

Transformative research and education in Living Labs using the SDGs as a compass

Transformative
research and
education

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Annelies Heijmans

*Department of International Development Management,
Van Hall Larenstein University of Applied Sciences, Velp, The Netherlands, and*

Rik Eweg

*Applied Research Centre, Van Hall Larenstein University of Applied Sciences,
Velp, The Netherlands*

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Abstract

Purpose – This study aims to investigate how Living Labs of Van Hall Larenstein UAS perform as sustainability-oriented, transdisciplinary learning environments. It shows how the sustainable development goals (SDGs) can be used as a compass and debates the sustainability impact of applied research.

Design/methodology/approach – A case study approach was adopted, including a literature review, scoping visits, online workshops and peer-to-peer inter-vision/learning, using the SDGs as a compass and framework for analysis.

Findings – Most Living Labs use a “silo-approach” on the SDGs and are designed from a technological-expert perspective. This results in blind spots, particularly on SDGs related to reducing socio-economic inequality and just institutions. Debating unsustainable systems, cultures and practices is avoided. To contribute to sustainability transitions, universities need to invest in developing transformative capacity. This refers to SDG-transition competences such as collaborative communication, constructively engaging with diversity and conflicts, discussing values, norms and ethics and encouraging reflexivity.

Research limitations/implications – Mainly lecturer-researchers were involved in the study. COVID-19 travel restrictions hindered the research at the grassroots level in India and Indonesia.

Originality/value – The study revealed the importance of creating Living Labs as safe and brave inter- and transdisciplinary learning environments to practice reflexivity: encouraging students, researchers and stakeholders to look at sustainability issues from plural perspectives and questioning unsustainable practices, which combined lead to changing perceptions, practices and relations and a deeper understanding of how change happens. The SDGs as a compass method supports reflexivity among stakeholders and in redirecting strategies towards a sustainable future.

Keywords Sustainability, Living Labs, SDGs, Higher education, Transitions, Transformative research, SDG compass

Paper type Case study

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1. Introduction

Climate change, environmental degradation, frequent disasters and socio-economic inequality are current challenges that can no longer be addressed by routine practices and technological fixes (Peterson, 2013). In their research agenda for sustainability transitions, Köhler *et al.* (2019) point out that systemic changes are required, referred to as “sustainability transitions”. Sustainability transitions imply fundamental changes in economic relations which evolve within safe ecological boundaries of the planet and reduce social inequalities (Raworth, 2017). These changes further recognize multiple views on sustainability and need a governance system steered by values of accountability, transparency, equity and equality (Loorbach, 2014). This requires collaboration between scientists from different disciplines (interdisciplinarity) and between scientists and multiple stakeholders such as local residents, municipalities, companies and interest groups (transdisciplinarity). Dialogue between science and society is crucial to develop sustainable solutions and to increase ownership, legitimacy and accountability (Wittmayer *et al.*, 2021, p. 7).

Institutions of Higher Education have a significant role to play in this systemic change, as they educate the leaders of transitions towards sustainability. However, higher educational institutes (HEIs) face structural and cultural obstacles within their own institutes when contributing to transitions. Examples are a divide between research and education, valuing the number of publications and citations over societal impact, inflexibility in faculty calendars, differing sub-cultures between departments impeding collaboration and HEIs often lack organizational learning capacity (Stephens and Graham, 2010).

Changing traditional ways of teaching and research requires new learning environments that are not hindered by such obstacles. Living Labs offer such an environment. In Living Labs, HEIs and researchers/lecturers from different disciplines work together in real-life settings with all kinds of stakeholders on sustainability transitions (Purcell *et al.*, 2019). The concept of Living Labs is developing constantly, and different types of Living Labs exist among HEIs. Most are referred to as learning configurations – in physical regions or virtual realities – involving multiple stakeholders collaborating for creation, prototyping, validating and testing of new technologies, services and products in real-life contexts (Westerlund and Leminen, 2011; Ståhlbröst and Holst, 2012; Maas *et al.*, 2017). Until now, most definitions emphasize technology-oriented innovations, making inventions work in practice, *within* the present economic and social systems. Only recently, Living Labs are defined in terms of learning among the different stakeholders, reducing power differences in society and advocating for sustainability transitions (Loorbach *et al.*, 2017; Mierlo and Beers, 2020; McCrory *et al.*, 2020). Corresponding to this conceptualization of Living Labs, Wals (2020, p. 61) refers to sustainability-oriented learning environments: a blended reflexive learning space (education–research–society) where multiple actors having different backgrounds co-create sustainability organically using a variety of tools, relations and forms of learning. The idea of what constitutes “sustainability” changes continuously depending on moment in time, on the place and on socio-cultural and eco-economic circumstances. He stresses to be aware of pluralism, diversity, minority perspectives on sustainability, including fundamental disagreements on how we should take care for the planet, for others here and elsewhere, for now and in the future.

In 2016, researchers at Van Hall Larenstein UAS (VHL) arrived at four design principles for a Living Lab (Witteveen *et al.*, 2016):

- (1) Foster inclusive “quadruple helix” participation among multiple actors;
- (2) Create authentic learning environments that focus on a sustainable future;
- (3) Stimulate reflexivity in learning and innovation for sustainability; and
- (4) Facilitate interaction, knowledge sharing and open system management.

These design principles largely resonate with Wals' (2020) description of a sustainability-oriented learning environment mentioned above.

The goal of this study was to investigate how the Living Labs at VHL perform as sustainability-oriented learning environments, considering the changing conceptualization of Living Labs. We used both the four design principles described above and also the sustainable development goals (SDGs). Our research question was twofold:

RQ1. To what extent do VHL's Living Labs meet their own design requirements?

RQ2. How to use the SDGs in these evaluations, as VHL's Living Labs aim to focus on a sustainable future (design principle two)?

However, what entails a sustainable future? We used the *SDGs as a compass* method to review how VHL operationalizes "sustainability" in its research. The findings and conclusions in this paper are of interest to scholars working in HEIs, aiming to strengthen the link between applied research and education by working on sustainable transitions in Living Labs. As far as known, applying the *SDGs as a compass* within Living Labs has not been studied before.

2. Methods

An interactive and exploratory case study approach (Svensson *et al.*, 2007; Swedberg, 2020) was adopted, inviting 32 VHL researchers–lecturers [1] engaged in VHL's international study programmes and VHL's Living Labs abroad. VHL research groups collaborate with regional stakeholders in these Living Labs since many years, during which they developed networks and knowledge in the field of ecological and agricultural systems. Out of the 32 persons, 29 researchers–lecturers actively participated in this study.

