



THE UNIVERSITY
of EDINBURGH

Embedding a Living Lab approach at the University of Edinburgh

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Executive Summary

Treating the University as a Living Lab [LL] involves using the University's research capabilities to solve sustainability issues relating to its infrastructure and practices. The LL in the university context fosters applied research and education by using the campus to test real-time sustainability solutions, offering opportunities to all university stakeholders to turn theory into practice, and enabling students to achieve greater engagement with their study material and a more well-rounded educational experience (International Alliance of Research Universities 2014). The University of Edinburgh's Department for Social Responsibility and Sustainability has already begun collaborating on some initiatives that reflect the LL model, and some academics in the University have established an Edinburgh Living Lab. This project has been carried out to explore the potential for developing this work further. Embedding the LL culture at the University would be justified by evidence offered from other universities demonstrating its contribution to reducing carbon emissions and to improving social responsibility performance. The approach is also justified by a rise in students seeking more exciting approaches to knowledge delivery.

Research was conducted between April and June 2015 to assess approaches to LL with sustainability goals in universities, and to highlight interest and opportunities for developing this approach further at the University of Edinburgh. Data were collected through a literature and document review, fifteen interviews, one focus group and three questionnaires filled in by LL practitioners in other universities. This report comprises four subsections: LL Theory, LL Practice, LL at the University of Edinburgh and Recommendations.

The LL concept emerged in the early 2000s and has been credited to William J. Mitchell of the Massachusetts Institute of Technology (van Geenhuizen 2013) who proposed moving various types of research from laboratories to *in vivo* settings. Since then, the concept has received endorsement from the European Commission and has been placed within the Innovation Europe Common Strategic Framework, and has been embedded within the organisational structure of various businesses. An increasing number of organically developing LL resulted in the establishment of a European Network of Living Labs. Prestigious academic institutions (e.g. Harvard, Yale, Cambridge) have adopted this concept within their strategy for sustainability. Definitions of LL vary amongst practitioners depending on the environment that the concept is embedded in and the desired outcome/innovation. Furthermore there are varieties of tools and methodologies that could be chosen to deliver LL projects, including field experiments or context mapping.

LL was a focus point of International Sustainable Campus Network Symposium and has been recognised within the Sustainable Campus Charter (to which UoE is a signatory) principles. It has been highlighted that universities have the right set of characteristics to make them qualified to be a LL because they operate as businesses / organisations able to make decisions about their own operations and land, and they carry out research. Three university LL case studies are expanded upon, meeting and setting challenging emissions reduction targets, greater sustainability performance, increased knowledge exchange and cross-faculty projects as key benefits from embedding this approach within the institutional culture.

Research conducted at the University of Edinburgh revealed that to most of the respondents LL was a new concept that they have never heard of before and only a small number of research participants were fully aware of the definition and benefits the LL approach could bring to the University. Once the concept had been explained to those who were not familiar with it, the majority of staff and all students interviewed were in favour of implementing LL within the University. In the interviews, the LL approach was described by operations staff as *'a great tool and a perfect example of what students could get involved with'*. An academic said that *'A LL would be good because it is exactly what is missing in our current structure'* and a student said *'LL would be not only be beneficial but are essential for what universities should stand for. That's what we should be calling education'*.

A number of project reflecting the LL concept already exist at the University, including Edinburgh Living Lab. Those could be brought together and under a unified framework that would allow further development. Interviewees proposed a number of project ideas that could be expanded upon in the future, those related to social (e.g. fair trade, working hours) and environmental sustainability (building insulation or energy

consumption). Furthermore respondents described the University as a place where communication between academics and operation staff is limited and LL are envisaged as a tool to bridge those gaps and allow cross-faculty collaboration. Students were very supportive of the concept and portrayed it as a chance for gaining practical skills, to enhance their employability and make the curricula more relevant. It has been stated that LL approach should be embedded within the academic activities and that it will compliment the emerging Learning and Teaching Vision.

It has not been fully agreed what role should the SRS Department take in establishing a LL, however leadership is needed to initiate further projects on SRS-related themes, and it seems most appropriate for the department to play a facilitation role. It was highlighted that a LL should not be branded as 'green' so as not to limit its outreach. It was stated that the LL should have an online presence. The main obstacles involved in establishing LL were time and financial commitment needed.

Recommendations in this report include further mapping of the key activities and expertise around sustainability at the campus and utilisation of the already existing databases of University stakeholders. Furthermore, through this research a significant amount of interest has been raised - it is suggested that as a result an event or workshop should be organised. Recommendations then focus on guidelines for identification of coordination and governance, stating that LL will require clear objectives, an online presence, and a framework for agreeing legal issues such as intellectual property rights and data access. The report then explores potential flagship projects, which could include buildings and energy, renewable energy systems, fairness in supply chains or sustainable transport. This is supported by a list of potential financing streams, based on those that have funded other university Living Labs, amongst which are Santander or Horizon 2020. Implementation of those steps should lead to potential institutionalisation of the LL approach within the culture of the University of Edinburgh.

It was expressed that the LL framework should be treated as a tool to enhance the University's reputation, which could attract research funding and create world class studying facilities.

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Abbreviations and Acronyms

EAUC	Environmental Association for Universities and Colleges
ECCI	Edinburgh Centre for Carbon Innovation
ENoLL	European Network of Living Labs
IAD	Institute for Academic Development
ISCN	International Sustainable Campus Network
LL	Living Labs
SRS	Social Responsibility and Sustainability
UBC	University of British Columbia
UoE	University of Edinburgh

1.0 Introduction

Treating the University as a Living Lab [LL] involves using the University's research capabilities to solve sustainability issues relating to its infrastructure and practices. The aims of a LL are to bring together and engage all stakeholders, including researchers, operations staff and students who cooperate to share their resources, knowledge, and expertise to tackle real life problems. It means being able to use the University's infrastructure, combined with available education and research to test, study, and apply the results to solve sustainability issues. A LL encourages collaborations between management and academics to equip students with real-world skills by designing solutions for practical issues. LL have been declared to be the *'new way of doing things that is worth taking notice of'* by the Low Carbon Research Review (Salter & White 2013), and have been gradually adopted as a strategy for sustainability improvements amongst cities, businesses and other establishments.

One of the aims of a university is to provide an excellent education accompanied by an outstanding student experience. As student expectations of the university experience continue to shift, a university must be both proactive and ambitious in order to meet and exceed these. Skills development, building a link between students' passions and academic work, stimulates student interest and provides relevant curricula that align with the students' interests.

Simultaneously, universities are also facing the challenge of exceeding their sustainability performance and meeting their emissions reduction targets in a manner that does not compromise on knowledge delivery and development. In this sense, LL have been defined as a silver bullet solution for academic institutions to achieve both goals.

The Department for Social Responsibility and Sustainability [SRS] has to date collaborated on numerous small-scale projects which reflect the LL concept, such as offering MSc work-based placements examining areas of University practice, and collaborative projects with course leaders. It is recognised that the concept of a LL is beginning to develop in different areas within the University, in addition to the work already done by the SRS department and its partners. For example an [Edinburgh Living Lab](#) is coordinated by James Stewart (School of Social and Political Science), Ewan Klein (School of Informatics) and Arno Verhoeven (Edinburgh College of Art). Therefore there is potential for exploring ways of better highlighting and linking these initiatives, and developing the concept further.

Reflecting the University's commitment to sustainability in the current Strategic Plan to *making 'a significant, sustainable and socially responsible contribution'* and considering the [emerging vision for teaching and learning](#) this report was written to evaluate the potential of developing the LL into a more substantial body of work as part of the University of Edinburgh's [UoE] strategy for social responsibility and sustainability.

1.1 Rationale

The reality of the 21st century is that students are seeking more exciting approaches to knowledge delivery. In 2011 NUS reported that 75% of students surveyed across the country said that the main purpose of university was to provide them with opportunities for the future (NUS/HSBC 2011). The LL in this sense could enhance the academic experience and provide an opportunity for the students to choose a more practical approach to learning. The University could also use it as a tool to improve the student experience satisfaction survey and strengthen its links with other prestigious academic institutions across the country.

