financial resources need to be provided to progress the process, in other words, co-creation workshops should be required at the genesis of, in the early stages of and indeed, throughout any LL project. Co-creation is a collaborative and trust building process that enables knowledge and innovation to progress to meeting societal challenges.

The Australian Living Labs, as is the case globally, have not had strong business models and they have evolved experimentally through the Living Lab lifecycle. The Excellence Business Model proposed by Katzy (2012) suggests that Living Labs should receive investment from venture capitalists, business angels or investors looking for investment ideas. Investors would benefit from not having to search the market for innovative products and Living Labs would benefit from obtaining funds before prototype completion and potentially obtain shares in a future venture. This model, however, requires Living Labs to foster entrepreneurship early in the process (Figure 9).

Figure 9 Stakeholder engagement processes and expected outcomes for Living Labs (adapted from Appendix 2). Venturing and commercialisation are the key aspect missing from the Australian Living Labs.



The systematic literature review (Appendix 2) revealed that the success and longevity of Living Labs is centred on strong partnerships that should be established during the pre-project and maintained through good communication and transparent processes during the duration of the Living Lab. These collaborations, however, need to foster win-win scenarios considering all the stakeholders goals and interests. The relationship format should be one of a network, where all partners, including users, have the same level of engagement and influence. Moreover, the network needs to be flexible enough to adapt to changes while also storing knowledge.

The most important aspect to ensure the sustainability of Living Labs, however, is arguably the venturing, or commercialisation, phase of the process (Figure 3.2). Most Living Labs are currently initiated by public bodies and researchers; however, self-sufficiency depends on the generation of revenues, which in turn relies on the involvement of businesses that will continue the innovation commercialisation process. While established businesses may not require support for research and development, SMEs and entrepreneurs can largely benefit from Living Labs as they gain access to resources and information in addition to minimizing their risks. Crowdfunding, venture capitalists or angel investors may be attracted to provide funding for prototype development and commercialisation.

The commercialisation of Living Labs products and services can benefit not only the research community but also foster local economic growth. While Living Lab research tends to focus on the early stages of the lifecycle, the last stages are equally important. A business model promoting economic sustainability can add value to Living labs which will ultimately help attract and retain business partners.

Workshop to develop a business model and structure for the Living Labs and the open innovation network

The systematic literature review (Previous chapter and Appendix 2) combined with the survey and typology for the Australian Living Labs (chapters 1 and 2) provided the basis for a workshop to define the Open Innovation Network moving forward. The stakeholder engagement model proposed in Figure 9 was the basis for the workshop.

Method

A select group of stakeholders and practitioners were invited to a defined workshop in Sydney in September 2017 (Appendix 3.1). The invitees were a cross section of researchers, business providers, entrepreneurs, SMEs, potential customers, government and investors (Appendix 3.2 is a list of the final delegates). Those who accepted were provided with the systematic literature review as background reading before the workshop.

At the workshop the stakeholders were introduced to the Australian Living Labs typology (chapter 2.1) and reminded of the fundamentals of the systematic literature review (chapter 3 and appendix 2). This was then followed by a presentation of the story map (chapter 2.2).

The workshop then moved into the consolidation phase of co-creation. The stakeholders were divided into three groups, with each group having 5 persons and a facilitator. Each stakeholder was provided with a sheet divided into six boxes. In the first box the stakeholder was asked to write a question they might have about Living Labs. After 2 minutes each delegate was asked to pass their sheet clockwise. With two minute brain-writing sessions around the table the stakeholder finally retrieved their sheet with comments on their question from the group. The group was then asked to spend 15 minutes collating and distilling their writings into three key points. After this the groups presented the findings.

The second writing session was a repeat of the brain-writing activity with the stakeholders being asked to write a question about sustaining the value and creativity of Living Labs.

Analysis

The thematic analysis of latent data was structured at three levels (Massey 2011); articulated, attributional and emergent. The brain-writing transcripts were read and a matrix of articulated, attributional and emergent data was compiled.

Articulated data directly addresses the posited question, providing the most visible and defensible conclusions of the three levels, but will tend to be least indicative of patterns of complexity and integral thinking (Massey 2011).

Attributional data are hypothesis driven propositions, providing evidence of integral thinking with proposals predominantly for further study (Massey 2011). It was expected that attributional data should be based on the background reading and the presentation of the Living Labs.

Emergent data are larger themes and unifying concepts that are data, rather than hypothesis, driven. Emergent data are the least defensible level in terms of accuracy of dialogue interpretation, but are the most likely to allow insight into patterns of complexity. Emergent data provide evidence of social learning with proposals largely for action (Massey 2011). It was expected that the emergent ideas should have formed from the attributional data combined with the group discussion where tacit knowledge of the stakeholders comes to the fore.

Results of the workshop

The results of the workshop are provided as listings of knowledge, thought and emergent ideas under the articulated, attributional and emergent propositions below. The workshop participants (Appendix 3.2) were very engaged and built on their tacit knowledge and the available resources to propose ideas for the model and strategic development of the Living Labs network.

Articulated

The user, customer, stakeholder of the Living labs should be able to extract value. More effort needs to be placed into the design of Living Labs to include both the researchers and end-users. The Living Labs have tended to be driven by an iterative process with unknown outcomes. The diversity and drivers should be considered in forming an innovation ecosystem.

The definition (typology) of Living Labs is semantic but has some use in defining purpose and most seem to agree that they should be research-based, demand-led and with commercial outcomes. The defining purpose includes:

- Carrying out collaborative, applied research.
- Being accelerators and incubators to provide products and services of commercial value.
- Testing technologies and behaviours before full-scale commercial roll-out.
- Real evidence base for potential products, mechanisms and approaches.
- Rapid rollout of results in an implementable form.
- Bringing together a wide range of utilisation partners which include industry and entrepreneurs, as well as other partners that wish to solve societal challenges. This provide acceleration and a sense of ownership of solutions.

The timeline for Living Labs is not known, but they should be able to adapt and evolve if they are to remain commercially viable once Government funding is

discontinued. In some cases Living Labs will need to be disestablished.

A process should be introduced to include and exclude CRC LCL projects in the LL innovation network. To aid this a mapping process where the Living Lab proponents are asked to elucidate and articulate their purpose and capacity should be introduced. This includes the ability to provide closure on a Living Lab while retaining knowledge, as well as extending the Living Labs to consider inclusion of the 100 projects in the CRC LCL. In many cases the Living Lab has been established by a person with passion and vision. This needs to be combined with the value proposition and strong leadership if the Lab is to remain successful.

Attributional

The core value proposition should be customer discovery features of the Living Lab through hackathons and ideation activities. This should be the terms of strategic engagement with industry where the workshops reveal attractive opportunities for industry, involve entrepreneurs and develop case studies relevant for target sectors. Cogently posed problems can provide the excitement for the innovation ecosystem. The ability to truncate the project lifecycle to accelerate commercial outcomes should appeal to industry as a low risk investment. The commercialisation component is essential for scaling solutions.

The value proposition should be sustained by incorporating prototyping and iterative change into the Living Labs. There will be flexible components which allow social innovation and less flexible components based on hardware that lead to technical innovation.

Scaling out projects to more ubiquitous solutions for society is very dependent on who identified the project challenge. The framing of the knowledge-innovation question needs to balance research opportunities with societal solutions. Researchers are good at surveying demographic traits and staked vested interests and by bringing the end user into the process one could imagine a better outcome. There needs to be a balance between research-led and demand-led projects. This is a particular issue as the value proposition for the Living Labs will depend on making this juxtaposition into a mutually inclusive concept. The outcomes should be publicised through industry media channels, although the ideas need to be viable in a social or commercial sense, hence the emphasis many place on the focus on demand-led projects.

Emergent

There is a need for a commercial structure, contracts and milestones, as well as clarity over IP issues. The shorter commercial timelines have to be combined with the longer research timelines and therefore the commercial structure should include a common strategic agreement between commercial and academic partners on timing and objectives. This commercial structure is essential if industry is to engage with the Living Labs and industry needs to see a proven market demand for potential outcomes before signing up.

The Living Labs should feature strategic management, map capabilities and share lessons learned. Knowledge diffusion needs to be understood and included in the strategy, allowing the dissemination of good practice and solutions.

A feature of the Living Labs should be that they are a pool of ideas, solutions and proposals, but there needs to be a management structure that allows for the balance of longer term research, shorter terms commercial outcomes and an entrepreneurial co-creation process.