Two VHL Living Labs served as a case study for this research: in Indonesia, the Living Lab "Restoring Peatlands" in Kalimantan (Rachmanadi *et al.*, 2021), and in India, the applied research initiatives in the dairy value chain, and in climate-smart farming systems in Baramati-Pune districts of Maharashtra (Eweg *et al.*, 2017) [2]. Insights from Indonesia and India were validated with those from the other Living Labs situated in Indonesia, Ethiopia and Kenya [3] to assess whether findings are context-specific or common for all Living Labs.

The study was *interactive* because the role of staff was more than just informant: they were keen to jointly reflect on how they operationalize the SDGs and the four design principles in Living Labs and to jointly make sense of how to improve Living Lab performance. The study was *explorative* because the aim was to explore if the 17 SDGs could serve as a compass to "measure" research outcomes towards sustainability. Iterative reflexive cycles and reciprocal relationships between staff ensured the validity of this action research (Herr and Anderson, 2005).

2.1 Views on the SDGs in literature

The 17 UN-SDGs comprise the interests of a wide range of stakeholders involved in the negotiations and formulation of the global goals (Hajer *et al.*, 2015). However, the SDG-framework still reflects the dominant thinking on International Development, promoting economic growth to reduce poverty and modernization of society through technological innovation (Chankseliani and McCowan, 2021, p. 2). We reviewed literature on the SDGs with the aim to find other views on the SDGs which fit our definition of sustainability transitions. In literature, three views on the SDGs can be discerned.

Firstly, the "silo-view", in which the SDG framework embodies a linear result-oriented management thinking by splitting goals into targets measured through indicators. Wollaert (2017) particularly criticizes this "silo-view" on the SDGs, which divides the SDGs according

to the five Ps: Planet, People, Prosperity, Peace and Partnerships. This view resembled VHL’s sustainability approach, which focused on only eight isolated SDGs (Figure 1). As many SDGs are interlinked and interact (Fonseca *et al.*, 2020), a “silo-view” on applied research may lead to unforeseen or neglected effects on specific SDGs and overlook trade-offs (Biggeri *et al.*, 2019). Nilsson *et al.* (2018) observed that insights about interactions, synergies and trade-offs among SDGs are poorly documented and fragmented across separate disciplines due to a “silo-view” on SDGs.

Therefore, Wollaert (2017) promotes a second view, which regards the 17 SDGs as inseparable and interdependent, and challenges the private sector, for instance, to look beyond their profit-oriented “business as usual” practice and confront them with rather uncomfortable questions of how they contribute to, e.g. human rights and biodiversity. This resonates with a social science power-oriented perspective on the SDGs challenging economic and legal systems (Norren, 2020). By doing this, the SDGs function as a “moral compass” to facilitate dialogue and social learning among stakeholders who think differently about sustainable development. The notion “SDGs as a compass and dialogue tool” (Figure 2) inspired this study: the assumption was that the *SDGs as a compass* method supports stakeholders to reflect and debate on how their applied research impacts on each of the 17 SDGs. It could further support stakeholders to reflect on their underlying assumptions and beliefs, contribute to social learning and to navigate to alternative sustainable futures.

A third view on *sustainable development* – absent in the SDG framework – stems from “cosmovisions”, indigenous worldviews, which view development rather as a *service* to one another and to the earth, stressing the human–nature–well-being interrelationship (Norren, 2020). It aims to live in harmony with nature, sharing of resources instead of profit-orientation, modelling the economy and law around the earth system and not the other way around.

While the SDG-framework embodies a linear, results-oriented approach, above cosmovisions emphasize an open-ended, flexible dialogue and learning process, creating a greater awareness of interrelations (Norren, 2020). This largely resonates with the “SDGs as Compass” view, the approach we have adopted. The Living Labs of VHL engage with stakeholders who have different views on the SDGs, and therefore, we aim to do justice to the diversity of interests and worldviews on how sustainable change happens. Furthermore, the “SDGs as compass” view promotes a holistic understanding of development, encompassing issues of identity, unravelling values, ethics, power dynamics, social change and agency of citizens, institutions and societies. They have a right to shape their own pathway of development and address inequality. This view also takes a process approach of actions and strategies towards systemic change where pre-set indicators are not always



Figure 1.
Silo-view on SDGs
and VHL’s focus on
eight isolated SDGs

Note: These figures are taken from VHL Institutional Plan (VHL, 2018)
Source: VHL (2018)



Note: Adapted from CIFAL Flanders material provided by Peter Wollaert in 2017 using figure from website: <https://ec.europa.eu/eurostat/cache/infographs/sdg-2018/index.html?lang=cng>

Source: Wollaert (2017)

Figure 2.
SDGs as a
compass view

clear (Chankseliani and McCowan, 2021). This calls for transdisciplinary research in Living Labs and resonates with Design Principles 1 and 4, referring to quadruple helix participation and to facilitate interaction, knowledge sharing and open system management (Witteveen *et al.*, 2016).

2.2 The case study: scoping visits, interviews and reflexive workshops [4]

During the first year of the research, two scoping visits were made: to Indonesia in July 2019 and to India in October 2019. The purpose of these visits was to understand issues at stake in their full complexity: map stakeholders' perspectives on urgent-felt problems, their interests, envisioned futures and obstacles/opportunities for sustainable change. Regrettably, follow-up visits for iterative action-reflection workshops with local stakeholders could not happen because of prolonged travel restrictions due to COVID-19. Therefore, the research approach was adapted and shifted to online workshops limited to VHL researchers, lecturers and students that were all active in the Living Labs. During these workshops, we used the four design principles for Living Labs and the SDGs as a compass by asking the VHL researchers three key questions: (1) What are the obvious SDGs your research or work and activities contribute to, and in what way? (2) How does your work impact on the other – less obvious – SDGs? (3) What is needed to also have a positive impact on the less obvious SDGs?

These questions were being answered jointly by the different stakeholders involved in (online) workshops during 2019 till 2021. Dialogues emerged about what “sustainability” means for each stakeholder, what importance they attach to particular values and what assumptions and beliefs they have in their research. Such dialogues recognize plural views on sustainability, detect blind spots and trade-offs, and facilitate mutual understanding. These

iterative reflexive workshops further allowed lecturer–researchers and stakeholders to discuss, “measure,” and to jointly make sense of the research findings. Through iterative processes of sense-making new knowledge was collectively constructed, and new learning questions were formulated. Sense-making refers here to *continuing redrafting of an emerging story so it becomes more comprehensive, includes more observed data, is consistent with data from other sources, and becomes resilient in the face of criticism* (Weick, Sutcliffe and Obstfeld, 2005, p. 415).

Yet, such open-ended dialogues, sense-making and learning are only possible when stakeholders let go of the SDGs’ fixed targets and indicators. The SDGs should be considered as aspirations, a *dot on the horizon*, and the SDG-compass with the three questions as a *dialogue and navigation-tool* to enable stakeholders to jointly identify alternative futures. Moreover, the tool can also bring to light so-called *sustainability sinkholes*: what is sustainable in one place and for particular social actors might not be sustainable for others.