According to the University of Edinburgh's Climate Action Plan, the carbon reduction target of around 20,000 tonnes per annum by 2020 from the baseline of 76,000 tonnes in 2007 has been set (Macgregor & Woods 2013). This ambitious target might be not feasible given the planned £20 million capital investment for the estates development over the next five years. Therefore there is a clear need for decoupling of emissions from growth and at a much faster pace. UoE, although it is slowly decreasing its relative carbon emissions year by year, is not meeting its targeted reduction (Social Responsibility and Sustainability 2014), and requires more engagement from the entire community to help combat this issue. In addition, the University has great ambitions to improve its social responsibility performance. In this sense the LL could be a cost effective and self-enforcing tool for tackling all the wicked problems at once, while providing benefits to both the student and staff community and complimenting the work already carried out by SRS.

1.2 Outline of the Report

This report highlights the aims and objectives of the study, details the methodology and expands on its limitations. It is then divided in the following subsections:

1. **LL theory** - where it evaluates and explains the definition of LL, its history, benefits and how has it been documented in literature and various publications.
2. **LL practice** - where it presents examples of how LL have been adopted within the strategies of prestigious academic institutions and how it has impacted on their sustainability performance.
3. **LL at the UoE** - where it presents research findings, explains and outlines key themes and projects currently reflecting LL concept at the UoE.
4. **LL recommendations** - this subsection draws on the research findings to reflect and provide ideas for how LL could be developed at UoE.

1.3 Key Objectives

1. To identify theories and concepts that frame the LL concept
2. To provide a synthesis of the literature about LL
3. To provide an overview of how other universities at a national and international level are implementing the LL concept

4. To identify how the concept of Living Labs fits in with the sustainability agenda
5. To identify how UoE could implement the concept on campus
6. To outline key initiatives on campus that fit in with the concept of LL
7. To identify key gaps at the UoE where the concept could be embedded
8. To provide recommendations for developing the LL at UoE

1.4 Methodology

The UoE's Department of SRS has begun some work reflecting the concept of viewing the University as a LL. Drawing from past successes of projects undertaken, and seeing the approach successfully implemented by some other universities, it was decided to scope how the LL at Edinburgh could be developed further. After SRS's call for expression of interest, MSc Carbon Management student Patrycja Graczyk was contracted to carry out research work between April and June 2015.

Research began with the literature review that included academic publications, methodological handbooks, guidelines for universities and reports from universities currently operating LL.

Primary research involved fifteen university staff members (three operations, six professional/support staff, six academics) amongst which fourteen respondents took part in a face-to-face interview and one was interviewed via email. The semi structured interviews were around 40 minutes long and on some occasions were followed up with the additional questions. Furthermore a group of four students participated in a focus group and one student took part in an email interview. Students were a mixture of undergraduate and MSc cohorts from various academic disciplines.

Some informal conversations with LL practitioners from Edinburgh and Berlin also took place as part of the desktop based research and interviews with stakeholders. This was in order to identify how LL operate in practice, and map the courses and initiatives in various Schools that the approach could potentially be embedded in.

Furthermore a total of three questionnaires were filled in by LL coordinators from other universities, and some of them were followed by a Skype call.

Project review meetings were held once a week with a projects supervisor from the SRS Department during the entire duration of the research project.

1.5 Limitations

There are a growing number of universities adopting the LL approach across the globe, which has made it impossible to fully scope and expand on the strategies and preferable methodologies to generalise which of those may work best at UoE. Given the limited timescale, involvement of more academic institutions in the research was not possible.

The UoE community exceeds 44,000 people; due to time constraints it was impossible to investigate all stakeholders and map out all relevant initiatives that are already taking place.

It was not possible to involve larger numbers of students and run more focus groups to allow greater representation of students' voices in the research findings, due to a limited time resource.

2.0 Living Lab Theory

The wide-ranging field of LL, although currently garnering increased academic attention, is lacking one unified and standardised definition. This has allowed researchers to expand on the concept and come up with different ways to approach it. An overview of concepts and theories around it is set out in this literature review, which has been divided into four sections:

1. History and overview of LL
2. Common and diverging perspectives of LL
3. Common processes and methods used to set up LL
4. How LL could benefit Universities

This section will aim to provide a clear idea of the current state of LL theory and draw attention to key ways in which the concept could be implemented at the University.

2.1 Historical Overview

The concept of the LL is relatively new, having only been introduced in the early 2000's (van Geenhuizen 2013). It has been credited to William J. Mitchell of the Massachusetts Institute of Technology, who proposed moving various types of research from laboratories to *in vivo* settings, such as specific buildings, institutions or areas of the city, to enable the monitoring of users' interaction with and responses to the innovation (van Geenhuizen 2013; Svensson et al. 2009). The concept has been fuelled by the idea of the influence of 'lead users' and more specifically of user groups as co-creators of open innovation (Bergvall-kåreborn 2009).

The concept rather quickly got buy in from a variety of prestigious academic institutions, as well as the European Commission who adopted it strategically by placing it within the Innovation Europe Common Strategic Framework and described it as a strong tool that will support increasing levels of innovation in European countries (Dell'Era & Landoni 2014; European Commission 2014). The LL was touted as a silver bullet solution that cities could implement to become 'smarter' and more sustainable in light of emission reduction targets and growing urbanisation levels (Vicini et al. 2012; Folstad 2008). To allow conceptualization, standardisation and international collaboration, a pan-European network of LL has been created and is currently operating under the umbrella of the 'European Network of Living Labs' [ENoLL]. ENoLL is an international non-profit association of benchmarked LL in Europe and across the world. Ever since its establishment the movement has been spreading in waves and ENoLL currently consists of 370

accepted members. The LL was at the heart of the International Sustainable Campus Network (ISCN) Symposium 'Better Campus, Better City' held at the Shanghai 2010 World Expo, has been adopted by the International Alliance of Research Universities and has been recognised by the Environmental Association for Universities and Colleges (EAUC) as a tool for improving sustainability performance. Ever since its establishment, the scope of the LL has been expanding, primarily focusing on ICT tools, however now also integrating other fields such as sustainable energy, health care, social responsibility and safety (Tan et al. 2011).

2.2 Living Labs Definition

LL have been attributed varying terminologies dependent on the author and are defined to be a methodology, an organization, a system, an arena, environment and/or systematic innovation approach (Folstad 2008; Tan et al. 2011; Mulder et al. 2008; Dell'Era & Landoni 2014; Bergvall-kåreborn 2009; Svensson et al. 2009). While there are divergences in definition in the literature, there has been an agreement on the common purpose of the LL being broadly described as an environment in which new solutions are evaluated or validated with all relevant stakeholders to create innovation (Bergvall-kåreborn 2009; Folstad 2008; Evans & Karoven 2011; Vicini et al. 2012; Dell'Era & Landoni 2014; Lin et al. 2012; Lafayette & Ind 2012; Budweg et al. 2011; Molinari 2012). As the discussion around the definition progresses, the key components of the LL have been defined to be:

- ICT & Infrastructure
- Management
- Partners & Users
- Research
- Approach (Marita Holst 2013)

It is worth highlighting the central position of the innovation in that process as Figure 1 presents.



FIGURE 1. LL Components. Source: (Mezzullo 2010)

While there is no one definition of LL, several actors in the field have attempted to create their own definitions (Folstad 2008). Scholars have described the LL as a *user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life context*. Eriksson et.al (2006) and Ballon et.al (2005) defines them as an *experimentation environment in which technology is given shape in a real life context and in which end users are considered co-producers*. Furthermore, Feurstein et.al. (2005) described LL as *a systematic innovation approach in which all stakeholders in a product, service or application participate directly in the development process*.

For the purpose of this research project the following definition will be used:

Living Labs in the university context foster applied research and education by using their campuses to test real-time sustainability solutions, offering opportunities to all university stakeholders to turn theory into practice, to achieve greater engagement with the study material, and a more well-rounded educational experience (International Alliance of Research Universities 2014).

The complexity of the definition derives from the fact that there are many different types of LL environments, such as:

- Research Living Labs focusing on performing research on different aspects of the innovation process.