A new funding model should be established which includes three items: identifying short-term cash flow, building a medium term value proposition for business partners and input investment and equity. This funding model should provide a mix of royalties, licensing, venture capital and impact funds.

The Living Labs need to be nimble and flexible. One approach might be through pop-up pods demonstrating and testing demand-led ideas. The network/Living Labs leader then becomes a broker and matchmaker for ideas from industry and research, which might also be cross industry initiatives. Constantly finding potential new entrants and existing partners who are willing to innovate will be a key challenge. Business needs to want to keep coming back for more.

Living Labs consolidation after the workshop: Towards an Implementation Plan 2018

The following proposal for an Implementation Plan for the Living Labs in 2018 is identified from the survey, mapping, analysis and stakeholder workshop. The model proposed in Figure 3.2 held well in the workshop and will remain a central driving force for directing the direction of the remaining, coordinated Living Labs.

- Redefine the Living Labs network with a core value proposition based on the mapped capabilities and lessons learnt, as presented in this report. This should be carried out in close consultation with business and investors to assess the likelihood of commercial success. There needs to be a clear relationship between the value proposition, leadership and potential funding.
- Build the open innovation ecosystem as a community of ideation, co-creation, venturing and business, while retaining the knowledge, diversity and drivers which have been established over the past 5 years.
- Create the four open innovation hubs with strong leadership in each hub under a centrally controlled value proposition and business model.
- Create a short, medium and long term financial model for the Living Labs as an investment opportunity for funding in addition to Government support.

Conclusions and recommendations

The research carried out in the CRC LCL Living Labs has tended to focus on co-creation and ideation (Figure 3.1) which has provided the scaling up of knowledge (eg Stevens 2017). The Living Labs need to include fully sponsored entrepreneurship through venturing (Figure 3.2) and start a new focus on scaling out. Scaling out requires cross-scale integration, which is more than intuitive scaling in time and space.

The continuation of the development of the Living Labs should focus on:

1. Research on the scaling out mechanisms (ie reproduction of results across scales) of the results from the Living Labs. The focus should be on demonstrating and disseminating the gems and tools from the current Living Labs (chapter 2.4).
2. Identification and management of introducing venturing and innovation into the existing Living Labs (Figure 3.2).
3. Development of a new model for the open innovation network (chapter 4.3) to build a fundable legacy. This will be developed into four open innovation hubs.

At the centre of the concept for the Open Innovation Network is the extended focus of the Living Labs from places and spaces of innovation ideas and research to places and spaces for venturing and commercialisation.

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Appendix 1. Business details of the Living Labs

Project name: **RP3020 Improving the carbon footprint of schools**

Typology: Community based

Location: Various schools in Perth. 2016-17 participating schools are Applecross Senior High School, Ardross Primary School, Aveley Primary School, Baldivis Secondary College, Belmont City College, Bibra Lake Primary School, Canning Vale Primary School, Fremantle Primary School, John Curtin College of the Arts, Lance Holt Primary School, Palmyra Primary School, Samson Primary School, South Fremantle Senior High School, Spearwood Alternative School, Winterfold Primary School

Project team members: Dr Vanessa Rauland, Portia O'Dell

Project status: Current

Project period: 06/2014 to 07/2018

Website: http://simplycarbon.com.au/climateclever-initiative-2018/

Project name: **RP3011 Yarra Livewell – Developing social norms for low carbon behaviour**

Typology: Community based

Location: Inner northern suburbs of Melbourne within the Yarra municipality

Project team members: Dr Robert Salter, Darren Sharp

Project status: Current

Project period: 03/2014 to 09/2015

Website: https://livewell.net.au/

Project name**: RP3010 Blue Mountains – Reducing the carbon footprint of tourism industries**

Typology: Community based

Location: upper Blue Mountains

Project team members: Associate Professor John Merson

Project status: Current

Project period: 09/2013 to 09/2015

Website: https://www.lowcarbonliving-bluemountains.com.au/

RP3017 Adelaide Living Laboratory Hub

Typology: Community based, Urban

Location: Tonsley, Bowden and Lockiel Park in Adelaide

Project team members: Professor Wasim Saman, Dr Stephen Berry, Dr Kathryn Davidson

Project status: Current

Project period: 04/2014 to 04/2018

Project name: **RP3009 10 homes – Case studies of high performance homes**

Typology: Embedded

Location: Fremantle, Perth

Project team members: Christine Eon and Dr Josh Byrne

Project status: Current

Project period: 07/2013 to 12/2017

Project name: **RP1010 CSR House – The energy, thermal and economic performance of an 8-star energy efficient home**

Typology: Embedded, Purpose built

Location: Schofields, outer western suburbs of Sydney

Project team members: Jesse Clarke, Professor Wasim Saman

Project status: Current

Project period: 01/2013 to 06/2016

Project name: **RP3009 Josh's House – Case studies of high performance homes**

Typology: Embedded, Purpose built

Location: Hilton, Perth

Project team members: Dr Josh Byrne

Project status: Current

Project period: 07/2013 to 12/2018

Website: http://joshshouse.com.au/

Project name: **Factory of the Future – Swinburne**

Typology: Purpose built

Location: Melbourne

Project team members: Clarence Tang, Professor Bronwyn Fox

Project status: Current

Project period: 2015 onwards

Website: http://www.swinburne.edu.au/research/strengths-achievements/strategic-initiatives/factory-of-the-future/

Project name: **Illawarra Flame House**

Typology: Purpose built

Location: Wollongong

Project team members: Professor Paul Cooper, Marty Burgess, Alexandra McPaul, Tim McCarthy, Zhenjun Ma

Project status: Current

Project period: 2013 onwards

Website: http://www.illawarraflame.com.au/

Project name: **Sustainable Buildings Research Centre – University of Wollongong**

Typology: Purpose built

Location: Wollongong

Project team members: Professor Paul Cooper

Project status: Current

Project period: 2010 onwards

Website: https://sbrc.uow.edu.au/index.html

Project name:**RP2018 Broadway – Retrofitting urban precincts to create low carbon communities**

Typology: Urban

Location: Sydney CBD

Project team members: Roger Swinbourne

Project status: Current

Project period: 03/2015 to 03/2016

Website: http://www.empoweringbroadway.com.au/

Project name: **Greater Curtin**

Typology: Urban

Location: Bentley, Perth

Project team members: Professor Peter Newman, Professor Greg Morrison

Project status: Preliminary

Project name: **Swinburne Innovation Precinct**

Typology: Urban

Location: Hawthorn, Melbourne

Project team members: Professor Sally McArthur, Associate Professor Anita Kocsis

Project status: Current

Project period: 2016 onwards

Website: http://www.swinburne.edu.au/innovation-precinct/

White Gum Valley – Facilitating uptake of low carbon homes in new precinct developments

Typology: Urban

Location: White Gum Valley, Perth

Project team members: Professor Peter Newman, Dr Josh Byrne, Professor Greg Morrison, Dr Jemma Green

Project status: Current

Project period: 07/2015 to 07/2019

Website: http://www.landcorp.com.au/innovation/wgv

Project name: **RP3043 Beyond White Gum Valley – Community battery storage**

Typology: Urban

Location: Fremantle

Project team members: Professor Peter Newman

Project status: Current

Project period: 05/2017 to 12/2018

Appendix 2. Systematic Literature Review on best practice and business models in Living Labs

A systematic literature review to identify best practice in Living Labs

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Abstract

Living Labs have become a popular method for the development of open innovation, especially since the European Network of Living Labs was created in 2006. Living Lab research, however, is still at its early stages and findings are fragmented. Living Labs are considered quasi-experiments, where innovations and methodologies are changed and adapted through the process. This has also been the case for business models, which develop through trial and error over the Living Lab lifecycle. Most Living Labs are publicly funded and struggle to continue their activities past the end of the initial funding. While each Living Lab has a unique stakeholder network and specific purpose, best practices should be understood to enable the acceleration of future innovation processes and ensure impact and longevity. This research identifies international best practices in Living Labs through a systematic literature review.