The workshops’ outcomes steered further literature review and individual interviews with key staff to make the four design principles more concrete and operational. The next step was then comparing workshop outcomes with new literature, which led to deepening the insights. These insights were then discussed in follow-up workshops with different audiences through iterative learning cycles. During 2021, insights from the reflexive workshops were summarized and presented to peers for validation purposes to directors and management of VHL. Table 1 provides a chronological overview of crucial steps in the research process and their outcomes.

3. Results

This section brings together the different insights gained through the interactive research, the scoping missions, workshops and discussions. The four design principles derived from Witteveen *et al.* (2016) were used to structure and analyse these insights, aimed to determine the extent to which the VHL Living Labs meet their own design requirements. Analysis of the reports and outcomes of the workshops (Table 1) resulted in observations of how the design principles were operationalized in practice and how the SDGs were addressed in Living Lab practices. Sense-making of the observations led to explaining factors that are critical for the successful performance of Living Labs regarding the design principles (see concluding overview of explaining factors in Table 2 on page #).

3.1 Fostering inclusive “quadruple helix” participation

The first design principle mentioned by Witteveen *et al.* (2016) refers to different kinds of stakeholders that are required to work together to address wicked problems: government agencies, knowledge institutes, the private sector and citizens. Each stakeholder possesses relevant knowledge, which combined, can bring about meaningful change. This asks for creative forms of transdisciplinary partnerships to co-create sustainable innovations.

The Living Labs examined have not yet reached the kind of collaboration that represents the “quadruple helix” participation design principle. The usual partners are universities, research institutes and small- and medium-sized enterprises (SMEs). The involvement of citizens and the public sector varies. Local people, whether farmers, indigenous people, citizens or users of a service, are involved but rather as informant and not yet as co-designer or co-decision maker of the research and learning agenda. In Living Labs in Ethiopia and Kenya, the dairy value chain is used to identify partners along the chain, from farmers groups to research institutes and consumers (Baars and Verschuur, 2020). In India, particularly governmental bodies are left out, but also critical civil society organizations are

Workshops	Participants	Outcomes
Orient management of VHL on SDGs as a compass method (April 2019)	2 directors, 5 managers and 3 policy advisors	Raised awareness about other views on SDGs beyond “silo-view”
Kick-off workshop (June 2019)	11 lecturers-researchers	Research design explained, informed consent by involved staff
Workshop and field visits with research partners in Kalimantan (July 2019)	12 researchers, mainly Indonesian, and stakeholders in the field were visited	Sustainability pathways for sustainable oil palm production identified; blind spots in SDGs in current research detected
Several workshops/meetings with research partners in Baramati-Pune districts using four design principles to assess Living Lab (LL) performance; applied initial SDGs as compass exercise (October 2019)	Stakeholders from university, private sector, NGOs, and farmers	Met new research partners from civil society and grassroots which were missing in the quadruple helix partnerships; review of research impact on SDGs and gaps
Workshop to review LL performance applying SDGs as compass and four design principles (May, 2020)	13 lecturers-researchers	Design principles of LLs assessed and ‘measured’ resulting in initial spider web diagram (first draft Figure 3)
Workshop on cross-overs between research and education in LLs (June, 2020)	11 lecturers-researchers (different composition compared to previous workshops)	Criteria identified for LLs to develop SDG competences, a.o. transformative capacity, of students, researchers and other stakeholders
Inter-vision of LLs Pune, India and Kalimantan, Indonesia using SDGs as compass and 4 design principles (June, 2020)	11 lecturers-researchers (mostly researchers)	Reflexive discussion on the performance of the LLs in more detail with particular attention to challenges in local contexts
Workshop on linking research and education in LLs. (November 2020)	11 lecturers-researchers (mostly lecturers)	Collection of Rich Practices for linking research and education in real-time settings.
Online workshops with research-partners in India to design action research on Transition Pathways to Climate-Resilient Farming Systems, Deccan (October 2020-January 2021)	Number of participants ranged from 7 to 30	Findings of this study enhanced performance of LL resulting in quadruple helix participation, reciprocal relationships among research partners, and a shared research agenda
SDGs as Compass method integrated in study programmes (Spring 2021)	5 lecturers and 150+ students	Students apply SDGs as compass on real-time cases and discover multiple views on sustainability and trade-offs,
Presentations of results to peers and management boards (2021)	Lecturers, professors, management staff and directors	Contribution to the new VHL institutional plan 2022-2025

Source: Authors’ own work

Table 1.
Reflexive (online)
workshops

Table 2.
Observations and
explanatory factors
per design principles
for VHL Living Labs

Design principle	Observation	Explanatory factors
1. Quadruple helix participation	– Mostly knowledge institutes and SMEs are involved; – HEI sets research agenda; focus on technological innovations; – Citizens, farmers, students and the public sector are hardly involved; – Farmers and citizens are just informants; and – Critical NGOs are absent.	– Funding agencies require the involvement of Dutch SMEs, preferably those which aim to test technological innovations; – Government's agencies perceived as bureaucratic, corrupt or having strategic agenda; – Critical reflections from farmers and NGOs on research are avoided; and – Researchers take on the traditional role as experts
2. Learning environments for a sustainable future	– Focus on obvious SDGs: SDG2 Zero Hunger, SDG12 Responsible production and consumption; SDG15 Life on land; SDG14 Life below water, SDG6 Clean water; SDG13 Climate action; – Indirect focus: SDG4 Quality education, SDG7 Clean energy, SDG8 Decent work, SDG9 Industry innovation; and – Blind spots: SDG5 Gender equality; SDG10 Reduced inequalities; SDG16 Peace, justice and strong institutions	– Researchers avoid challenging the unsustainable practices of stakeholders; – Research projects developed from a technological expert perspective taking silo-view on SDGs; and – Little attention on action-oriented capabilities, social learning and challenging prevailing systems which are unsustainable
3. Reflexivity in learning	– Learning processes are rarely conceptualized; no explicit learning agendas; and – Transformation component of applied research remains hidden	– Output and task-oriented research culture instead of learning, reflexivity and action – Experience, knowledge and interests of practitioners and citizens are not fully recognized
4. Interaction, knowledge sharing and system management	– Interactions, roles and relationships are not made explicit; and – Local actors are perceived as informants, not yet as partners or change-agents	– Research is goal-oriented overlooking the importance of developing reciprocal relationships; and – Open communication, honest reflection and accepting critical remarks are not self-evident
5. Transformative capacity	– This capacity is not yet developed; and – New knowledge is co-created but not yet actionable and change-oriented	– Debating unsustainable practices causing frictions are avoided; and – Researchers, lecturers and students take on the traditional role as researchers; not yet as transition-makers or change-agents

Source: Authors' own work

lacking as research partners in almost all Living Labs from VHL. Why were not all quadruple helix groups involved?