- Corporate Living Labs that focus on having a physical place where they invite stakeholders (e.g. citizens) to co-create innovations.
- Organizational Living Labs where the members of an organization co-develop innovations.
- Intermediary Living Labs in which different partners are invited to collaboratively innovate in a neutral arena.
- A time limited Living Lab as a support for the innovation process in a project. The Living Lab closes when the project ends. (Marita Holst 2013)

2.3 Living Labs Methodology

Although the use of the term LL amongst international communities is widespread, methods and tools used differ widely (Markopoulos & Rauterberg 2000; Molinari 2012; Dell’Era & Landoni 2014). It has been identified that in the past, the LL approach lacked a standardized reference methodology (Tan et al. 2011; Svensson et al. 2009) and since 2008, when some of the core tools started to be developed, there has been on going work conducted by a variety of stakeholders to establish key frameworks that could be copied and implemented by LL at any level of development (ENoLL 2015; Mulder et al. 2008). The most widely used sources for tools, guidelines and methods are organized and grouped within the knowledge section of the [ENoLL website](#) and have been prepared in conjunction with the Advanced Pilots of Living Labs Operating Networks, Amsterdam Living Lab and the European Institute of Innovation and Technology (ENoLL 2015). Methodologies proposed are outlined in table 1. To gain more in depth information the reader should refer to the [Knowledge Centre](#).

METHODOLOGY	Explanation
<u>Expert Database</u>	Database identifying stakeholders from a specific relevant environment and their expertise, to facilitate connections and support from experienced partners.
<u>Cross-sectional study</u>	Cross-sectional studies involve observation of some subset of a population of items all at the same time.
<u>Ethnography</u>	Methodology based on the idea of studying human behaviors in their real-life context, focuses on gathering empirical data on societies/cultures and consumers/consumption patterns.
<u>Context mapping</u>	Context mapping involves conducting contextual research with users, where tacit knowledge is gained about the context of use of products/services. It aims to inform and inspire design teams, where users and stakeholders actively participate in the design process to ensure a good fit between the design and the use of a product.
<u>Longitudinal study</u>	A longitudinal study involves repeated observations of the same people over (long) periods of time.
<u>Field experiment</u>	A field experiment examines a manipulation or intervention in the real world rather than in a laboratory.
<u>Contextual inquiry</u>	Contextual inquiry involves collecting detailed information about customer work practice by observing and interviewing the user while they actually work.

Table 1. LL methodologies. Source: (ENoLL 2015)

From an academic standpoint, there has not been a significant amount of research conducted evaluating processes of development of LL (Dell’Era & Landoni 2014; Tan et al. 2011). One way of approaching a LL is an action research based in social network theory – testing a stakeholder mapping-based approach to sustainability objectives. One of the most broadly used pieces of literature is the LL methodology handbook. It describes the FormIT methodology, derived from action research. Three theoretical streams that have inspired these methodologies are Soft System Thinking, Appreciative Inquiry and NeedFinding. The FormIT process (presented by figure 2) can be seen as a spiral in which the focus and shape of the design becomes clearer, while the attention of the evaluation broadens from a focus on concept and usability aspects to a holistic view on the use of the system (Marita Holst 2013). However, Environmental Association for Universities and Colleges guidelines stress that the structure and methods selected should be tailored to the institutional framework of the university, but do not expand on any particular methodologies.

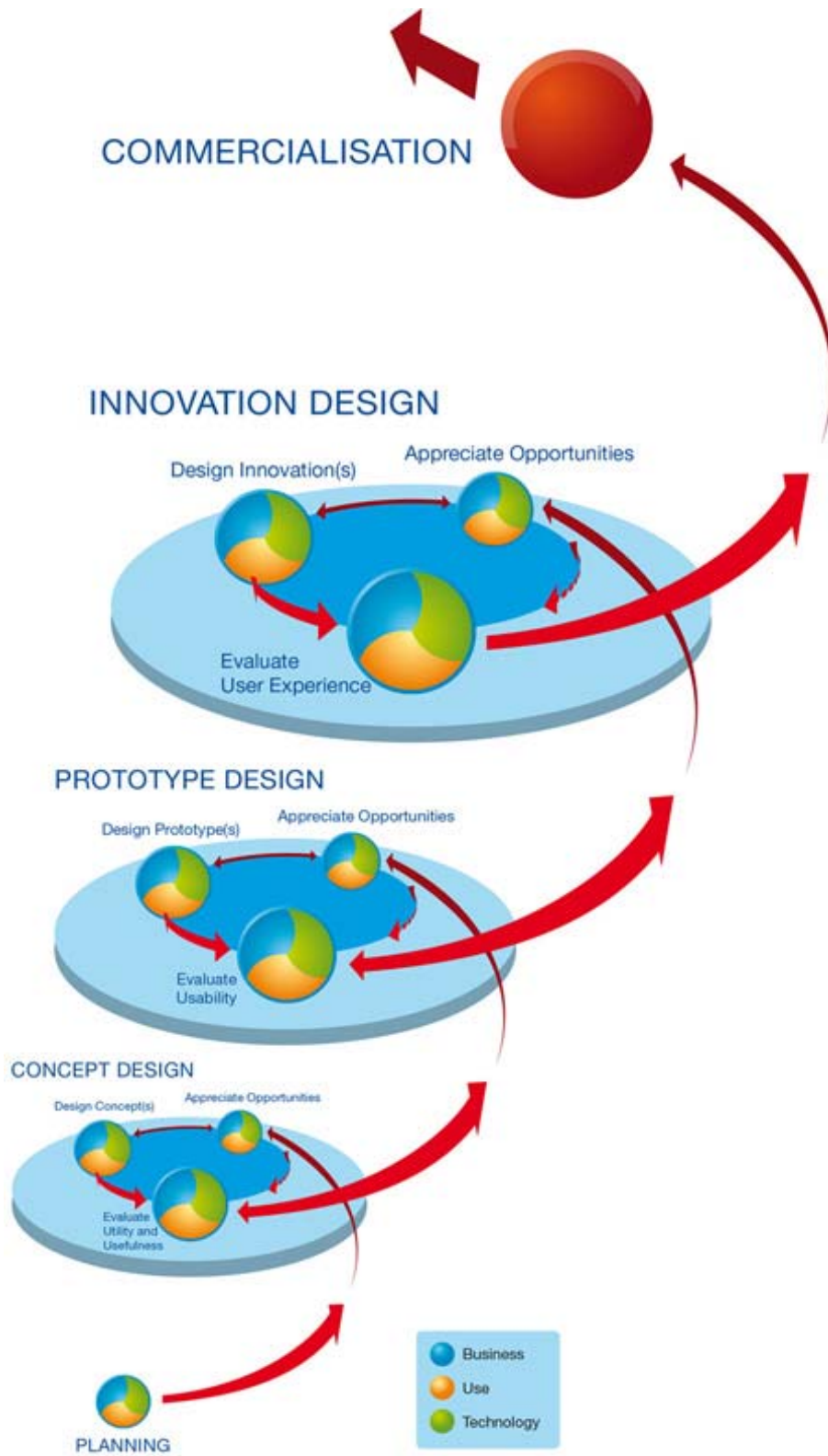


FIGURE 2. FORMIT METHODOLOGY. Source: (Marita Holst 2013)

3.0 Living Labs at the University

Various researchers have evaluated the utilisation of the physical campus space in teaching and learning themes pertaining to sustainability in the past. For example Orr et al. (2004) justified that estate projects have the potential to promote a greater understanding of the challenges universities face when attempting to implement sustainability.

Moreover, pedagogical strategies that promote collaborative learning, and utilise discovery and problem based approaches whilst also challenging individual values and behaviours have been identified as the most appropriate approaches in many cases (Cotton & Winter 2010). In this sense, not only do LL have the potential to engage all stakeholders of the University in this type of collaboration but they can also educate and initiate a shift away from the unilateral perception of sustainability in its environmental sense and expand on its social and economic dimension. LL have been recognised as a tool for sustainability leadership in universities by the IARU (International Alliance of Research Universities 2014).

The Sustainable Campus Charter (to which UoE is a signatory) acknowledges that organizations of research and higher education should recognize the role of sustainability. Principle 3 states: *To align the organization's core mission with sustainable development, facilities, research, and education should be linked to create a 'living laboratory' for sustainability* (UNEP 2013; Global University Leaders Forum 2010).