Introduction

Since the concept of Living Laboratories (Living Labs) was first introduced in the 1990's (Schuurman & Tonurist, 2017), more than 400 Living Labs have been created and at least 170 of them are currently active, many of them partners in the European Network of Living Labs (ENoLL). Despite the abundance of exemplars over the years, Living Labs are still at the early stages of development and there is some discussion over a need for a unified definition (Burbridge et al., 2017; Dell'Era & Landoni, 2014). Sustainable business models and insights from innovation processes are still at the development stage (Burbridge et al., 2017; Grezes, Fulgencio, & Perruchoud, 2013; Rits, Schuurman, & Ballon, 2015). The successful commercialisation of innovation outcomes and the added value of Living labs have been relatively unexplored in the literature (Schuurman, De Marez, & Ballon, 2016b). Living Labs are considered by many as quasi-experiments, where innovations and methodologies are subject to a pre-test, an implementation phase and a post-test (Almirall & Wareham, 2011; Katzy & Bucker, 2015; Schuurman et al., 2016b). As such, business models have been revealed through trial and error during the whole Living Lab lifecycle.

Since there is no single consensual definition of Living Labs, authors may include elements of place (Burbridge et al., 2017), methodology (Dell'Era & Landoni, 2014) and test-bed (Ballon, Pierson, & Delaere, 2007) in their experimentation. Most would reason that Living Labs are real-life environments that promote innovation in services or technology by facilitating co-creation between multiple stakeholders including business, academia, government and end users (Dell'Era & Landoni, 2014). Living Labs have also been defined as a quintuple helix model to promote socio-ecological innovation, where stakeholders are researchers, government authorities, industry, society and environmental groups (Baccarne, Logghe, Schuurman, & De Marez, 2016). Regardless of the nuances in definition, Living

Labs function as innovation accelerators, where new ideas emerge, are prototyped and tested in collaboration with users in real-life settings. Unlike other innovation models, such as the traditional triple-helix model (Etzkowitz & Leydesdorff, 2000), business incubators or science parks (Baltes & Gard, 2016) , Living Labs consider user needs and feedback at the genesis of product development. This approach implies that innovations should reach the market at faster rates and accelerate successful adoption by users (Hyysalo & Hakkarainen, 2014).

The Living Lab lifecycle (Figure 1) can vary across projects depending on the Living Lab initiator. Living Labs that are coordinated by researchers tend to conduct insight research as a first step, looking to obtain an understanding of baseline practices and user needs before moving on to the development of new concepts (Herrera, 2017). Living Labs that are initiated through businesses and already have a prototype may start at the testing stage, using real-life places to trial the new technology and obtain user feedback that will either validate the innovation or cause it to be reviewed (Hyysalo & Hakkarainen, 2014). Users can also initiate the innovation process by exposing their needs and designing new concepts that are then prototyped and tested with the support of other stakeholders (Salminen & Konsti-Laakso, 2016). The last phase of the lifecycle is the commercialisation of successful innovations, which is usually but not necessarily carried out by the business partner(s) involved in the Living Lab.

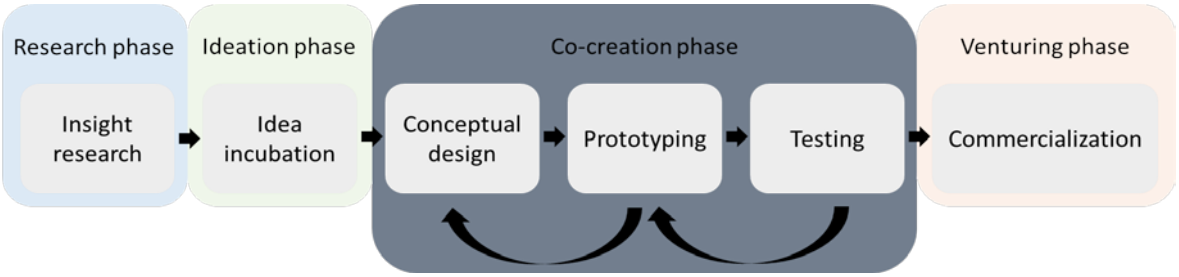

Figure 1. Living Labs lifecycle stages (adapted from Katzy and Bucker, 2015)

Initiators also influence the Living Labs objectives and innovation outcomes. Small and medium enterprises (SMEs) that become collaborators in Living Labs are highly motivated to achieve commercialisation and start generating revenues (Hyysalo & Hakkarainen, 2014). Many Living Labs, however, are managed by universities in collaboration with governments which provide funds for their coordination and maintenance (Gasco, 2017). Whilst this is a common model, it has proven challenging at times, with limitations in the public funding model (Gasco, 2017; Katzy & Bucker, 2015; Turgut & Katzy, 2012) and focus has biased towards Living Lab insight, ideation and co-creation rather than venturing (Gasco, 2017).

Living Labs can be designed for several niches. Examples of implementation are sustainability (Baedeker et al., 2014), governance (Van Stijn, Rukanova, Wensley, & Tan, 2009), healthcare (Hyysalo & Hakkarainen, 2014) or the food industry (Guzman, Schaffers, Bilicki, Merz, & Valenzuela, 2008). They also have different purposes, different scales (Baedeker et al., 2014) and different stakeholders with different roles (Nystrom, Leminen, Westerlund, & Kortelainen, 2014) and therefore one might expect Living labs to have distinct and targeted business models. Best practice should provide insight into enabling the acceleration of future innovation processes and ensure Living Labs success, impact and longevity.

The purpose of this article is to identify best practices in Living Labs, more specifically related to business and commercialisation models at an international scale. It follows that an investigation should be made to explore best practices and challenges experienced across each phase of the Living Lab lifecycle, consisting of incubation of ideas, conceptual design, prototyping, validation and commercialisation (García-Guzmán, Fernández del Carpio, de Amescua, & Velasco, 2013). The approach here is through a systematic literature review (SLR) (O'Brien & Mc Guckin, 2016) to provide recommendations for current and future Living Labs implemented globally in the domain of urban sustainability.

Methodology

The purpose of the SLR was to identify international best practices for Living Labs business models. The development of the SLR methodology has traditionally been in health care research but it has also been applied to other fields to assist with the revision of large and often unmanageable bodies of information (e.g. de Medeiros, Ribeiro, & Cortimiglia, 2014; Xavier, Naveiro, Aoussat, & Reyes, 2017). This methodology is used to obtain a general overview about a topic while reducing the risk of bias that often affects narrative reviews (O'Brien & Mc Guckin, 2016). The methodical and rigorous approach of the SLR process also ensures the replicability of the research (O'Brien & Mc Guckin, 2016).

SLRs consist of five steps including i) problem definition; ii) the identification of relevant studies; iii) the selection of studies; iv) data synthesis; v) and the summary of results (de Medeiros et al., 2014; Xavier et al., 2017). Each of these steps will be discussed below.

Problem definition

The aim of this SLR is to review the state of the art in relation to Living Labs business models and the commercialisation of innovation outputs. This research is particularly focussed on understanding how Living Labs can create positive impacts through a business model that enables self-sufficiency.

Identification of relevant studies

Based on the problem definition, the next step in the SLR was to conduct a search of the main scientific databases using a defined string including relevant keywords (O'Brien & Mc Guckin, 2016). Four international high impact databases were selected for this study: Scopus, Science Direct, Web of Science and Google Scholar. The key areas to be investigated, or research headings, were defined as “business model”, “commercialisation” and “Living Labs”. These three areas were further expanded to include synonyms and derivative words (Table 1). Initial test searches with the added concepts of “sustainability” and “urban” living laboratories were also performed but these additional criteria appeared to exclude a number of relevant articles, including articles written by leading authors in the Living Labs field of research. The database searched through titles and abstracts for any research published in the last ten years, between 2007 and 2017. This period was chosen given that the main publications in the Living Labs field started after the creation of the ENoLL in 2006.

Table 1. Keywords used in the search string. Words with * indicates that they can have several alternative endings, for example, Living Labs or Living Laboratories.

Key areas	**String expressions**
Business model	Business model* OR model*
Commercialisation	Commercial* OR impact* OR outcome* OR valorisation OR benefit* OR innovation or effect*
Living Labs	Living Lab*

Selection of studies

Once the articles were retrieved from the four databases, they were sorted alphabetically by title and all duplicates were removed as well as articles not written in the English language. Theses, complete books, lecture notes and editorial material were also excluded. Journal articles, book chapters and conference proceedings were further evaluated based on additional inclusion and exclusion criteria. Since it is critical for the research that the models or innovation processes discussed are about Living labs, all articles that did not possess a variation of the expression "Living Labs" in the title were excluded. A second filter was applied to exclude articles that had less than two of the string keywords (Table 1) in the title. The remaining articles were compiled based on their subject relevance. Living Labs in the medical and learning industries were excluded from the search. Articles included had to address processes in Living Labs, either discussing innovation processes and outcomes and/or Living Labs models and governance. The initial search in four databases found 621 results, 68% of them in Scopus. After filters were applied and articles were screened for relevance, 50 peer reviewed journal articles remained (Table 2).