The first reason was related to the way the research was financed: most of VHL's research funds come from Dutch funding agencies such as the Dutch Taskforce for Applied Research (SIA), Government Office for Enterprising in The Netherlands (RVO) and the

Dutch Organisation for Scientific Research (NWO) which often require the involvement of Dutch SMEs as key research partners. They promote applied research focusing on *technological* or *sectoral* innovations. These SMEs share their products and services with local knowledge institutes and users, but their interest is also to explore international markets to sell their products for profit. A critical perspective by concerned civil society organizations or by researchers on who benefits from such technological innovation is not required.

A second reason relates to hidden assumptions, stereotyping and beliefs of researchers, which play a role in (not) selecting specific partners. These include cross-cultural differences, like, for instance, Dutch culture valuing non-hierarchical relationships, which might not rhyme with hierarchical, power distant cultures abroad (Hofstede, 1991). During the inter-vision workshop, some researchers mentioned that *involving government bodies and critical civil society organizations might cause tensions, and it will be challenging to create “safe” research and learning environments*. Government agencies – as one researcher mentioned – are perceived as bureaucratic, corrupt and having political agendas, and therefore, difficult to engage in building trusted relationships. Acknowledging that frictions and tensions are part of change processes seems to be difficult to accept or to deal with for both Dutch and their international partners. However, “dealing with diversity and tensions” is exactly one of the SDG-competences that students, lecturers and researchers should develop to be able to address wicked persistent challenges (Wals, 2020; Wiek et al., 2011).

Related to this, VHL-researchers raised a third reason for missing specific partners: research initiatives are predominantly developed from an expert perspective (technological, sectoral focus) and less from a local or more complicated societal perspective (social transition focus). This self-reflection triggered a discussion about *whose* sustainability issue does the university aim to support through research, what kind of sustainability change processes does the university envision and what does this mean for the “positioning” of researchers? It is an illusion to think that sustainability transitions happen without tensions: differing views and frictions are inherent to quadruple helix partnerships, which relate to power dynamics, different values and interests. Gamache et al. (2020) – based on their bibliometric analysis and study of Living Lab practices worldwide in agroecological transitions – confirm that most Living Lab approaches focus on the dissemination of technological innovations to users, and none of them relates to agroecological transitions of agri-food systems (ibid: 94).

The systemic nature of sustainability themes requires all stakeholders to be involved. McCrory et al. (2020) arrive at the conclusion that transitions require a profound overhaul of the way we produce, process, distribute and consume food and goods, moving from a technological product and service-oriented framing of Living Labs towards including a transition and governance perspective. Tulder and Keen (2018) argue that partnership configuration flows from the issue at stake: the bigger the wickedness and urgency of a problem, the greater the need for systemic change, the more stakeholders need to be involved linking top-down policymakers, planners and government agencies with bottom-up alternative perspectives. Various scholars propose to strategically select grassroots initiatives as partners like concerned citizens, farmers’ cooperatives and civil society organizations (Gamache et al., 2020; Wittmayer et al., 2021). Specifically, when these partners and their networks experiment on sustainable alternatives, have a sense of urgency, are willing to spend their time and energy to mobilize and organize collective action and dare to challenge vested interests and dominant unsustainable policies and practices (Gamache et al., 2020). It is crucial to further include actors who could foster interaction and broker between society, science and policy (Metha et al., 2019).

3.2 Create authentic learning environments that focus on a sustainable future

The second design principle refers to Living Labs as learning environments where stakeholders in real-life settings bring the aspirations of the SDGs on a shared agenda. It is without doubt that VHL’s applied research and education contribute to “sustainability”. However, if we take the *SDG as compass* method seriously, a “sustainable future” rather refers to a holistic change process recognizing the multiple perspectives and agency of different stakeholders. In one of the workshops, researchers scored the Living Lab research on a scale 1–5, using the *SDGs as a compass* as a “spider web”. It was observed that many SDGs – particularly those related to food production and consumption, life on land, clean water and climate action – are directly addressed, but several blind spots exist. Most striking are social inclusion (SDG5), addressing power inequalities (SDG10) and just institutions (SDG16), which are neglected in the applied research projects (Figure 3). These all relate to issues of power, politics, actors and agency, meaning that the *socio-institutional perspective* on transition thinking is absent (Loorbach et al., 2017). The remaining SDGs were more difficult to “measure”: we assumed that VHL’s applied research has a more indirect impact on them, but we could not provide sufficient evidence to assess progress. More research is required to measure how VHL’s applied research *enables* contribution to these SDGs (Nilsson, 2018).

Working on a sustainable future implies a willingness to engage with differences, frictions and to engage in the political arena with stakeholders involved in unsustainable practices. This engagement for sustainable changes is not yet practised in the Living Labs of VHL. Its current research agenda aims to gain and co-create new knowledge and insights on the issues at stake that are receptive for especially technical, sectoral solutions referred to



Figure 3. SDGs as a compass spiderweb showing progress (green), indirect progress (light green) and blind spots (red) towards the SDGs, based on evaluation of the Living Labs

Source: Authors’ own work

by [Loorbach et al. \(2017\)](#) as the *socio-technical perspective* on transitions. Little emphasis is put on developing action-oriented capabilities, on social learning and challenging prevailing systems, culture and practices.

From literature on sustainability-oriented learning ([Wals, 2020](#); [Barnett and Jackson, 2020](#)), a set of criteria for Living Labs for being suitable learning environments to develop “SDG-competences” can be derived. These criteria are especially relevant to prepare students to work in complex, unpredictable settings:

- Interaction between different stakeholders in real-life settings.
- Discussing values, norms and ethics.
- Engage constructively with diversity and conflicts.
- Develop creative, innovative, transformational capacity.

These criteria are based on a pedagogy which is *relational* (allowing for, caring for and connecting with people, places and other species), *critical* (allowing for critique and questioning), *ethical* (opening spaces for ethical considerations and moral dilemmas) and *political* (confrontational, challenging prevailing power relations, structures, cultures and practices). When discussing these criteria and reflecting on the extent to which VHL’s Living Labs comply, we observed that the first criterion is met: different actors contribute their expert, tacit and practitioners’ knowledge and learn together, while the other three criteria seem to be avoided to circumvent difficulties. To make tacit knowledge explicit and dealing with plural, opposing views can be a challenge. It requires trust, credibility of the initiator and genuine engagement with actors and their struggles. Researchers in the Living Labs do discuss values and norms, mainly to build trusted relationships and often in an informal setting, but discussing ethics is considered difficult and sensitive because prevailing unsustainable cultures and routines are challenged. This is essentially what transformations are about: how to change these practices (criteria d.). The researchers lacked the ability to produce knowledge that is actionable and to challenge prevailing unsustainable policies and practices, which [Loorbach \(2014\)](#) defines as *transformative capacity*.