It has been highlighted that universities have the right set of characteristics to make them qualified to be a LL because:

- they operate as businesses / organisations able to make decisions about their own operations
- they have a public mandate so the longer pay back periods are more acceptable
- Universities conduct research (Robinson et al. 2013)

There are a growing number of guidelines on implementing a LL strategy in campuses, such as the one prepared by [IARU](#) or the one created in partnership of the [American Association of Community Colleges, Sustainability Education and Economic Development, and the Centre for Green Schools](#).

Campuses have been identified as spaces that provide numerous, dynamic sustainability learning opportunities for students across all programs. Some of those are presented in figure 2. The aim of a LL is to join campus facilities and encourage management and academics to equip students with real-world skills. In addition it pushes for institutions to provide a path to meet their sustainability goals (Cohen & Lovell 2014).

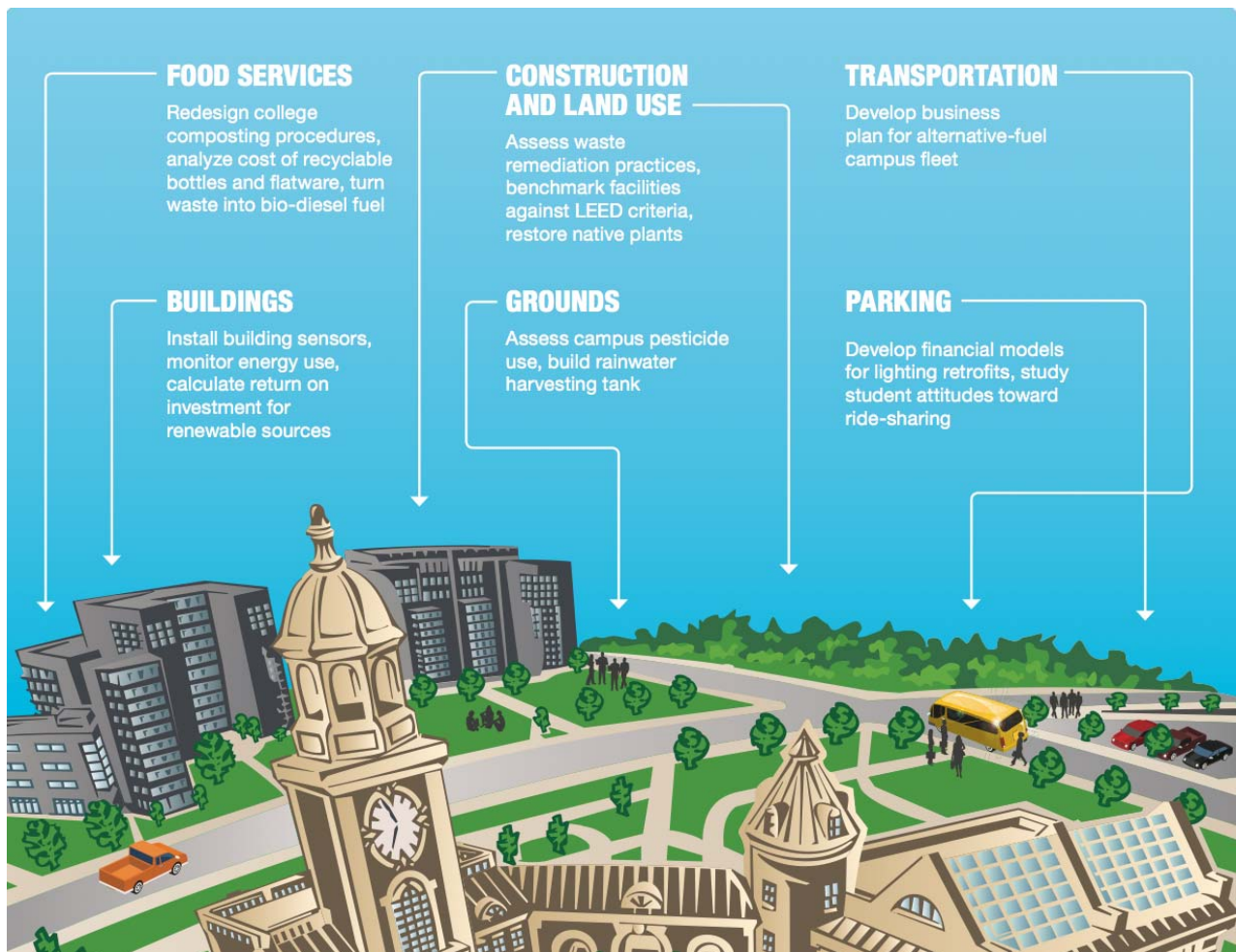


FIGURE 3: LL AT THE CAMPUS. Source:(Salter & White 2013)

There are plenty of successful stories of universities and colleges that have implemented LL within their campuses, which have in turn benefited the student and staff community (Evans & Karoven 2011). This has very often resulted in a reduced carbon footprint of the institution and provision of critical real-world hands-on learning opportunities for students (Cohen & Lovell 2014; Crommenlaan 2012), who can not only benefit through enhancement of their analytical, interpersonal, and technical skills, but most importantly of transferable skills that are desired by employers. LL can also instil in students the desire to think critically about the most daunting and crucial sustainability challenges to better understand all three social, environmental and economic dimensions and to subsequently maximize learning experience. LL in campuses can provide an effective tool to tackle arising issues that universities are facing of decreased allocated budgets, pressure to improve the student experience, aging infrastructure and increasing enrolment (Cohen & Lovell 2014; van Geenhuizen 2013; Soetanto & Geenhuizen 2011).

In a nutshell, LL have been defined as an excellent tool to:

- Facilitate experiential learning and make curricula relevant
- Improve understanding of social responsibility
- Enhance social sustainability performance
- Enhance community engagement across all university stakeholders

- Reduce carbon footprint of the institution
- Use institutional resources efficiently
- Improve university completion (Cohen & Lovell 2014)

Furthermore, LL may allow and support the establishment of forums and supportive environments for innovators across a variety of fields (Budweg et al. 2011) as they plant the desire to seek creative solutions. This can, in turn, strengthen the process of facilitating collective action at universities (Hawk & Romine 2012).

3.1 University- Industry Relationship

LL enable a smoother level of internal communication between academics from various institutes and professional staff, allowing them to embrace the differences in working styles and communication streams. This can be also translated into the university-industry relationships that LL support through an increased mutual understanding of commonalities and differences in values and needs. It has been identified that academic institutions are gradually taking a more direct role in participating in the business world and are getting involved more than ever in contract research commissioned by the business sector (Soetanto & Geenhuizen 2011). LL can provide good opportunities for accelerating knowledge valorisation through user-driven innovation and early customer involvement. In addition, the collaboration of diverse partners (internally at the university and with external players) may produce synergy in learning and can contribute to a more effective valorisation (van Geenhuizen 2013). This may also increase the involvement of local SMEs and allow the creation of possible new models of financing and investment. As well as spreading the financial risks for universities and spin-off firms or other small high-tech firms (Soetanto & Geenhuizen 2011). This approach has been embedded within other universities LL projects, such as University of British Columbia [UBC], which established great links with various industry stakeholders who partially funded some of the initiatives. Those projects will be expanded upon in the latter part of this report.

3.2 Living Labs in Universities – Examples

LL have made their way into the strategies of some of the most prestigious academic institutions across the globe. Some of these universities, although not in a formalised manner, do collaborate and meet to discuss and learn from each other about what works and how to set up LL within their own estates. This can involve national and international level collaboration, for example a Cambridge-Manchester-Luxemburg workshop was held in 2014 to explore on funding options. Three case studies of university led LL are expanded upon in this section, and some of the tangible benefits from various other institutions are presented.

3.2.1 [University of British Columbia \[UBC\]](#)

Description: This university has been acknowledged as one of the institutions that has managed to

introduce the most successful LL. It was created in 2010 with the goal of integrating operational and academic sustainability deeply across the university and to make its campus available as a kind of societal test bed. The LL operates within the UBC's [Sustainability Initiative](#) and has been designed around the four key strands:

- integration with UBC's core academic mandate
- partnership between university and the private, public and NGO sectors
- sound financial use of UBC's infrastructure
- opportunity to transfer knowledge UBC gains into practical, positive action applicable to the wider community

Funding: UBC's LL projects very often have a strong business case and have received funding for the specific projects from amongst others UBC Board of Governors or BC Hydro.