Table 2. Search results (2nd May 2017)

Database	**Results**
Scopus	421
Google Scholar	145
Web of science	48
Science direct	7
Total	**621**
Duplicate removal	560
Living Labs and additional keyword on title	141
Relevant articles	**50**

Data synthesis and summary of results

Data synthesis consists in aggregating the articles obtained to provide a general overview of the findings, which enables the identification of gaps in knowledge as well as strengths

(O'Brien & Mc Guckin, 2016). All articles were read in detail and classified according to the criteria presented in Table 3. Some of the classification relies on subjective interpretation by the researchers, which is a weakness of SLR studies in the management field (de Medeiros et al., 2014).

Table 3. Article classification into six selected criteria

Criteria	**Description**
Year	Year that the article was published
Country of origin	Articles were allocated according to the first author's affiliation
Type of article	Articles were classified into case study if findings were based on one or more applications of Living Labs; theoretical if findings were based on a combination of theories but did not include real-life applications; review if findings were based on Living Labs reviews but did not explain them in detail; qualitative if findings were based on interviews with multiple Living Labs experts
Article subject	Articles were classified according to the aim of the research
Living Lab country	For articles based on real-life applications, the Living Lab country was identified
Living Lab typology	For articles based on real-life applications, Living Labs were classified into typologies according to their scale.

Result Synthesis

Article distribution

The greatest number of articles in the field of business model and innovation in Living Labs were published in 2016 (Figure 2). Finland dominates the field, authoring 26% of the publications (Figure 3). This is not surprising since the ENoLL originated in Finland, where three Living Lab members are currently located.

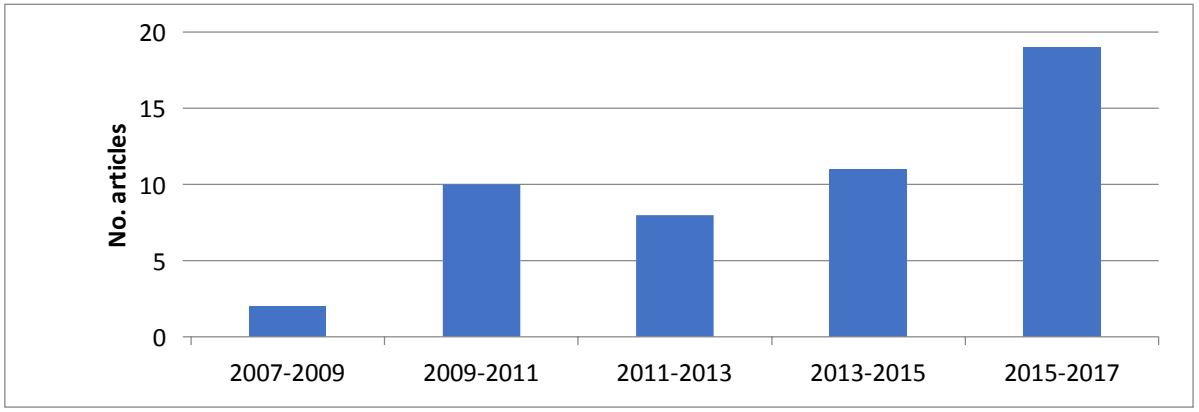

Figure 2. Publication years

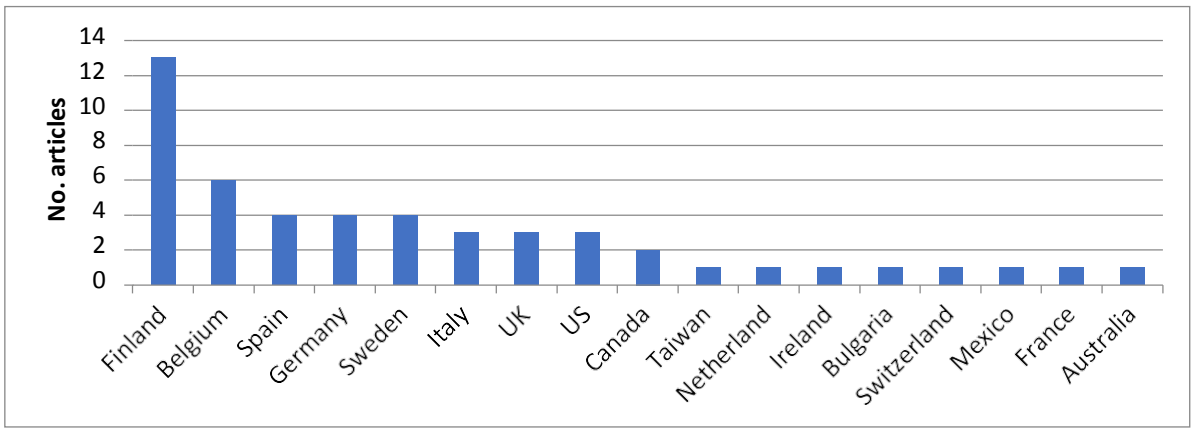

Figure 3. Distribution of selected articles per country of authorship

The journal with the most publications was Technology Innovation Management (TIM) Review, having published 14% of the articles (Figure 4). The International Technology Management (ITM) Conference was also a source of 22% of the publications. Given the novelty of the Living Labs topic, many projects are still underway or at the early stages of development, which is a possible explanation for the high percentage of conference proceedings (54%) in comparison to journal articles (40%).

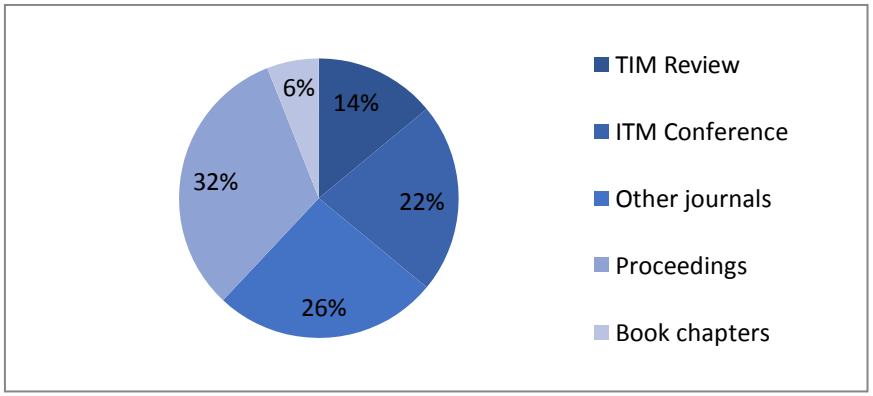

Figure 4. Article source

Article classification

Articles are mostly based on case studies (Figure 5) discussing findings from the ENoLL Living Lab projects. These are typically spread across Europe, in particular Finland, Sweden and Spain, although examples were also found in China, Mexico, South Africa and Taiwan (Figure 6). These Living Labs explore various topics including construction (Romero, Flores, Vallejo, & Molina, 2016), food (Van Stijn et al., 2009), governance (Luccini & Angehrn, 2016), media (Tang & Hämäläinen, 2012), rural development (Schaffers et al., 2016) and wellbeing (Chen, Tsui, Yang, Ting, & Houng, 2016; Makarainen-Suni, 2016); however, most of the innovations seem to occur in the information and communication technology (ICT) space.