3.3 Stimulating reflexivity in learning and innovation for sustainability

As discussed in the previous design principle, Living Labs are sustainability-oriented learning environments, but conceptualizing the “learning process” itself is relatively new. Different conceptualizations of “learning” are used interchangeably – collaborative learning, organizational learning, social learning, joint learning, interactive learning, learning-by-doing – but conceptual nuances are often ignored or loosely applied ([Mierlo and Beers, 2020](#)). “Social learning” is the most common learning tradition in Living Labs. [Sol \(2018\)](#) defines “social learning” as an interactive, dynamic process in a multi-actor setting where knowledge is exchanged, and where actors learn through dialogues, and where knowledge is co-created through continuous interaction and iterative action-reflection cycles. Here, “social learning” could contribute to systemic change since a collective basis is formed for networked action. A risk of this social learning is that stakeholders get caught up in tensions or conflicts about direction, choices made, values and many other things. As discussed earlier, these tensions are inherent to processes of change and relate to a lack of trust, commitment or willingness to change one’s own viewpoint, behaviour or to reconsider possible solutions (*ibid*). Tense situations can stagnate the learning process or the network of stakeholders can fall apart or, when handled well, could lead to the re-orientation of values, goals and viewpoints. If the latter happens, *reflexivity* takes place: it is a way of learning where hidden beliefs, worldviews, values and interests are made explicit by asking,

“are we doing the right things, or should we start doing something completely different?” Reflexivity encourages groups and networks to look at a situation or issues from plural perspectives, which lead to changing perceptions, rules, institutions, practices and relations (Mierlo and Beers, 2020; Wittmayer *et al.*, 2021). Reflexivity among stakeholders can be stimulated by competent facilitators of change using specific instruments or tools that encourage stakeholders to question and re-orient their values, knowledge, roles and actions to take (Sol, 2018). Also, students in the role of “knowledge-broker” in regional development projects in Living Labs can encourage reflexivity by action research, exchanging viewpoints, creating possibilities for debates and ultimately for joint planning of interventions and actions.

From the workshops, it turned out that the *change* or *transformation* component of applied research remains hidden or it is assumed that practice will change after the research ends when findings are shared. Most of the applied research lacks an explicit “learning agenda” or conceptualization of “learning”. Research culture in the Living Labs was output and task-oriented rather than dealing with learning, reflexivity and action.

Looking at the kind of innovations developed in the Living Labs (Peterson, 2013), they are partly technical innovations (improving breeds, recording of milk production, dairy processing techniques) and partly adaptive innovations (new business models to ensure sustainable livelihoods; adapted cropping patterns like paludiculture in Kalimantan, Indonesia) but still with a high technical focus. Innovations resulting in transformative or systemic change are not yet visible or happening, which most likely relates to weaknesses in the operationalization of the previously discussed design principles.

3.4 Facilitate interaction, knowledge sharing and open system management

The nature of interactions between researchers and the involved stakeholders varies in the different research initiatives and is not always made explicit. In most international Living Labs, local actors *are* involved in the research, but rather as “informant” and not as partner or change-agent. In the Living Lab in India, this is changing: the “Sahiwal Club” – a network of farmers with indigenous cow breeds – is involved in setting the research agenda and directly benefits from the research.

During the inter-vision-workshop, researchers realized that they would gain from mutual social learning with those stakeholders who know the local context. In Maharashtra, interaction with local partners supported the process of understanding the history of the area, the issues at stake, priorities of local people and possible desirable solutions. Through online workshops in late 2020, they were involved in designing the research and learning agenda, decided on where the research is being done, and what the different roles and responsibilities are of each stakeholder. The interactions further resulted in increased trust, joint understanding of each other’s expertise, motivation to join the research and network building (Wittmayer *et al.*, 2021).

Getting to know each other and building trust are pre-requisites for building *reciprocal relationships*, meaning that all stakeholders are willing and competent in articulating their views and opinions. Unfortunately, this process was severely hampered by the COVID-19 pandemic. Open communication, honestly reflecting on one’s own performance, admitting weaknesses and accepting critical remarks are not self-evident and should also be goals in the research process (Tromp *et al.*, 2009, p. 232). Reciprocal relationships are of crucial importance to keep interactive research going, especially during intervals when no project funding is available or visiting research sites has become impossible due to safety or security reasons.

So, interaction should go beyond knowledge exchange and co-creation and lead to joint action and social change. Therefore, a fifth design principle for Living Labs came forward: *Develop transformative capacity to challenge prevailing systems, cultures and practices*, which is further explained below.

3.5 *Develop transformative capacity to challenge prevailing systems, cultures and practices*

The review of the four design principles highlights the importance of developing transformative capacity of researchers, lecturers and students. *Transformative capacity* refers to the ability to deal with diversity in norms, values, beliefs, encourage reflexivity when facilitating multi-stakeholder processes and collectively create knowledge that is *actionable* and contributes to sustainable change. The actions must make sense of plural visions among stakeholders on sustainability. They particularly aim to address the blind spots related to SDGs targeting gender equality, reduced inequality and just institutions. These are fundamental to achieving progress towards the other SDGs. Researchers – and graduates – must, therefore, adopt new and often challenging roles as facilitators of change, transition-makers or brokers beyond the traditional role of researchers providing knowledge and advice (Wittmayer *et al.*, 2021). Together with context-specific stakeholders, students, researchers and lecturers learn, act and navigate through transition processes in different contexts, thereby interacting with power dynamics (Avelino and Wittmayer, 2018). Being actual engaged as “student/researcher” and “facilitator of change” in real-time settings means that “research encounters” include negotiations, frictions and conflicts; rather than a nuisance, these disruptive experiences reveal new insights and contribute to advance understanding of how change happens (Heijmans, 2012). This is not always easy and requires courage and perseverance.

4. Discussion

We investigated how the Living Labs at VHL perform as sustainability-oriented learning environments, using both the four design principles of Witteveen and the *SDGs as a compass* method. Our findings show that the performance of these Living Labs, and thus how to operationalize the SDGs, ultimately depends on three improvements in the design:

- (1) firstly, transformative capacity;
- (2) secondly, the nature of relationships and quality of interactions among stakeholders; and
- (3) finally, on the sources and structure of financing that influence the direction of research and actions.