Projects: UBC's projects are based on large scale developments such as the creation of a biomass gasification co-generation plant, constructing outstanding buildings that score the highest standards of sustainability certifications, a Continuous Optimization program in partnership with the local utility energy company where they are going to re-commission and recalibrate energy and water systems in 72 core buildings.

Project Deliverables: Operationally UBC has achieved its Kyoto targets, core academic buildings reduced their carbon footprint by 6% below the 1990 levels, which was decoupled from the 35% growth in space and 48% growth in number of students. UBC continues to challenge its sustainability performance and set the most ambitious climate change goals of any top 40 universities in the world of 67% by 2020 and 100% by 2050 emission reduction targets (Robinson et al. 2013).

3.2.2 [University of Manchester](#)

Description: This relatively new LL was established in February 2013 by a team of five people as a collaboration between academic researchers and the sustainability/estates department. In its initial stage it ran for six months to establish foundations and map sustainability activities and key people to be involved in the process. It furthermore developed a database and website to present its flagship projects. This LL is focused on sustainability and acts as a supporting tool for meeting the 40% carbon reduction target set by the university. It aims to develop the university campus as a site for applied teaching and research around sustainability and low carbon.

Funding: Funding was required to cover staff expenses who did the initial work and for creating the website/database. It was covered through the £40,000 grant from the University of Manchester Research Institute and financial support from the ESPRC for a Knowledge Transfer Feasibility Study. It furthermore secured funding through the European Commission as a part of [Horizon 2020](#) to conduct a specific project.

Projects: Some of the flagship projects established by Manchester were 'I-trees' which by using sensitive monitoring equipment compare the water absorption and cooling rates of different trees and surfaces across the university campus, and a [Triangulum](#) which is a [Horizon 2020](#) project to work on smart cities technology.

Project Deliverables: In Manchester the LL approach has supported increased dialogue between professional and support staff and academics, inclusion of LL ideas into sustainability recommendations for new projects, creation of new applied student projects with support from diverse supervisors, increased knowledge exchange and networking resulting in cross-faculty projects or extension of LL network to other areas (e.g. Manchester Museum Sustainability Summer School).

3.2.3 [University of Cambridge](#)

Description: A LL in Cambridge was established in 2012 after group of students communicated to the university the need for embedding the LL culture within the structure. Initially a two-year project secured three additional years of funding and is outlined to run till at least 2017. It has been established within the Environment and Energy Section at the University of Cambridge within the Estates Management. Project facilitation and delivery is conducted by the LL Coordinator and overseen by the university's Environmental Officer. Outputs of the project are then fed back to Estates Management and wider University stakeholders through the Environment and the Energy Section. Originally, there was a LL Advisory Group however current governance reports directly to the Environmental Strategy Committee at the University. This LL is at a more advanced stage than Manchester's, and has thus outlined strands of action and is functioning as an individual branded unit of the University. It has its own website and promotional material.

Funding: This LL was funded by Santander University charter initially for two years, and has now been extended for an additional three years.

Projects: This LL has witnessed a large number of projects ranging from MSc dissertations to internships and academic credited modules. One of the examples was funded software for a photovoltaic course in the department of Engineering. Students in classrooms were able to model buildings and assess their potential for photovoltaic. This was then fed back to the estates team. Another project featured a student who looked at the freezers in labs to advise on the most cost effective models as well as appropriate maintenance regimes to reduce energy use.

Project Deliverables: Cambridge has been recognised on the national and international level for the LL work that they have been doing, being featured in IARU guidelines and presenting its achievements at conferences. Internally it has contributed to increased awareness around sustainability issues and greater involvement of students supporting the goal of meeting the university's sustainability targets.

3.3.3 Sustainability Successes in other universities

Some of the most noteworthy results and projects from various universities are presented in table 2.

	PROJECT EXAMPLES	OUTCOMES
<u>University of California Santa Barbara</u>	Landscape and Vegetation in the carbon cycle at the campus Evaluation of Campus Sustainability Committee - to evaluate organisational weaknesses and opportunities	<ul style="list-style-type: none"> - mitigation strategy report - 44% reduced hot water use - 16.5% total energy savings - 5.1% reduction of electricity - Sustainable Supply Chain Management report evaluating purchasing decisions
<u>Princeton University</u>	Washington Road restoration project The Grand Challenges Program education for sustainability for everyone Building sustainability specific continuing education courses for facilities employers	<ul style="list-style-type: none"> - 29 academic disciplines involved in educational program of energy challenges - 44 grants awarded sustainability funds for students and staff to work on the LL - Geothermal cooling and heating installed in graduate housing
<u>Tongji University</u>	The Campus Integrated Circuit Card projects - tackling energy consumption in student housing Development of the system for intelligent management of water and electricity	<ul style="list-style-type: none"> - water consumption was reduced of about 3,774 tonnes in bathrooms and hot water use has decreased by 1579.4 tonnes a year - same approach used for the electricity measures – almost 50% decrease of energy consumption

TABLE 2. LL PROJECTS AND RESULTS

3.3.4 Lessons from other universities

LL take different shapes across different institutions, with various areas of focus, however all of the investigated places tackle wide sustainability issues and support emission reduction targets. Therefore well-designed LL programs would contribute to the decreased carbon footprint of the institution. Development of the LL strategy is dependent on the desired outcome, available human resources, levels of interest from different types of staff, courses offered and the challenges that universities are facing. To date, social sustainability projects have not been greatly adopted by universities LL. One of the successful examples of sustainable responsibility projects is University of California Sustainable Supply Chain Management Report prepared by students to support fairness in trade and to revise university’s purchasing decisions.

Through consultations with other LL coordinators it has been highlighted that in depth research of the internal structure of the university and mapping of the key challenges is crucial to establish a framework for

LL. It has been furthermore advised that starting off with the academic projects as a part of dissertations and classroom activities (an initiative UoE has already undertaken) will be the most suitable to engage students and academics. Most tangible effects from LL were observed around the improvements of estates and energy performance.

It has also been stressed that enhanced communication has been observed following the establishment of LL, however breaking through institutional silos was found to be the biggest challenge. This was followed by funding, which in the presented examples is a mixture of internal and external streams.

4.0 Living Labs at the University of Edinburgh

This section presents findings from primary research carried out at the UoE on developing the LL approach. Key constraints and challenges identified are also reflected upon.

4.1 Feedback from Interviews

Interview and focus groups data were analysed to identify the key emerging themes, presented below.

4.1.1 Living Lab Definition

Due to the novelty of the concept, lack of awareness and its complexity, time should be devoted to outline what a LL at the UoE would be. The extent of knowledge about the concept of LL and what it entails in practice varied amongst the respondents. About 50% of them had never heard of it before the time of the interview. Only a small number of research participants were fully aware of the definition and benefits LL could bring to the University. Furthermore a vast majority of people taking part in the project expressed that LL as a concept comes across as vague, confusing and in certain ways misleading of what is it actually trying to capture or achieve. It proved somewhat difficult for many respondents to discuss the concept, although supporting information was provided.

One the other hand, participants who were fully aware of the LL concept described it as a tool to learn by doing, and give ownership to students to work on their own projects. It was on numerous occasions linked with the practical aspect of the projects, constant learning, experimenting and mutual benefits that come from the LL activities for students and all other university stakeholders.

4.1.2 Perception of the LL approach

Once the concept had been explained to those who were not familiar with it, the majority of staff and all students interviewed were in favour of implementing LL within the University.

In the interviews, the LL approach was described by operations staff as *'a great tool and a perfect example of what students could get involved with'*. An academic said that *'A LL would be good because it is exactly what is missing in our current structure'* and a student said *'LL's would be not only be beneficial but are essential for what universities should stand for. That's what we should be calling education'*.

Respondents envisaged a LL as a tool that would provide a platform for tackling university sustainability related problems, enhancing teaching and learning, encouraging multidisciplinary collaboration, bridging gaps in communication and reducing organisational silos. Operations staff highlighted that a LL could support them in everyday operations to expand their outreach, to gain a better understanding of the complex issues of the University's infrastructure and advise them on how to tackle those problems. It was also emphasized that a LL would provide a channel for making people aware of and improving engagement in research opportunities and on going projects that aim to improve university practices

4.1.3 Existing projects at the University that reflect the concept

A number of projects were identified that reflect LL, yet those are very often disconnected, such as initiatives around sustainable food or smaller projects focusing on tackling building efficiency. There is a visible potential for bringing all these together under a unified framework that would include the already existing Edinburgh Living Lab and allows the development of future projects, across the entire campus.