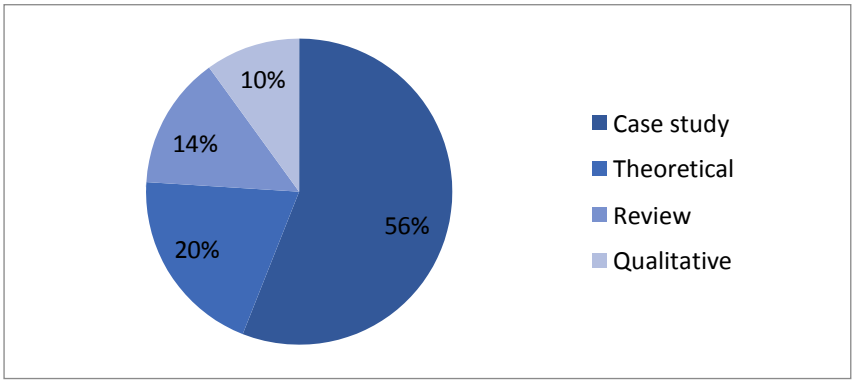

Figure 5. Type of article

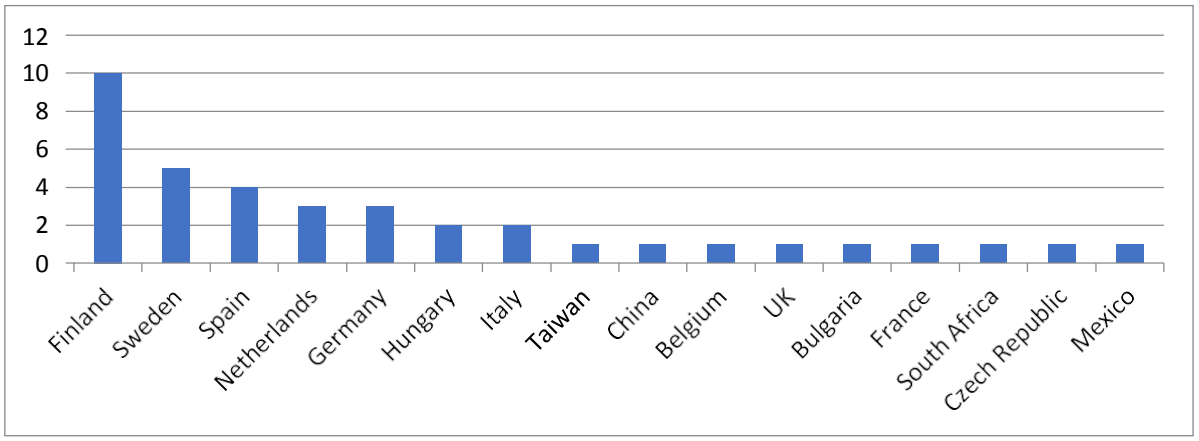

Figure 6. Living Lab location

In terms of Living Lab typology, five main categories were identified: embedded, purpose-built, urban, community-based and virtual Living Labs (Figure 7). The embedded type consists of Living Labs that are based in existing places, where users can be observed interacting with existing technologies or prototypes. Examples of embedded Living Labs found in the literature include the testing of a technology to detect patient falls in a nursing home (Hyysalo & Hakkarainen, 2014) and the observation of user interaction with feedback technology in their own residences (Ståhlbröst, 2012).

Purpose-built Living labs are specifically built to become a place for prototyping and testing new materials and technologies. The HSB Living Lab in Sweden is an example of this typology. It consists of student apartments designed specifically for testing new concepts and monitoring their adoption by users (Baedeker et al., 2014).

Urban Living Labs have the same intent as embedded Living Labs, but at a larger scale. Innovations have been tested in villages (Chen et al., 2016), residential precincts or recreation centres (Makarainen-Suni, 2016).

Community-based Living Labs do not necessarily have a defined physical boundary. Whilst co-creation workshops and prototype development might occur in a specific location, such as universities or community centres, innovations are tested by users in a variety of settings. It is common for this type of Living Lab to create social innovation (Gasco, 2017; Luccini & Angehrn, 2016) or ICT products such as software (García-Guzmán et al., 2013) and

knowledge exchange platforms (Baltes & Gard, 2016). This is the most common Living Lab typology found in this review, with 42% of case studies fitting this description.

Finally, the fifth type of Living Labs encountered are virtual Living Labs. The activities in this type of Living Lab are entirely through virtual platforms, fostering international collaboration and experimentation (Nikolov & Antonova, 2012; Tang & Hämäläinen, 2012).

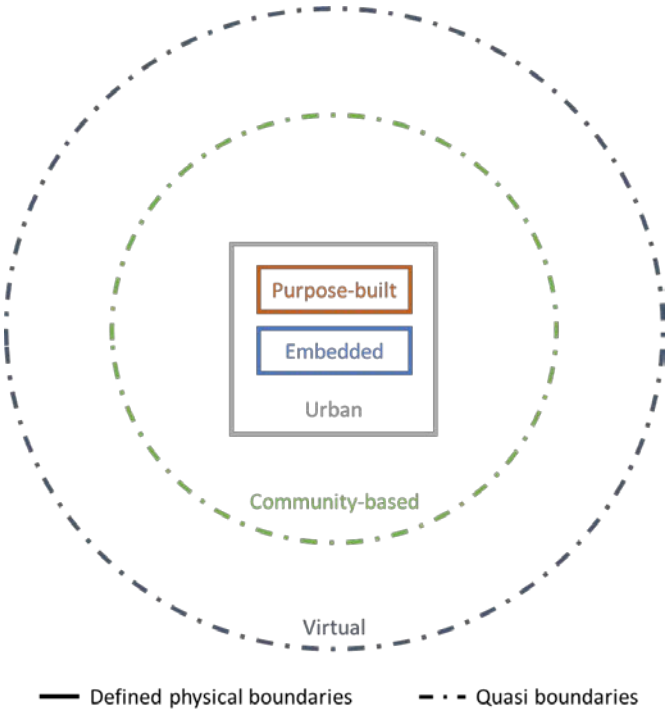

Figure 7. Living Lab typologies with spatial boundaries and quasi-boundaries

Articles were also classified into six themes according to their primary research objectives and contributions (Figure 8). The most prevalent theme was collaboration, and provides a description of the interaction between stakeholders, collaboration tools and the involvement of stakeholders at the early stages of the Living Lab process. Several articles described the Living Lab process, explaining the different steps adopted in real case studies. These articles covered a range of topics and their main objective was to reveal results and lessons learnt from specific projects. The evaluation of the Living Labs impacts was also discussed in nine articles in which authors proposed methods to assess innovation outcomes and the effectiveness of Living Labs as compared to non-Living Lab processes. The stakeholder category includes articles discussing the roles of different key stakeholders in the Living Lab process including motivations and contributions. Several articles in this group focus exclusively on the role of users. Business models for Living Labs were discussed in six articles; however, not all of them mentioned the last phase of the Living Labs process, which is successful commercialisation. Only five articles focused exclusively on this topic, demonstrating that there is a gap in the literature. Whilst the ideation and co-creation phases of Living Labs are well discussed and analysed, the venturing stage of the process remains relatively unexplored as this step is usually carried out by private institutions or entrepreneurs and does not necessarily involve researchers directly.

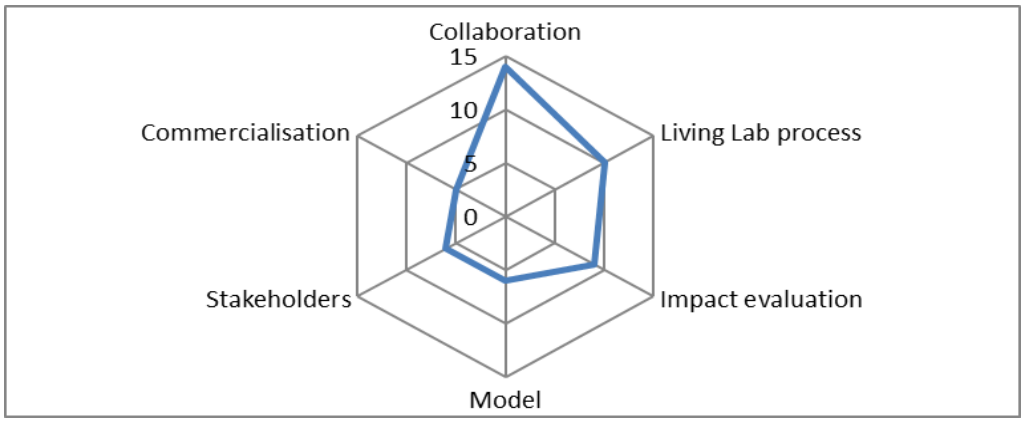

Figure 8. Article classification into six themes according to their main research objectives

Results Summary and Discussion

This section will summarize and discuss five of the major themes presented above: stakeholders, collaboration, evaluation, commercialisation and business model. Lessons learnt and challenges identified in the case studies discussing the Living Lab process are incorporated into the five themes as subjects overlap.