4.1 *Develop transformative capacity to challenge prevailing systems, cultures and practices*

As stated in the introduction, HEIs have a significant role to play in systemic change as they educate the leaders of transitions towards sustainability. Wals (2020, p. 61) argues that sustainability could become a driver of educational innovation, while simultaneously, education and learning can become drivers for sustainability transitions. The research results show the need to expand the scope of applied research from knowledge co-creation with relevant stakeholders to include a change and transformation component. This implies acknowledging plural views on sustainability and questioning current unsustainable systems, cultures and practices: What do we consider “sustainable”? Who decides what is sustainable and how to achieve that? Who benefits and who does not? How to address the blind spots which appear when using the SDGs as a compass? What is needed to phase-out

unsustainable systems, cultures and practices, and how to build-up sustainable ones? “Sustainability” requires constant deliberation, questioning, negotiation and experimentation (Wals, 2020, p. 62).

Debating and answering the above questions require specific SDG-transition competences such as collaborative communication, engaging constructively with diversity and conflicts and daring to discuss values, norms and ethics. When HEIs aim to educate staff and future graduates to become transition-makers or facilitators of change – and to develop this transformative capacity – it requires that the educational system of HEIs itself must become the subject of change as well. These SDG-transition competences are best developed in real-life, open education settings such as in Living Labs, where the divide between education, research and contributing to societal transitions gets blurred. Additionally, HEIs should not just educate students in one discipline but also encourage interdisciplinarity by developing joint modules for students from natural and social disciplines – and trans-disciplinarity where students actively engage in real-world settings contributing to systemic change. These joint learning environments aim to facilitate social learning, co-creation of new knowledge but also learning from sense-making together with practitioners, farmers, government officers, civil society organizations and the private sector to develop an action agenda for change. These processes of joint learning bring together multiple research perspectives, and it would be helpful if students learn to appreciate different research methodologies, including action research (Wittmayer *et al.*, 2021).

Equally important is to understand how “sustainability transitions” happen, how to deal with power dynamics and uncertainty and how to arrive at new governance arrangements through participatory processes of visioning, learning and experimenting. It also implies that, at times, researchers, lecturers and students are confronted with difficult and uncomfortable questions. HEIs should, therefore, create *safe and brave spaces* within their institution where there is room for reflection, (un)learning, constructive dialogue and collective sense-making (DIT platform, 2023). These spaces can further be organized with international partner universities to learn how sustainability solutions in one place impact on localities elsewhere in the world and vice versa. Higher education is more than a way to acquire knowledge, skills and a diploma. It also allows students to develop emotionally and relationally, to discover what they value, where they wish to make a difference in society and in which role they wish to contribute to a sustainable future. Nowadays, scholars generally accept that research and learning in authentic, real-world settings is needed to create impact (Turnheim *et al.*, 2020).

4.2 Nature of relationships and quality of interactions

The nature of relationships and quality of interactions among stakeholders can be greatly improved when using the *SDGs as a compass* method. Our Living Labs approach enhanced the dialogue among stakeholders and researchers who think differently about *sustainable development*. However, using this approach implies that students, researchers and lecturers should become familiar with a broader repertoire of research methods (qualitative, quantitative and action research). This can be achieved in interdisciplinary education (involving knowledge from different disciplines) and in real-time research settings involving practitioners’ knowledge (transdisciplinary research). Also, the knowledge and agency of those who experience persistent challenges (like minorities) is needed for unravelling context-specific problems and for designing inclusive and effective change-pathways. Students, lecturers and researchers will develop skills to understand power dynamics, to engage with stakeholders who promote unsustainable policies and practices and to deal with frictions. Only then the blind spots can be addressed.

Using the *SDG as a compass* method to review the second and third design principle – *create authentic learning environments* and *stimulate reflexivity in learning* – emphasized that a university has three missions: education, research and engagement (Chankseliani and McCowan, 2021). These three missions can best be achieved in Living Labs, where the distinction between classroom teaching and applied research in real-life settings gets blurred [5]. Living Labs are conducive sustainability learning environments only when the conceptualization of Living Labs shifts from a technological innovation's orientation towards transformative change (Loorbach *et al.*, 2017; van Mierlo and Beers, 2020; McCrory *et al.*, 2020).

Such a shift is not easy. Some stakeholders will favour picking SDGs, such as SMEs, which focus on profitability for their company or farmers prioritizing sufficient income for their family on the short term. Dialogue and reflexivity – inherent part of our method – will enhance mutual understanding about why they focus on profit or short-term income and what they need to make a transition possible. In this way, Living Labs expose students, researchers, lecturers to relational and political issues in society and develop their competences as *transition-experts* (VHL, 2021).

The review of the fourth design principle – facilitate interaction, knowledge-sharing and open system management – discussed the nature of relationships and quality of interactions, emphasizing that building trust and establishing reciprocal relationships among stakeholders are a pre-requisite for open communication, reflexivity and jointly engage in a learning and change process. Tromp *et al.* (2009) recommend to regard “building reciprocal relationships” as a goal of the research and learning process as well. Therefore, we suggest reformulating the fourth design principle into *facilitate interaction, social learning and reciprocal relationships*.

4.3 Financing

How well the Living Labs operationalize the SDGs also relates to the general way of financing transitions in a country, which is not yet well-researched. This is surprising given the important role of financing in supporting experiments, upscaling and system change (Turnheim *et al.*, 2020). We see that sustainability transitions require more process-oriented than project-oriented financing systems. Funding organizations could, therefore, be involved as stakeholder or as shareholder or investor. SDG17 refers to strengthening domestic resource mobilization and to re-orient financial policy and investments. This implies that it is crucial to look for finance and funding *within* the research context: What are existing budget cycles made available for innovations by local and national governments or by the private sector? Which budgets can be applied for by local communities and organizations (annual or five-year budget cycles) to support the change process? What kind of financial incentives or policies exist to re-orient investments? How can we disclose responsibilities and accountability rules, standards and labels for sustainable financial products, speculative investments or lobby for fairer prices for farmers (Turnheim *et al.*, 2020, p. 118)? Instead of becoming dependent on (large) external grants – which substantially determine the research agenda – it might be wiser to look for a wide range of finance options, preferably arranged by or coming from (grassroots) stakeholders involved in the transition process. If stakeholders together become responsible for resources, either financial, human or political, they can also determine how these resources will be allocated and for what purpose. This will create reciprocity and a more sustainable fundament for change. Additionally, when Living Labs address issues that are *urgent*, stakeholders are willing to invest their time, energy, leadership, networks and other resources in the change and learning process beyond financial means. These resources – called “effective agency” – are equally important as finance. Also, students can bring research and action processes forward by maintaining relationships and through small deliverables, even without funding.