4.1.4 A number of issues were expressed that could be tackled in a LL

Interviewees were actively proposing ideas of projects - this enthusiasm and these ideas could be expanded upon in the future. Willingness from most respondents to collaborate has been expressed. However, there is currently a lack of leadership to initiate and provide the support framework to take it forward. Although the concept is being taken forward in various ways, it needs to be developed into a more recognised framework with more partners and projects.

It has been also expressed that staff and students feel disempowered for taking ideas forward as they are either being ignored or are lacking awareness of who should they contact to initiate change. A member of professional staff was not able to introduce MSc thesis ideas to students due to lack of collaboration from the academic staff. Another respondent highlighted that despite bringing up issues related to the building and working environment to various members of staff; it has never been responded to.

Some of the issues highlighted by interviewees were:

- *Social Responsibility*
 - Taking the approach to fairness in trade further
 - Flexibility of working hours
 - Diversity and equality issues amongst students and staff
 - Institutional structure of providing feedback and discussion forum for academics
 - Delayed response to MSc students feedback on the quality of courses and knowledge delivery

- *Environmental Sustainability*
 - Poorly insulated buildings

- High energy consumption
- Low rate of biodiversity development

4.1.5 Lack of Collaboration between Academics and Operations

Interviewees expressed that academics and operations very rarely cooperate and reasons for this included the lack of common understanding, lack of time or not realizing what structure the cooperation could take, however lack of capacity was mentioned as the main reason for that. Respondents very often felt uncertain about who would be the right person they should talk to in order to initiate such collaborations. A LL in that sense is envisaged as a tool that will bridge the gap and provide the platform for this collaboration, where operations staff could provide the project with ideas and issues that the university and academics could engage their students with. It has been also highlighted that it could be a tool for all university stakeholders to identify problems or gaps not only related to the tangible infrastructure but also to the leadership, governance and policy.

4.1.6 Students are seeking practical skills

Students are seeking more opportunities to gain practical skills, to enhance their employability and make the curricula more relevant. It was highlighted that currently students often feel like passive receivers of knowledge and that a LL could provide an avenue for more hands-on learning, and for student projects to have real impacts on policies and practices, reflecting the new Learning and Teaching Vision for the University, which states that every student should be treated as a researcher/practitioner and authority should be given to them to create their own learning.

The University has a great record of student entrepreneurs and successful start ups that could be linked to a LL. In that sense it could be a great way for testing newly developed products.

4.1.7 Embedding Living Lab projects within the University courses

Students highlighted that this format could be used as a part of modules, however opinions were divided whether this would be the best way of approaching LL. It was defined that this is the easiest option for gaining student engagement however it could discriminate students with more established and strict curricula who do not have the freedom to select the modules they want to gain credits for. Innovative Learning Week, where students from any course are able to take part in projects of their choice, could provide an opportunity for these students to also get involved in LL.

It was also highlighted that LL through their interdisciplinary approach could engage long distance, part time students and allow greater exposure to work and projects undertaken outside of the central campus, e.g. Easter Bush or Kings Building.

4.1.8 Opinion of SRS's role in the process have been divided

SRS have been praised for taking upon this research concept; the overall opinion was that leadership is required to create and take the concept forward and that it should be provided by the SRS. It has been also

stated that LL should have sustainability education embedded within it. Large amounts of respondents believed that LL should have a separate entity and not have an ‘owner’ that would categorise the scope of projects that could be conducted within it and that LL should not be branded as ‘green’ so as not to limit its outreach. However, operations staff expressed that the SRS Department would be best placed to take ownership of the LL.

4.1.9 The LL will require an online presence, support from the top management and a facilitator

It has been emphasized that if LL are to become an integral part of the sustainability strategy and gather greater interest from students and staff it would require at least an online presence. A digital portal that explains the initiative, act as a database of projects and contains contact details for the relevant people would be needed. Furthermore, some sort of leadership would be expected. Respondents highlighted that somebody should be there to facilitate connections and support development of projects. Moreover, for the initiative to gain legitimacy it would require support from the University’s senior management, including in academic Schools and different operations units.

4.2 Challenges in implementing a LL

Respondents agreed that developing and framing a LL would have certain barriers and challenges to overcome. The main concern was the time commitment required. Staff in different functions are often busy and may need to make changes to their planning and prioritisation of work in order to collaborate on LL projects. The financial aspect was also expressed as a constraint, with costs being associated with staff coordination time, development of resources, and any equipment potentially needed for specific projects. Another important issue raised was the communication differences and difficulties. Due to the interdisciplinary nature of LL it will come across different approaches to work amongst multi disciplinary stakeholders. This may be an issue not only between academic disciplines but between academics and operations.

4.3 Projects Already Taking Place

As stated above, through the research a number of projects and initiatives at the campus that reflect the LL concept have been identified.

Projects described below have been identified through the interviews and the desktop based research. Their nature varies and some of them reflect the concept more than others.

PROJECT	DESCRIPTION
Edinburgh Living Lab	Established by a group of academics, this is a LL that has delivered projects through the Design Informatics module working with the data received from city council, developed by the MSc students. It involved a 10-week pilot project with Inverleith Neighbourhood Partnership and students got to experiment with novel ideas for increasing the uptake of Active Travel It is currently considering various funding options and ENoLL membership.
R&Dialogue	A research organisation trying to establish dialogue between science and civil

	society actors about low carbon transition. It has run series of stakeholder engagement workshops. One of them was designed around the new Darwin building development.
Institute for Academic Development [IAD]	The Institute has run series of projects that fit in within the LL framework. One of them would be a senate meeting on the community engagement, where mapping has been carried out to identify what is going on at the university and if students gain credit for the work they do outside from the classroom.
Innovative Learning Week	Initiative established by the IAD. It is a week without conventional teaching, where variety of activities, workshops and projects are coordinated to create a chance for students, staff and alumni to develop skills, meet new people and celebrate innovation in the academic community. This provides a space for collaboration and multidisciplinary engagement of stakeholders meeting organically to work on specific projects
Edinburgh Centre for Carbon Innovation	ECCI is a hub where low carbon leaders, policy makers, innovators, students meet to accelerate ideas, stimulate collaboration and exchange knowledge. ECCI is also home to business start ups and a host to the Smart Accelerator project focused on delivering smart cities initiatives.
Virtual Edinburgh	Virtual Edinburgh will aim to turn city and its environment into a learning environment through mobile devices, which will enable people to find out where they are, the geology, the art, the architecture, the pollution and also record events and information in locations in specific way
Edinburgh2020	A student - staff partnership, a community of practice where students and staff who come together and in a natural way engage, get together and build a community.
GeoScience Outreach	Module that students can take which allows them to develop expertise in science outreach and/or knowledge transfer, where they get to work with external partners on real life projects.
Carbon Assessments	MSc Carbon Management- students are being trained to carry out carbon audits for the external SMEs to identify their carbon footprint reduction strategy.
International Development and African International Development	It is an integral part of the curricula to allow students to participate in overseas placements and exchanges.
Challenges Worldwide	Organisation that sources international placements for MSc students' dissertations around sustainable development. Each year a group of students gets a chance to part take in the international exchange to work with an NGO.
EdinSolar	Consisting of a group of undergraduate students studying a mix of Business, Computer Science, Engineering and other courses who are designing and building a solar powered car to race in the 2017 World Solar Challenge in Australia. The aim is to demonstrate the feasibility of renewable energy use in personal transportation and to build on and improve existing technologies in the field of sustainable transportation
OPERATIONS	
Waste Department	Part of the on going collaboration between the SRS office and the Waste department to carry out waste audits by students in various parts of the campus.

TABLE 3. PROJECTS REFLECTING LL CONCEPT AT THE UoF

It is apparent that more students could be involved with the operations departments of the University.