Living Labs stakeholders

Living Labs are based on the co-creation and collaboration between multiple stakeholders, including academia, government, private institutions and users. Accordingly, the success of innovation in Living Labs is dependent on the stakeholder network, the way it functions and on individual roles and expertise (Leminen & Westerlund, 2012).

Leminen and Westerlund (2012) classify stakeholders into providers, users, utilisers and enablers according to their roles in the Living Lab. Providers are usually private companies looking to develop new products; users are potential clients; utilisers are seeking to learn best practices and outsource their knowledge; and finally enablers support Living Labs with required resources (Leminen & Westerlund, 2012). Nystrom et al. (2014), on the other hand, identified seventeen roles in Living Labs, all of them contributing to the development of innovation in a unique way. A commonality of these roles is that they are ambidextrous, reciprocal, temporal and multiple (Nystrom et al., 2014). Ambidexterity refers to actors that can both create roles as well as take roles. The example provided by Nystrom et al. (2014) is users who help both in the development of products and their validation. Reciprocity refers to active participants who can redefine their roles in the Living Lab, create roles for newcomers according to their skills and change positions as new goals arise. Temporality means that responsibilities are temporary, changing and adapting according to variations in the network. Finally, multiplicity means that stakeholders usually perform more than one role at once.

Users are considered as the most important actors in the Living Lab network as they provide unique insight into needs and innovation outcomes. Distinct user typologies have been identified in the literature based on their innovation adoption rate (Schuurman et al., 2010b). According to Schuurman et al. (2010b), the different types of users should be involved at different stages of the Living Lab lifecycle, simulating real-life innovation diffusion. Moreover, user groups need to be a close representation of the target group and have the required skills to participate in the co-creation process (Svensson et al., 2010). However, they

also need to be heterogeneous enough to provide different perspectives on the innovation at hand. Early adopters should be included at the initial stages of the process as they are more inclined towards innovation and more motivated to co-creation participation (Schuurman et al., 2010a; Schuurman et al., 2010b). Pragmatists (early majority) and power users (advanced ICT users), on the other hand, are more suited to involvement at the testing stage of the Living Lab (Schuurman et al., 2010b). However, some dedicated long-term users should also take part in the whole Living Lab lifecycle. Keeping them motivated, in contrast, could be a challenge and some authors suggest that a monetary compensation might be required (Svensson et al., 2010).

Private sector involvement in Living Labs is a less discussed topic. Businesses may perceive Living Labs as a way of accessing open innovation for problem-solving and reaching commercialisation at a faster rate (Lapointe & Guimont, 2015). Private companies, especially small and medium enterprises (SMEs) and entrepreneurs, can become more competitive as they gain access to resources that they would not have been able to obtain otherwise (Schaffers & Santoro, 2016). However, involving businesses in the Living Lab process can be a challenge. Obstacles include intellectual property control, resistance to change organizational practices, lack of time and financial resources and the fear of financial cuts to the company research and development department (Lapointe & Guimont, 2015).

Stakeholders have different interests and do not necessarily engage in Living Labs in the long term. It is therefore important to understand individual motivations and find synergies between the different actors and the Living Lab. The latter needs to be flexible to adapt to changes as they arise while maintaining stability to ensure that knowledge generated through the Living Lab is kept within the network (Leminen & Westerlund, 2012). This might be achieved through maintaining openness between actors, documenting processes, creating policies and guidelines and ensuring that users feel empowered (Leminen & Westerlund, 2012).

Stakeholder collaboration

As discussed above, Living Lab stakeholders have different motivations and agendas. However, Living Labs activities are dependent on successful long-term partnerships and collaboration. These should be coordinated by experts, especially during the front-end of the innovation process which is usually uncertain and may lack clarity for stakeholders (Bendavid & Bourgault, 2010). The mediating role between users and private companies is often enabled by researchers (Makarainen-Suni, 2016; Schuurman et al., 2016a), but Living labs can also be utilizer-driven, enabler-driven or user-driven; and the person(s) who assumes the coordinating role will likely influence the outcomes (Leminen et al., 2016). The coordination responsibility, however, is not always defined, which can generate confusion (Lund & Juujärvi, 2015). Project coordinators are also not usually fully dedicated to the Living Lab, which can limit communication and delay feedback loops (Turgut & Katzy, 2012). Research has shown that one of the main challenges in Living Labs is related to inadequate or irregular communication between partners, especially when collaborators are international (Turgut & Katzy, 2012). Developing good communication and ensuring that different organization cultures are recognised and respected is crucial (Burbridge et al., 2017).

Successful collaborations start at the ideation phase of the Living Lab with match-making of stakeholders (Katzy & Bucker, 2015) and a process for understanding participant's goals and expectations (Bendavid & Bourgault, 2010; Juujarvi & Lund, 2016; Schuurman et al., 2016a). Win-win strategies should be sought after to prevent competition and conflict of interests between stakeholders (García-Guzmán et al., 2013; Guzmán et al., 2013). This phase is considered by some as the most important stage of the innovation process, having also been termed as the *preject* (Juujarvi & Lund, 2016).

Engaging utilizers and users has proven challenging in some Living Labs, with trust being a major obstacle (Guzman et al., 2008; Schuurman et al., 2016a). At the rural Homokháti Living Lab, collaborations were initially established with existing farmer cooperatives (Guzman et al., 2008). User numbers grew at later stages when the Living Lab became well-known and trustworthy. According to Johansson and Snis (2011), building trust is a key element in the co-creation process, which can be attained through perspective making and taking in group activities. A series of community workshops with dedicated facilitators is often the chosen method used to build these relationships (Johansson & Snis, 2011; Juujarvi & Lund, 2016). At the early stages of the process, workshops are also useful to identify individual goals, roles and expertise as well as to share both personal and expert knowledge (Juujarvi & Lund, 2016).

Virtual platforms are also commonly employed as collaboration vehicles as they can enable international co-creation and open innovation in addition to diminishing engagement costs (Molinari, 2011; Mulvenna et al., 2011; Nikolov & Antonova, 2012; Santoro & Conte, 2016; Schaffers et al., 2009). These platforms are often combined with face-to-face activities for continuous offline collaboration as well as a tool to share knowledge and information between stakeholders (Guzman et al., 2008; Luccini & Angehrn, 2016). These virtual platforms can connect people through video conferencing, chats and discussion forums (Luccini & Angehrn, 2016). A Connection Game has also been trialled, in which people are profiled and matched up according to their mutual interests (Luccini & Angehrn, 2016). The C@R project, which consists of a network of rural Living Labs in seven countries, also deployed a common platform for the sharing of services and tools between all the seven Living Labs as well as a shared library and catalogue of business processes (Schaffers et al., 2009).

Online platforms have also been suggested for crowdsourcing as this is an effective and inexpensive way to generate collaboration through all stages of the Living Lab lifecycle: ideation, prototyping, testing and commercialisation (Figure 1) with the potential for crowdfunding (Ståhlbröst & Lassinantti, 2015).

Commercialisation

The commercialisation stage of Living Labs is not satisfactorily discussed in the literature as this phase is carried out by private institutions, when researchers are often no longer involved. However, successful commercialisation is the main purpose of industry and understanding commercialisation would not only help attract business partners but also improve product development. Rits et al. (2015) even suggest that Living Labs should be used to test the product business models to better understand value creation, distribution, consumption and value capture.

In fact, disregarding innovation commercialisation in the real world could lead to innovation failure, as the political context, for instance, might be overlooked (Van Stijn et al., 2009). The Beer Living Lab (Van Stijn et al., 2009) developed an electronic system to reduce fraud associated with the beer trade in European countries. Whilst regulations were carefully considered during the product development stage, legislation and politics were still the main barrier for product adoption. Attempts to overcome these challenges involved interacting with a much larger network of actors, such as European law makers and industry associations in several EU member states (Van Stijn et al., 2009).

One body of research indicates that rather than acting in the pre-commercialisation phase, Living Labs could perform the role of business incubators and become more actively involved in the commercialisation process (Baltes & Gard, 2016; Carayannis & Dubina, 2014; Schaffers & Santoro, 2016). In this case, potential entrepreneurs (e.g. researchers, students or lead users) could become a partner in the innovation process and develop a start-up with the project outcomes, reducing associated risks. This type of Living Lab has been defined as a Microlevel Living Lab, where the focus is on developing individual businesses rather than products alone (Baltes & Gard, 2016). Stimulating the involvement of SMEs in Living Labs is also mentioned as one of the most effective ways for new technology to be transformed into business ideas and drive regional innovation (Schaffers & Santoro, 2016).

