GW4 living labs: Scope 3 and the road to net zero

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Abstract
To limit global warming to 1.5°C, reaching net zero emissions is crucial but can only be achieved through a universal transformation of energy and land-use systems. The interdependent nature of these systems means that all sectors of the economy are involved in some capacity across supply chains, and so will need to undergo transformation together. However, how to achieve net zero emissions is still unresolved, and organisations increasingly seek support from external sources of knowledge. In addition, inertia at national and global levels has led to an increase in actions at local levels through place-based initiatives. As a result, there has been a widespread increase in the use of living lab models as places of experimentation and innovation for climate-related research and development. However, there remain questions about what constitutes a living lab and how they work in practice. This summary briefly explores how living labs are defined and designed, taking into account the necessary conditions for successful implementation. It then investigates how universities can serve as facilitators of innovation by co-creating knowledge, initiating action and providing capacity within a living lab model. Finally, a mission-oriented model is outlined that communicates living labs in a wider societal context.

1. Background

A 1.5°C increase in global warming is believed to be the tipping point at which climate change would be irreversible. Estimates indicate that with current emissions rates, the greenhouse gas levels for 1.5°C warming is likely to be exceeded roughly within the next decade (IPCC, 2021).

Carbon emissions have increased by 50% post-Industrialisation (Betts, 2021), with nearly 85% of overall emissions coming from power, industry, mobility, buildings, agriculture, forestry and other land use, and waste (IPCC, 2019). Of these, as much as 90% of an organisation's emissions come from what is known as Scope 3 (Griffin, 2017). More complicated to calculate and more challenging to reduce, Scope 3 emissions are the indirect emissions in an organisation's value chain that are not covered by other emission sources known as Scope 1 and 2[1]. Scope 3 emissions come from both the production of business products or services (upstream emissions), and from their use and disposal (downstream emissions).

By December 2021, more than 70 countries and more than 5,000 companies (Krishnan et al., 2022:1) had put net-zero commitments in place. However, around 40% of these companies with a net-zero pledge still need a plan on how they intend to achieve them (IEA, 2021). Poorly prepared and uncoordinated action will present significant challenges and have implications for the success of many initiatives.

To limit global warming to 1.5°C, reaching net zero emissions is crucial, and this can only be achieved through a universal transformation of energy and land-use systems. The universal and interdependent nature of these systems will require that all sectors of the economy are involved

[1] Scope 1 emissions originate directly from an organisation's operations (e.g. through petrol or fertiliser use); Scope 2 are emissions associated with the production of the energy an organisation consumes.

in some capacity across supply chains and will need to undergo transformation together. While there is understanding of the scale and urgency to achieve this transformation, how to achieve it is still unresolved and organisations increasingly seek support from external sources of knowledge (Baccarne et al., 2015), recognising that the traditional approach of working in isolation will not be sufficient. It is widely accepted that effective delivery of low-carbon and climate-resilient development will require new governance arrangements (Bulkeley et al., 2019; Castán Broto, 2020; Jordan et al., 2018; Kivimaa et al., 2017 as referenced in Howarth et al. 2022), involving all stakeholders working together within new ways.

2. Livings Labs

While climate change is a global challenge, its impacts are felt locally, and inertia at national and global levels has led to an increase in actions at local levels through place-based initiatives (Howarth et al., 2022). 'Living labs' (see Figure 1) are widely seen as places of experimentation and innovation for climate-related solutions and are rooted in local and regional action with the potential to create transformative outcomes. A living lab is an approach designed to tackle real-life challenges often framed around one of the Sustainable Development Goals. They can be centred around a university campus, a campus living lab (CLL), or more regionally as an urban living lab (ULL). In either case, they include all relevant stakeholders in the collaboration and co-creation of knowledge. A key characteristic is that living labs involve end users in the development and research from the beginning of the design process. Adopting a variety of approaches, they create an inclusive and collaborative environment which takes into account different interests and backgrounds that involves a process of trial and error resulting in a process that can be flexible and responsive to the changing needs of stakeholders and communities (Evans & Karvonen, 2014; Evans et al., 2015, Evans et al., 2019; Veeckman et al., 2013).