5. Conclusions

This research reveals the need to redefine the Living Lab approach: Living Labs should be viewed in terms of learning configurations, looking at sustainability issues from different angles and worldviews. For this, it is necessary to deal with power, question values and engage with grassroots organizations and marginalized groups. Finally, it is necessary to advocate for sustainability transitions and challenge unsustainable policies and practices. This can best be practised in authentic, real-world settings to create impact (Turnheim *et al.*, 2020). Living Labs offer an environment for this. Based on this research, we came to five conclusions for redefining the Living Lab approach to have more impact on transitions towards sustainability and (societal) learning.

Firstly, the *SDGs as a compass* method helps to facilitate a dialogue among the different stakeholders and to make their views and interests explicit. So, Design Principle 1, *Fostering inclusive “quadruple helix” participation*, does not just refer to the principle of involving different stakeholders but rather stresses the relevance of plural views on sustainable development and multiple research practices (Wittmayer *et al.*, 2021, p. 7). Differing views on sustainability and frictions are inherent to quadruple helix partnerships, which relate to power dynamics, different values and interests (Gamache *et al.*, 2020; McCrory *et al.*, 2020).

Secondly, the *SDGs as a compass* method revealed that much research, although contributing to sustainability, still takes a silo-view. The socio-institutional perspective on transitions is largely absent (Loorbach *et al.*, 2017). More attention should be paid to transition-thinking in research and education, on developing action-oriented competences, on processes of joint learning and challenging prevailing systems and practices. It is, therefore, crucial to view the SDGs as interdependent and recognizing plural and holistic views on sustainability. The SDGs as a compass method enhanced dialogue and mutual understanding among researchers, lecturers and students from different disciplines. We see the potential of this method to identify likely trade-offs or spill-overs, which enable stakeholders to search for ways to manage conflicts.

Thirdly, *Stimulating reflexivity in learning and innovation* should become more central in Living Lab practices. “Social learning” does not just refer to exchange and co-create new knowledge but particularly stresses the importance of questioning underlying assumptions, values and views on sustainable development (Sol, 2018). Reflexivity encourages stakeholders to look at a situation from plural perspectives, which lead to changing perceptions, rules and relations (Mierlo and Beers, 2020; Wittmayer *et al.*, 2021). Reflexivity is required to understand how change happens, while the *SDG as a compass* method supports redirecting strategies towards a sustainable future. We recommend that lecturers pay more attention in their curricula to question “how change happens” and what is meant with “interaction” and “how stakeholders learn”. Stimulating reflexivity in learning and innovation should become a separate Working Package in new research proposals and implementation.

Fourthly, in most Living Labs, local stakeholders are involved in the research but rather as *informants*, and not yet as *partners or change-agents*. In the new Living Labs, research initiatives should come from society and no longer from universities. Local stakeholders usually seek close relationships with civil society organisations, local non-governmental organisations (NGOs) or SMEs. They meet government agencies, the private sector and universities at open fora, consultations, conferences, or during protests and in the media when urgent issues are *not* addressed adequately. Relationships vary between harmonious and antagonistic. Transition experts and researchers should first explore the nature of these relationships – before co-developing research and learning agendas – by getting to know each other and building trust. These are pre-requisites for building reciprocal relationships

and trust, needed to create mutual understanding and willingness to honestly reflect on one's own performance and values, and to engage in a joint learning and change process.

Fifthly and finally, the key conclusion is that we need a fifth design principle on “developing transformative capacity”. Therefore, VHL needs to *develop transformative capacity through its education and research programmes*. *Transformative capacity* refers to competences such as collaborative communication, engaging constructively with diversity and conflicts and daring to discuss values, norms and ethics. This capacity is best developed in Living Lab settings where the three missions of a HEI blend: education, research and engagement with society. To make this happen, Living Labs should be safe and guided interdisciplinary and transdisciplinary learning environments where students, researchers and practitioners learn and address uncomfortable questions. In these learning environments, the researcher is no longer the expert, but needs to accept that addressing complex issues and contributing to systemic change requires collective efforts where the knowledge of all those involved matters.

The encounters during this research generated positive energy and motivation among researchers to use the *SDGs as a compass* for applied research and to strengthen the link with education. VHL's recent Institutional Plan 2022–2025, titled *Developing as experts in transition*, took notion of some of this research insights. Research on Living Labs as an authentic learning environment for sustainability will be continued within the innovations of regional sustainability: European University Alliance. It is clear though, that “transformative education and research” require institutional changes within HEIs as well. It is important that a university views itself as a learning organization in transition to further improve its performance and practices towards a sustainable future and deliver graduates who are competent to deal with the complex challenges around us. Through this paper, we expect to disseminate our findings and to further contribute to this shift in higher education.

Notes

1. They represented the following disciplines: International Development, Tropical Forestry, Land and Water Management, Animal Husbandry, Environmental Studies, Dairy Value Chains, Sustainable Agribusiness in Metropolitan Areas and Management of the Living Environment.
2. These Living Labs were selected because of the authors' active involvement there.
3. These are the countries where the 29 researchers-lecturers are engaged in Living Labs.
4. This research complied with the [Netherlands Code of Conduct for Research Integrity \(2018\)](#), referring to the five principles – honesty, scrupulousness, transparency, independence and responsibility.
5. <https://greattransition.org/> the Pedagogy of Transition: Educating for the future we want.

References

- Avelino, F. and Wittmayer, J. (2018), “Transformative social innovation and its multi-actor nature”, Howaldt, J., Kaletka, C., Schröder, A. and Zirngiebl, M. (Eds), *Atlas of Social Innovation–New Practices for a Better Future*, Sozialforschungsstelle, TU Dortmund University, Dortmund, pp. 47–50.
- Baars, R.M.T. and Verschuur, C.M. (Eds) (2020), *Inclusive and Climate Smart Business Models in Ethiopian and Kenyan Dairy Value Chains (CSDEK), Practice Briefs 2019–2020*, Van Hall Larenstein University of Applied Sciences, Velp, doi: [10.31715/2020.2](https://doi.org/10.31715/2020.2).
- Barnett, R. and Jackson, N. (Eds), (2020), “Ecologies for learning and practice: emerging ideas”, *Sightings and Possibilities and Political Paradoxes*, Routledge, London and New York, NY, doi: [10.1080/08941920.2020.1831673](https://doi.org/10.1080/08941920.2020.1831673).