Innovation requirements and evaluation

Innovation is the primary objective of Living Labs and understanding the requirements to achieve it and the effectiveness of the innovation process has been the subject of nine articles in this review.

Leminen and Westerlund (2017) describe four different types of Living Labs according to their innovation process and utilised tools: linearizers, iterators, mass customizers and tailors. These categories of Living Labs are based on whether their innovation process is linear or iterative and whether they use standardized or customized tools. A linear innovation process, such as the one described in Figure 1, has distinct phases that have little interaction between them. Iterative processes, on the other hand, are circular and characterized by a repetition of phases (Figure 9). Living Labs that achieve the highest levels of innovation (radical innovation), are termed tailors, which use customized tools in an iterative process, while the other three categories can only achieve incremental innovation due to the use of less sophisticated models and tools (Leminen & Westerlund, 2017).

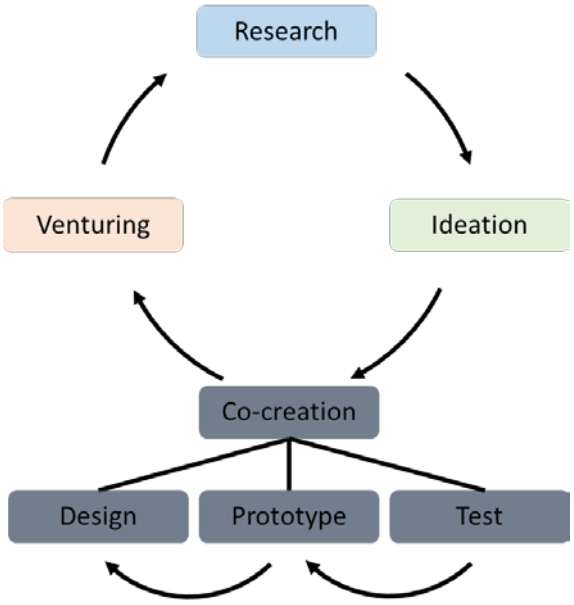

Figure 9. Iterative Living Lab processes

According to Leminen et al. (2016) the network configuration of stakeholders and the coordinating partner can also exert a major influence on the development of innovations. Distributed multiplex network structures, that is, structures where partners do not exert control over one another, tend to support joint innovation as well as the sharing of knowledge and resources (Leminen et al., 2016). This type of collaboration configuration supports radical innovation, while centralised and decentralised structures usually lead to incremental innovation. Moreover, utilizer-driven and provider-driven coordination are also more likely to support radical innovation as they are less constrained by resources and time as compared to user-driven and enabler-driven coordinators (Leminen et al., 2016).

Whilst Living Labs have become a common approach to creating open innovation, it is argued that their effectiveness and merits have not been thoroughly verified. Hyysalo and Hakkarainen (2014) compared two similar innovations that were carried out using different methodologies; one of them used a Living Lab approach while the other was carried out by a start-up company. Results revealed that both innovations relied on collaboration with users in real-life settings to achieve a successful outcome. In the Living Lab, however, the stakeholders were willing to engage in collaboration from the start, which accelerated the innovation process. Schuurman et al. (2016b) also identified that the Living Lab setup and the use of real-life settings contribute to user engagement, ultimately influencing product design and accelerating innovation. Moreover, it has been argued that projects following all the stages of the Living Lab lifecycle are less likely to fail (Schuurman et al., 2016b).

Santoro and Conte (2016) suggest that Living Labs should be evaluated based on the number of stakeholders involved (SMEs, citizens, venture capitalists and users), the amount of funds generated for continued operation of the Living lab and the number of innovation outcomes. Nonetheless, Living Labs can have different objectives that do not necessarily involve product commercialisation. With that in mind, Ståhlbröst (2012) proposes the evaluation of the impact of Living Labs not only from an innovation outcome, but also from a process point of view. It was posited that the following aspects should be assessed: the value generated for the stakeholders; the sustainability of both the Living Lab operations and the

product; the influence of users in the innovation outcomes; the realistic setting for the testing of innovation; and the openness of the collaboration, which should facilitate knowledge inflow. Similarly, García et al. (2009) suggest that the evaluation of Living Labs should consider social impacts as well as the measurement of results against stakeholders goals. To meet this requirement it is important to implement instruments to measure results and capture needs at different phases of the process (Badii et al., 2011). Meanwhile, the C@R Living Lab project reports success based on improving the quality of life in rural environments through influencing policy and incentivizing local entrepreneurship and competitiveness (Schaffers et al., 2009).

Business models

Living Labs do not tend to have strong business models (Mulvenna et al., 2010). The models usually experiment and evolve through the Living Lab lifecycle. The long term sustainability of Living Labs is also not usually considered until after the Living Lab structure has been set up (García-Guzmán et al., 2013). Financial self-sufficiency is a major challenge (Katzy, 2012; Krawczyk, 2013).

Burbridge et al. (2017) identified three types of Living Lab business model based on their funding structure. One type involved the establishment of long term business partnerships at the early stages of the process and considered options for long term funding and revenues (HSB Living Lab and SusLab NRW). For instance, the HSB Living Lab (a purpose-built Living Lab consisting of student accommodation) has a ten-year binding agreement between the utilisers (researchers) and providers (business) (Burbridge et al., 2017). Moreover, partnerships were also established between ten other business partners who made a financial commitment to the Living Lab. Income is also generated from the students who rent the apartments. Another business model was a demonstration project (SusLab Living Lab), which consists of a facility that is lent to interested parties to carry out research (Burbridge et al., 2017). While no income is generated, the borrowers are in charge of maintaining the facility. The third business model identified was sponsorship (the Concept House at TU Delft), that is, the Living Lab is funded by public institutions (Burbridge et al., 2017). This is the most common business model found in the literature. However, governments usually have a limited budget and timeframe and Living Labs struggle to complete product prototype or achieve real-life experimentation (Gasco, 2017).

Living Labs that continue past the duration of the public sponsorship usually seek funding from the private sector and eventually aim to become self-funded (Guzman et al., 2008). Grezes et al. (2013) suggest licensing, micro-franchises, pay-per-service, infopreneurs and events fora as ways to generate revenues in African Living Labs after the depletion of public funds. The utilization of Living Labs as business incubators for small, micro and medium enterprises (SMMEs) has also been considered (Schaffers et al., 2016). Mulvenna et al. (2010) also suggest that innovative financial models such as HackFwd and Y-Combinator can be incorporated into Living Labs to complement their strengths. These financial models provide staged funds and support to entrepreneurs in exchange for a share of their intellectual property.

The Excellence Business Model proposed by Katzy (2012) suggests that Living Labs should receive investment from venture capitalists, business angels or investors looking for investment ideas. Investors would benefit from not having to search the market for innovative

products and Living Labs would benefit from obtaining funds before prototype completion and potentially obtain shares in a future venture. This model, however, requires Living Labs to foster entrepreneurship early in the process as suggested in other research (Salminen & Konsti-Laakso, 2016; Schaffers et al., 2016; Schaffers & Santoro, 2016).

While business models for Living Labs need to carefully consider context and individual stakeholder goals, current research seems to agree that commercialisation enables the economic sustainability of a Living Lab. Commercialisation, in turn, requires the involvement of SMMEs as well as the establishment of strong business partnerships early in the Living Lab lifecycle. Figure 10 summarises the Living Lab engagement process, including essential actors and expected outcomes at each stage, both of which are vital elements in the development of sustainable business models.