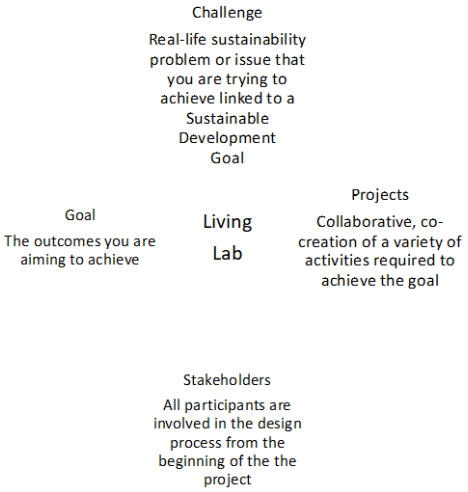

Figure 1: A Living Labs Framework based on characteristics defined by Steen and van Bueren 2017a

The use of living labs as places of experimentation and innovation is rooted in local and regional action with the potential to create transformative outcomes. A crucial element is that there is representation of stakeholders from all sectors of society, and involve a combination of local authorities, companies, community organisations and universities in a collaborative process. In

the case of a campus living lab the stakeholders are representatives from a combination of academic staff and students, professional staff, campus operations and external stakeholders (see Figure 2).

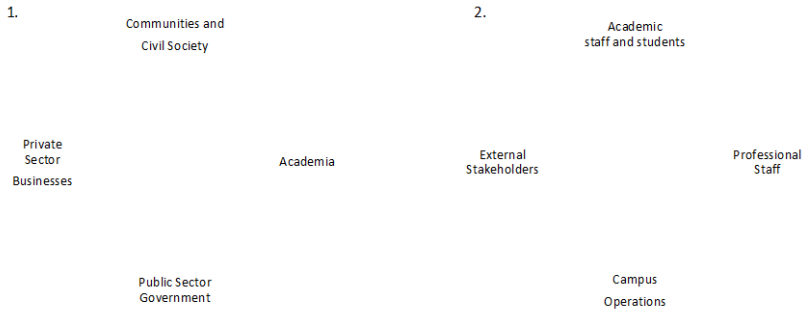

Figure 2. Stakeholder representation for 1. an Urban Living Lab and 2. a Campus Living Lab based on the quadruple helix model of Carayannis and Campbell, 2009

If living labs are considered an approach requiring all stakeholders to respond to the need to find solutions to societal issues, then how they operate and are governed is significant. Governance is recognised as crucial to the successful transformation of sustainability issues. Whether a large or small-scale project, the inclusion of multiple stakeholders with an array of knowledge and diversity of backgrounds will require new ways of working. (Krishnan et al., 2022; CUN, 2022; Evans and Karvonen, 2014; Bulkeley et al., 2016; Bifulco et al., 2017). In order to tackle societal challenges, collaboration is an accepted part of the process, but how to collaborate is often overlooked (Kalinauskaite et al., 2021).

Collaboration in the co-creation or co-production of knowledge and solutions is a core principle of the living lab approach and it is this aspect that sets it apart from other research methods (Evans and Karvonen, 2014). Co-creation of knowledge can be defined as a group of people from diverse backgrounds with differing perspectives and different sets of knowledge who come together from the initial stages design and develop solutions to a defined challenge (Mahmoud et al., 2021). University generated knowledge is one type of knowledge, the lived experience is another. These different forms of knowledge have to be integrated in order to have value in complex contexts and this necessitates collaboration (e.g. to implement new knowledge) and co-creation (e.g. to integrate multiple forms of knowledge from the beginning). Adopting this process helps ensure end users are equal contributors rather than subjects of studies, and are involved in creating social, economic, and environmental solutions that will impact them. It is important to note that navigating collaboration and co-creation will also mean navigating issues of power.

3. Universities and Living Labs

Universities feature prominently in living labs as critical stakeholders in the fight against climate change and their involvement may take two different approaches: the university as a campus-based living lab (CLL) and the university as a knowledge hub, host or partner of an urban living lab (ULL) as part of its civic mission. Whether campus or urban-based, universities, as centres of knowledge creation and a contributor to urban sustainability, have a critical role in a net-zero transformation.

3.1 Campus Living Labs

Campus living labs (CLL) are institutional in nature and based around campus operations. Often described as a microcosm of society with housing, transport, food and health services, the university campus is considered one of the most appropriate places for conducting a living lab. Universities are quickly recognising the opportunity of using their campuses as a testbed to conduct applied research to tackle sustainability challenges, transforming the campus into an active learning environment while simultaneously achieving their net-zero targets.