4.4 Risks

Through the literature review and primary research key risks of implementation of LL have also been identified. Important issues to consider when designing a framework for a LL are the following:

- Lack of engagement and buy in from students due to a large number of projects, societies and events already happening at the campus. To avoid this, a clear strategy or value proposition that the LL are going to deliver as well as joined up approach to the promotion of LL amongst all mapped stakeholders would be required.
- Attracting only the ‘usual suspects’.
- Students feeling treated as ‘free labour’.
- Expectations and skills mismatch. To avoid this, structured supervision and facilitation will be required.
- Communication breakdown with students dropping undertaken projects. Engagement management will be required along with established communication channels.
- Too much interest and not enough capacity to meet and accommodate all projects.
- Inaccurate timescale estimation and setting unrealistic deadlines and targets, especially at the beginning of the LL operations.

5.0 Recommendations:

Based on the research findings it is apparent that many staff and students would be in favour of further developing the LL concept and embedding it within the University’s strategy for social responsibility and sustainability. Therefore, the recommendations of this report focus on ways of taking this concept forward.

Taking into consideration the research findings and strategies for implementation undertaken by other universities, it is recommended to implement the following path that would allow gradual establishment of LL at the campus.

5.1 Map Key Activities and Expertise around SRS at the Campus

A LL should be able to demonstrate and provide a database that maps out some of the key activities around sustainability at the campus. This will allow gathering all relevant projects in the same area and allow people to find projects that may be of the interest to them. A database of all the relevant and interested University stakeholders should be created, to allow finding people with common research interests. This has been partially achieved through the development of this report, and the SRS Department holds a contact database covering students, academics and other staff. However, mapping needs to be completed with the LL approach in mind, and continually added to. This could draw on the ‘Pure’ research database, or the [Crowdsourcing Citizen Science Platform](#). More comprehensive assessment of key stakeholders’ needs would be also required.

5.1.1 Raise awareness amongst stakeholders: throughout this report, a variety of interest has been mapped. To involve all identified stakeholders, running a follow up meeting or event would be recommended. This could take a form of a workshop for interested researchers, teaching staff with

relevant courses, student representatives, and operations. This could potentially be done in collaboration with the University of Manchester LL, who expressed interest in future cooperation.

5.2 Identify Coordination and Governance

The decision needs to be made regarding how and where the LL is going to be managed. It is recommended to place it within the SRS leadership, to provide the structure to initiate new LL projects. The concept at the moment appears to be too vague to organically spread within the University's culture amongst various departments. Identifying a few stakeholders who would support LL development or appointing an Advisory Group would be beneficial.

Establish Clear Objectives: A clear leadership and framework is required, to provide the support network for anybody willing to engage with LL. To meet expectations of the wider audience clear specification of the vision that LL aims to portray and objectives that it aims to achieve will be needed.

Appoint the coordinator: To establish coordination and governance, it is recommended to consider and identify the potential facilitator or a group of individuals from various institutions/disciplines who would initiate and oversee the first few LL flagship projects.

Create a brand: It is recommended to create an online presence to in order to establish LL brand. To begin with it could be just a sub site on SRS website explaining what LL is and flagship projects.

Create a legal framework: LL will potentially have to deal with data protection and IP rights, therefore disclosures and examination of the data that is going to be used requires careful consideration. In case of multidisciplinary collaboration and projects, clear ownership rights would need to be considered, and initial meeting and advice should be sought from the IT specialists and/ or [Edinburgh Research and Innovation](#).

5.3 Identify flagship Living Labs projects

The establishment and development of a few flagship projects whose potential outcomes will be measured and the findings reported back would be recommended. Priority themes could include: buildings and energy consumption including student halls, renewable energy systems viability, sustainable food systems, staff and student's transport, use of waste oil from campus to fuel Estates vehicles, general and food waste reduction, carbon footprint accounting, purchasing and full life cost assessment.

Projects could be categorised by:

- **Academic projects** - either those where research is carried out by academic staff, or those that involve student dissertations and any academic projects that are run for credits. Initiatives run by course organisers, or projects brought up by operations who would like to carry out a piece of research.

- **Internships** - this could focus on the short-term projects for students who are interested in gaining more practical experience; this could fit in with the SRS small grant scheme run between the SRS and EUSA. Projects initiated from students or academics where they would need explain their impact on the university community.

5.4 Seek Funding

LL at the initial stage should not involve a high capital investment, however given the support that they could provide and potential savings, it would be recommended to seek internal funding streams as well. Possibilities for external funding from sources that funded other LL's like Cambridge and Manchester are listed in table 4. It is furthermore recommended to consider other smaller funding streams and seek for short term funding opportunities.

FUNDING	EXPLANATION
<u>Santander University</u>	Awarding number of scholarships and grants committed to universities every year. Main funding body of the Cambridge LL.
<u>Horizon 2020</u>	Horizon 2020 is the EU Research and Innovation programme with €80 billion of funding available over 7 years (2014 to 2020), that funded projects of various university based LL.
<u>European Social Fund Programme</u>	One of the five European Structural and Investment Funds (ESIF) with over €80 million to spend over next 7 years. One of the funding strands is social innovation, i.e. testing and scaling up innovative solutions to address social, employment and education needs.
<u>Data Lab Funding</u>	Total funding of £150,000 is available, The Data Lab is looking to fund up to 3 quick start projects to enable industry to work with academia.
<u>Innovation in Higher Education Fund</u>	Provides funding for knowledge exchange to support and develop a broad range of knowledge-based interactions between universities and colleges and the wider world. Used by LL at the Manchester University.
<u>Engineering and Physical Science Research Council</u>	The UK's main agency for funding research in engineering and the physical sciences. EPSRC invests around £800 million a year in research and postgraduate training that supported some of the LL projects.
<u>Scottish Funding Council</u>	Invests around £1.6 billion in Scotland's colleges and universities for teaching and learning, research and other activities in support of Scottish Government priorities.

Table 4. LL funding options

5.5 Institutionalising Living Labs at the campus

In the long term LL could be embedded and expanded into a fully institutionalised model, which could also engage with external companies and enhance the relation that the university has with the City Council. UoE has a large population that creates impacts on the city itself; fully institutionalised LL could involve local community issues and seek opportunities for collaboration on the city level as well.

It is recommended that the University take responsibility for supporting its staff and students in projects that they wish to develop but due to the lack of time and capacity are not able to initiate them. Therefore

in the long term LL could develop into a standalone model where smaller projects organically emerge to plug into a larger framework that is already established.

The LL framework should be treated as a tool to enhance the University's reputation, which could attract research funding and create world class studying facilities, where students can take ownership over their learning experience and are active players in creating and shaping the environment that they are in and subsequently in improving the wider sustainability issues.

6.0 Conclusion

This report was conducted in order to assess the potential and scope for introducing LL to the UoE, by identifying the projects that already reflect it, ideas for taking the concept forward and how could it be implemented. Research was limited by the timescale and available resources, therefore a more in depth study would be required to identify and map all stakeholders and measure the interest and its potential.

The University should be treated as and act as a catalyst for a sustainable society, offering fresh knowledge and leading by example. This means engaging students and staff in its everyday activities and how to make them more sustainable. The LL concept proposes a new approach to what learning should be representing, to inspire students to go and discover research, examine and fail in a safe environment of the infrastructure provided by the university. It allows creation of benefits for all stakeholders, as it stimulates knowledge exchange and taps into underused brain power that the university has. LL are there to support the everyday battle of tackling climate change, to make the University a more sustainable institution, reduce its carbon footprint and be more socially responsible.

The LL as a concept used by universities has been present for a long time, especially in USA and Canada, and is now making its way to the UK. It has been defined as a way to make curricula more innovative and provide real life learning skills for students in a way that would in turn benefit the university's infrastructure. At the UoE it became apparent that staff and students are seeking a support network that would embrace the countless actions of individuals and groups that already reflect the LL approach, that could gain exposure and boost from being a part of a larger, institutionalised approach. Developing a recognised LL at UoE would allow easier collaboration, better communication and bridging gaps between all the University's stakeholders. LL in this sense gives all these projects a framework so that ideas that students, staff or any stakeholders could have can find their way into the consciousness of the right people who could act upon that knowledge.