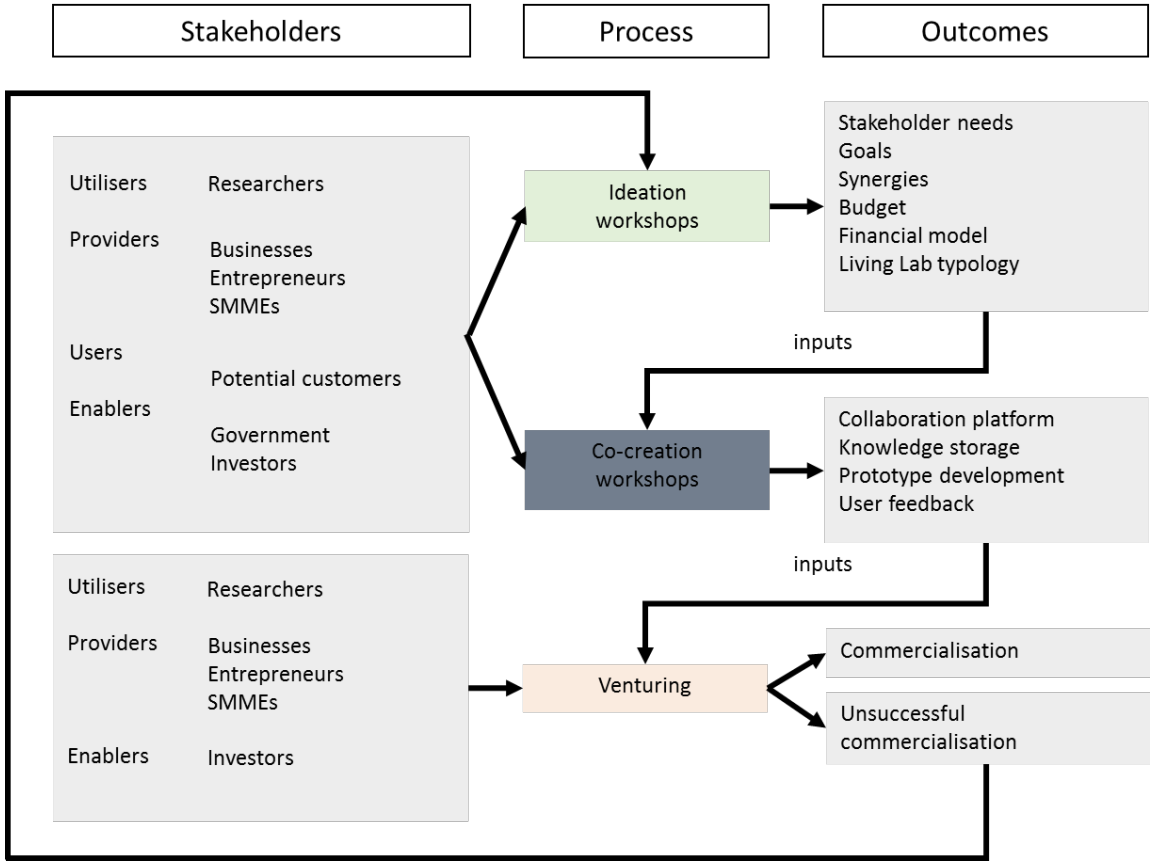

Figure 10. Living Lab engagement process, stakeholder engagement and expected outcomes

Conclusion

The SLR of 50 articles in the topic of Living Labs business models and commercialisation revealed that the success and longevity of Living Labs is centred on strong partnerships that should be established during the pre-project and maintained through good communication and transparent processes during the duration of the Living Lab. These collaborations, however, need to foster win-win scenarios considering all the stakeholders goals and interests. The relationship format should be one of a network, where all partners, including users, have the same level of engagement and influence. Moreover, the network needs to be flexible enough to adapt to changes while also storing knowledge.

The most important aspect to ensure the sustainability of Living Labs, however, is arguably the venturing, or commercialisation, phase of the process. Most Living Labs are currently initiated by public bodies and researchers; however, self-sufficiency depends on the generation of revenues, which in turn relies on the involvement of businesses that will continue the innovation commercialisation process. While established businesses may not require support for research and development, SMEs and entrepreneurs can largely benefit from Living Labs as they gain access to resources and information in addition to minimizing their risks. Crowdfunding, venture capitalists or angel investors may be attracted to provide funding for prototype development and commercialisation.

The commercialisation of Living Labs products and services can benefit not only the research community but also foster local economic growth as seen in several case studies. While Living Lab research tends to focus on the early stages of the lifecycle, the last stages are equally important. A business model promoting economic sustainability can add value to Living labs which will ultimately help attract and retain business partners.

The last stages of the Living Lab lifecycle have not been extensively discussed in the academic literature as pointed out in this review. The conclusions in this article are based uniquely in the publications obtained through the SLR methodology and restricted peer-reviewed literature; which constitutes a limitation of this review. It is recommended that the topic is further researched with the use of other methods such as a narrative literature review, including non-academic publications.

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Appendix 3. Workshop invitation and list of delegates for Living Labs business model

Invitation

A special invitation to a workshop on

The development of a business model for the CRC LCL Living Labs network

Date and time: Tuesday 19th September 2017, 9-12, morning tea and light lunch provided
Place: UNSW CBD campus, Level 6, 1 O'Connell Street
Organisation: CRC Low Carbon Living with professor Greg Morrison, Christine Eon and Saskia Pickles

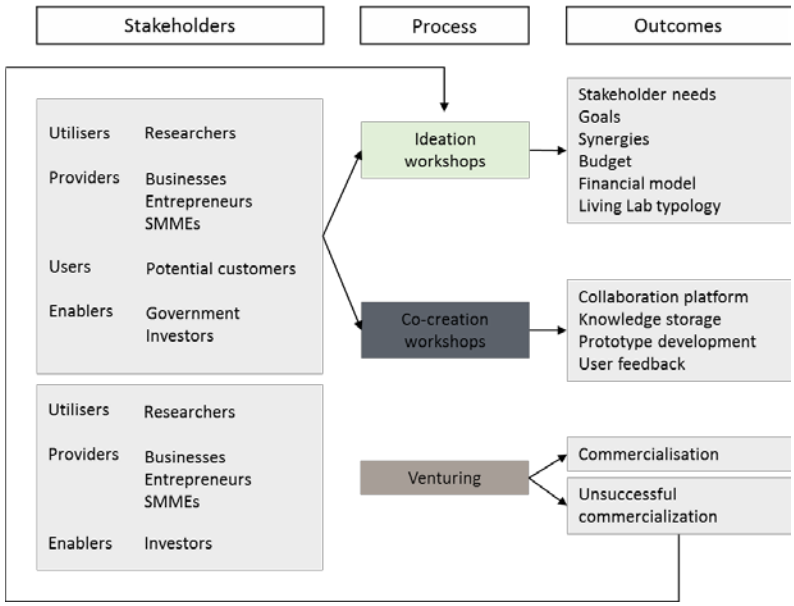
A Living Lab is a contemporary place and space for innovation and the development of Living Labs has become an integral element in the CRC for Low Carbon Living.

If you join us for this meeting then you will:

- Be a part of developing the 17 pan-Australian Living Labs into a sustainable commercial venture.
- Co-create an open innovation network with other motivated professionals in business, investment, research, start-ups and Government.
- Be a part of the next generation of Living Labs.

The CRC LCL Living Labs are currently being managed by national universities in collaboration with the CRC LCL which provides financial and human resources for their coordination and maintenance. This is the most common type of business model globally, however, it has proven a challenging business model as the Living Labs usually struggle to continue their activities past the duration of the sponsorship.

Living Labs tend to act in the pre-commercialization phase of the innovation process, but it is their capacity to accelerate innovation and develop market-ready products that make them stand-out and generate value. Research suggests that Living Labs should be more actively involved in commercialization by attracting small, micro and medium enterprises (SMMEs) or entrepreneurs at the early stages of the Living Lab lifecycle, acting as a business incubator (see figure below).



The aim of this workshop with selected researchers, potential investors and businesses is to:

- understand innovation diffusion for the outcomes of the Living Labs
- discover investor and business needs for future Living Labs
- identify the appetite of potential investors in Living Labs for prototype development, testing and commercialization

Please reply to this invitation to Professor Greg Morrison: greg.morrison@curtin.edu.au

List of delegates at the workshop

Greg Morrison, Curtin University

Christine Eon, Curtin University

Saskia Pickles, Curtin University

Stephen Summerheyes, CRC LCL

Stephen White, CRC LCL and CSIRO

Paul Cooper, University of Wollongong

Piers Grove, EnergyLab

Chris Lee, Climate-KIC Australia

Ben Waters, Presync

Hudson Worsley, Presync

Brett Pollard, Hassell

Jorge Chapa, Green Building Council Australia

James McGregor, Bluetribe

Ian Dixon, AECOM

Jesse Clarke, CSR

Yoshihisa Kashima, University of Melbourne

Vanessa Rauland, Curtin University

Katherine Featherstone, Stockland