3.2 Urban Living Labs

The living lab framework can facilitate engagement beyond the campus, thus expanding the potential for universities to engage with external stakeholders and support broader sustainability challenges in its locality, resulting in urban living labs. A ULL is local in reach and scale, and the university is seen as a place-based institution operating within a civic space. As a participant, universities may act as a knowledge hub, host or partner.

Cities account for some of the most significant carbon emissions in the world because they are involved in global consumption, production, and pollution. In an urban context, living labs can be used as a bridge between research and society-wide implementation, achieving more impact faster (Steen and van Bueren, 2017b) and are seen as a way for cities to become sustainable (Florez Ayala, 2020). A distinctive feature of an urban living lab is the focus on civic participation and increased quality of life, rather than the development of a commercial product or service. Much of the recent literature focusses on living labs as a form of collective experimental governance, where stakeholders develop new ways of living to address the challenges of climate change, sustainability and resilience. (Bulkeley and Castan Broto, 2013; Voytenko et al., 2015; Bulkeley et al., 2016). Like campus living labs, governance is an essential part of urban living labs and is considered a part of the wider shift in sustainability governance (Buckeley and Castán Broto, 2013).

4. Communicating Living Labs

As a living lab aims to solve a real-life problem, projects can be designed around a mission-oriented model framed by a specific Sustainable Development Goal (see Figure 3). Adopting a mission-led organisational structure offers a new way to advance innovation by taking a more focused approach relevant to society locally. It results in goal-oriented research with more precisely defined objectives. A Mission-oriented approach can be explained as identifying a challenge (such as a Sustainable Development Goal), setting an ambitious goal (mission), identifying main themes around this goal and then using these to create projects (living labs), engaging a variety of stakeholders across sectors and disciplines (Mazzucato et al., 2018). In order to convert these challenges into achievable solutions, they need to be broken down into more manageable component parts which become the living lab. Once a goal is defined, themes, living labs and associated projects and, stakeholders are more easily identified. Organising living labs in this way has the potential to link projects, allow for interdisciplinary collaboration and act as a framework for communication for external stakeholders and funders.

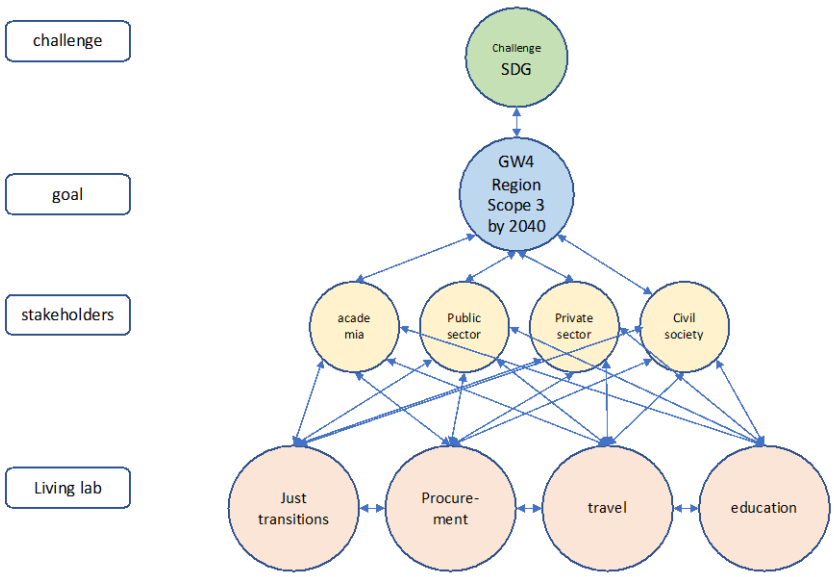

Figure 3. Example of living labs structured around a mission-oriented approach based on the Missions model by Mazzucato, 2018

5. Conclusion

If a 1.5^{o}C world is to be achieved, urgent action is needed to achieve net zero emissions. While climate change is a global challenge, its impacts are felt locally, and there is an increase in locally led initiatives. These initiatives increasingly take the form of living labs, sometimes structured around UN Sustainable Development Goals, demanding collaboration from across sectors of society in the design and research process. Universities have a part to play in the process and their role as anchor institutions allows for a more strategic collaboration between stakeholders to forge a path towards a net zero transition. In order for living labs to be successful and achieve long-term sustainability, two key elements need careful consideration: the inclusion of all stakeholders from inception; and, a clear and funded governance structure that will allow living labs to progress beyond the initial collaboration phase.

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