Change will not happen overnight, and it would be wishful thinking to believe that LL will reinvent the way that University operates within a short period of time. However, successful stories from other institutions and organisations provide evidence that it is a worthwhile approach, that in a semi self-enforcing manner can provide nothing else but benefits to the University community. Respondents were unified in opinion that the LL is a concept worth investigating and acting upon. Whether it will be used by everybody is

doubtful, whether it will strike a link of collaboration between school of veterinary and anthropology course – most likely not. But the LL framework will be there to give users access to research, teaching and learning opportunities on connections between environment, social and economic issues in the most accessible and approachable way.

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8.0 APPENDICES

APPENDIX 1 Interview question guide

Participants were invited to take part in 40 minutes one to one interview. Prior they have been sent research consent and some background information that explains the LL concept and directs them to a specific website with more information. At the beginning of the interview respondents were informed about the confidentiality of research and that the conversation will be recorded. When required, short discussion about the LL concept took place before proceeding to questions.

1. Position at the University and background (Personal)
 - **Information obtained:**
 - Information about the areas of work of respondent
 - What category staff member person is
 - The scope of decision making capacity that person has
2. Were you aware of the Living Lab concept – if so, how do you understand it? [If person has not been aware of the concept before, background information were sent prior to the interview] (Personal)
 - **Information obtained:**
 - Identifying if respondent understands the concept
 - Tracking key themes of what respondents portrait the concept to deliver
 - Identifying attitudes towards the concept
3. Have you ever worked on any initiatives that are reflecting the way that LL are operating? If so, can you explain those projects? (Personal)
 - **Information obtained:**
 - Identifying if any LL initiatives already take place at the University
 - Finding out how institutionalizing LL would impact those projects
 - Are similar projects at the campus connected or isolated
 - Is there support from the University for carrying out those projects
 - How do those projects impact students and staff
 - What are the key obstacles/constrains/ challenges to establish them
4. What are the main issues that University could address using the LL concept? (General)
 - **Information obtained:**
 - Identifying issues at the campus
 - Identifying why respondents think that LL could solve them
 - Identifying why and how LL could support solving those issues
5. If this have not been mentioned in the answer to the question 4: How would LL impact on tackling

those issues especially those related to:

1. Environmental issues
 2. Social sustainability issues
6. What would be key barriers for implementing LL at the campus?
- **Information obtained**
 - Verifying what respondents regard as constraints
 - If not mentioned, specific questions about: finance, data protection, intellectual property, communication and cross departmental cooperation were asked
7. What would you think help to overcome those barriers?
- **Information obtained**
 - Identifying solutions to listed issues
 - Verifying if LL is an appropriate tool to tackle those problems
 - Discussing how LL should be structured to overcome those barriers
8. What LL would have to provide with for people to engage with it
- **Information obtained:**
 - Verification if physical space or virtual presence is required
 - Is establishing LL is preferable or should it be promoted as a culture to be embedded within the university's structure
 - Verifying what objectives should LL deliver
 - If not mentioned, specific questions about university- industry cooperation and potential of research spin –offs were asked.
9. How would you see SRS role in the LL project?
- **Information obtained**
 - Establishing what respondents expect of SRS in establishing LL
 - Verifying what gains more support- LL for sustainability or generic LL for the University
10. Are there any other stakeholders / partners that should be involved in establishing LL
- **Information obtained**
 - What groups of stakeholders are associated with LL

Respondents were invited to share any further comments and ideas for any other interview contacts.

APPENDIX 2 Questionnaires

A number of universities across the world were approached and invited to participate in a short questionnaire about establishing LL at the campus. After receiving questions set, respondents were invited to participate in a Skype/phone conversation to expand on the information provided.

Issued questionnaire:

This is a research project being conducted by Patrycja Graczyk at University of Edinburgh. The purpose of it is to establish how universities can implement concept of Living Labs at their campuses. You are invited to participate in this research project because you currently are or were involved with the establishment of the Living Lab at your campus.

Your information will remain confidential. All obtained data is stored in a password protected electronic format. The results of this study will be used for scholarly purposes only and will be shared with Social Responsibility and Sustainability Office.

Participation in this research project is voluntary therefore you have a liberty to withdraw any time without prejudice or negative consequences.

If you have any questions about the research study, please contact [researcher's email address].

1. When was the Living Lab established at the campus and who were the people who initiated it. How many people were initially involved.
2. How long did it take to establish Living Lab?
3. Were there significant financial resources required?
4. What were the key funding streams that allowed establishment?
5. What were the key projects resulted from Living Lab approach?
6. What were the outcomes of the projects?
7. Who were the key stakeholders? (external and internal)
8. Was there a noted improvement in student and staff engagement through the implementation of the Living Lab?
9. Was there a return on investment? (if that was an objective)
10. What are the long-term goals of the Living Lab at your University?
11. What tools and methodologies have been used to establish Living Lab (any ENoLL framework used)?
12. What were the key challenges and obstacles to establish a Living Lab at the campus?
13. Has Living Lab approach enabled enhancement of social and/ or environmental sustainability at the campus?

APPENDIX 3 Focus Group Question Guide

Participants were invited to take part in 90 minutes focus group. Prior they have been sent research consent and some background information that explains the LL concept and directs them to a specific website with more information. At the beginning of the focus group respondents were informed about the confidentiality of research and that the conversation will be recorded. Furthermore a short presentation about why was the research commissioned and what LL are was delivered.

1. What University course are you taking and which year are you?
 - **Information obtained**
 - Students background
 - Potential level of understanding of the social and environmental sustainability
2. What creates your student experience?
 - **Information obtained**
 - What students value as a contributing factor to their academic experience
 - How students rate their current experience
3. How do you understand concept of LL?
 - **Information obtained**
 - Identifying if respondent understands the concept
 - Tracking key themes of what respondents portrait the concept to deliver
 - Identifying attitudes towards the concept
4. What LL should deliver to gain your engagement?
 - **Information obtained**
 - How respondents envisage key LL strands
5. Have you participated in any projects that reflect this concept?
 - **Information obtained:**
 - Identifying if any LL initiatives already take place at the University
 - Finding out how institutionalizing LL would impact those projects
 - Are similar projects at the campus connected or isolated
 - Is there support from the University for carrying out those projects
 - How do those projects impact students and staff
 - What are the key obstacles/constrains/ challenges to establish them
6. What areas of your student experience would LL impact and how would it impact?
 - **Information obtained**
 - Will LL impact in any way student's satisfaction
7. What are the main issues that University could address using the LL concept?
 - **Information obtained:**

- Identifying issues at the campus
 - Identifying why respondents think that LL could solve them
 - Identifying why and how LL could support solving those issues
8. If this have not been mentioned in the answer to the question 4: How would LL impact on tackling those issues especially those related to:
- a. Environmental issues
 - b. Social sustainability issues
9. What would be key barriers for implementing LL at the campus?
- **Information obtained**
 - Verifying what respondents regard as a constrain
 - If not mentioned, specific questions about: finance, data protection, intellectual property, communication and cross departmental cooperation were asked
10. What would you think help to overcome those barriers?
- **Information obtained**
 - Identifying solutions to listed issues
 - Verifying if LL is an appropriate tool to tackle those problems
 - Discussing how LL should be structured to overcome those barriers
11. What LL would have to provide with for people to engage with it
- **Information obtained:**
 - Verification if physical space or virtual presence is required
 - Is establishing LL is preferable or should it be promoted as a culture to be embedded within the university's structure
 - Verifying what objectives should LL deliver
 - If not mentioned, specific questions about university- industry cooperation and potential of research spin –offs were asked.
12. How would you see SRS role in the LL project?
- **Information obtained**
 - Establishing what respondents expect of SRS in establishing LL
 - Verifying what gains more support- LL for sustainability or generic LL for the University
13. Are there any other stakeholders / partners that should be involved in establishing LL
- **Information obtained**
 - What groups of stakeholders are associated with LL

APPENDIX 4 Useful Resources on LL

Guidelines and toolkits

- [IARU Green Guide for Universities](#)
- [The Living Lab Methodology Handbook](#)
- [The Campus as a Living Laboratory guide](#)
- [Regenerative Sustainable Development of Universities and Cities. The Role of Living Laboratories.](#)
- [Greening University Toolkit](#) (UNEP)
- [Citizen-driven Innovation \(ENOLL\)](#)

Websites

- [European Network of Living Labs](#)