- Biggeri, M., Clark, D.A., Ferrannini, F. and Mauro, V. (2019), "Tracking the SDGs in an 'integrated' manner: a proposal for a new index to capture synergies and trade-offs between and within goals", *World Development*, Vol. 122, pp. 628-647, doi: [10.1016/j.worlddev.2019.05.022](https://doi.org/10.1016/j.worlddev.2019.05.022).
- Chankseliani, M. and McCowan, T. (2021), "Higher education and the sustainable development goals", *Higher Education*, Vol. 81 No. 1, pp. 1-8, doi: [10.1007/s10734-020-00652-w](https://doi.org/10.1007/s10734-020-00652-w).
- Design Impact Transition (DIT) platform (2023), "How universities are organising themselves to create societal impact", blogpost, Erasmus University Rotterdam.
- Eweg, R., Rankenberg, B., Verschuur, M. and Agarwal, P. (2017), *Family dairy tech India, Advisory Report*, Van Hall Larenstein University of Applied Sciences, Velp, doi: [10.31715/2019.3](https://doi.org/10.31715/2019.3).
- Fonseca, L.M., Domingues, J.P. and Dima, A.M. (2020), "Mapping the sustainable development goals relationships", *Sustainability*, Vol. 12 No. 8, p. 3359, doi: [10.3390/su12083359](https://doi.org/10.3390/su12083359).
- Gamache, G., Anglade, J., Feche, R., Barataud, F., Mignolet, C. and Coquil, X. (2020), "Can living labs offer a pathway to support local Agri-food sustainable transitions?", *Environmental Innovation and Societal Transitions*, Vol. 37, pp. 93-107, doi: [10.1016/j.eist.2020.08.002](https://doi.org/10.1016/j.eist.2020.08.002).
- Hajer, M., Nilsson, M., Raworth, K., Bakker, P., Berkhout, F., Boer, Y.D., Ludwig, K. and Kok, M. (2015), "Beyond cockpit-ism: four insights to enhance the transformative potential of the sustainable development goals", *Sustainability*, Vol. 7 No. 2, pp. 1651-1660.
- Heijmans, A. (2012), "Risky encounters: Institutions and interventions in response to recurrent disasters and conflict", PhD Thesis, Wageningen University, available at: <http://edepot.wur.nl/202163>
- Herr, K. and Anderson, G.L. (2005), *The Action Research Dissertation: A Guide for Students and Faculty*, Sage Publications, London, doi: [10.4135/9781452226644](https://doi.org/10.4135/9781452226644).
- Hofstede, G. (1991), *Cultures and Organizations: Software of the Mind*, McGraw-Hill, London.
- Köhler, J., Geels, F.W., Kern, F., Markard, J., Onsongo, E., Wiczeorek, A., Floortje, A., Avelino, F., Bergek, A., Boons, F., Fünfschilling, L., Hess, D., Holtz, J., Hyysalo, S., Jenkins, K., Kivimaa, P., Martiskainen, M., McMeekin, A., Mühlemeier, M.S., Nykvist, B. and Wells, P. (2019), "An agenda for sustainability transition research: state of the art and future directions", *Environmental Innovation and Societal Transitions*, Vol. 31, pp. 1-32, doi: [10.1016/j.eist.2019.01.004](https://doi.org/10.1016/j.eist.2019.01.004).
- Loorbach, D. (2014), "To transition! governance Panarchy in the new transformation, inaugural address", available at: <https://drift.eur.nl/nl/publicaties/transition-governance-panarchy-new-transformation/> (accessed 21 July 2021).
- Loorbach, D., Frantzeskaki, N. and Avelino, F. (2017), "Sustainability transitions research: transforming science and practice for societal change", *Annual Review of Environment and Resources*, Vol. 42 No. 1, pp. 599-626, available at: www.annualreviews.org/doi/abs/10.1146/annurev-environ-102014-021340
- McCrory, G., Schapke, N., Holmen, J. and Holmberg, J. (2020), "Sustainability-oriented labs in real-world contexts: an explanatory review", *Journal of Cleaner Production*, Vol. 277, pp. 1-18, doi: [10.1016/j.jclepro.2020.123202](https://doi.org/10.1016/j.jclepro.2020.123202).
- Maas, T., Broek, J. and Deuten, J. (2017), *Living Labs in Nederland: Van Open Testfaciliteit Tot Levend Lab*, Rathenau Instituut, Den Haag.
- Metha, L., Srivastava, S., Adam, H.N., Alankar, Bose, S., Ghosh, U. and Kumar, V. (2019), "Climate change and uncertainty from 'above' and 'below': perspectives from India", *Regional Environmental Change*, Vol. 19, pp. 1533-1547.
- Mierlo, B. and Beers, P.J. (2020), "Understanding and governing learning in sustainability transitions: a review", *Environmental Innovation and Societal Transitions*, Vol. 34, pp. 255-269, doi: [10.1016/j.eist.2018.08.002](https://doi.org/10.1016/j.eist.2018.08.002).
- Netherlands Code of Conduct for Research Integrity (2018), doi: [10.17026/dans-2cj-nvwu](https://doi.org/10.17026/dans-2cj-nvwu).
- Nilsson, M., Chisholam, E., Griggs, D., Howden-Chapman, P., McCollum, D., Messerli, P., Neumann, B., Stevance, A., Visbeck, M. and Stafford-Smith, M. (2018), "Mapping interactions between

- sustainable development goals: lessons learned and ways forward", *Sustainability Science*, Vol. 13 No. 6, pp. 1489-1503, doi: [10.1007/s11625-018-0604-z](https://doi.org/10.1007/s11625-018-0604-z).
- Norren, D.E. (2020), "The sustainable development goals viewed through gross national happiness, Ubuntu, and Buen Vivir", *International Environmental Agreements: Politics, Law and Economics*, Vol. 20, pp. 431-458, doi: [10.1007/s10784-020-09487-3](https://doi.org/10.1007/s10784-020-09487-3).
- Peterson, H.C. (2013), "Fundamental principles of managing multi-stakeholder engagement", *International Food and Agribusiness Management Review*, Vol. 16, pp. 11-21, doi: [10.22004/ag.econ.155141](https://doi.org/10.22004/ag.econ.155141).
- Purcell, W.M., Henriksen, H. and Spengler, J.D. (2019), "Universities as the engine of transformational sustainability toward delivering the sustainable development goals 'living labs' for sustainability", *International Journal of Sustainability in Higher Education*, Vol. 20 No. 8, pp. 1343-1357, doi: [10.1108/IJSHE-02-2019-0103](https://doi.org/10.1108/IJSHE-02-2019-0103).
- Rachmanadi, D., Faridah, E., Sumardi, S., van der Meer, P. and Qirom, M.A. (2021), "The effect of flooding and light competition on the planting success of degraded tropical peatland", *Jurnal Galam*, Vol. 1 No. 2, pp. 123-140, doi: [10.20886/GLM.2021.1.2.123-140](https://doi.org/10.20886/GLM.2021.1.2.123-140).
- Raworth, K. (2017), *Doughnut Economics: Seven Ways to Think like a 21st-Century Economist*, Random House Business Books, London.
- Sol, J. (2018), "Reflexively stumbling towards sustainability: understanding social learning in regional governance networks", PhD dissertation, Wageningen University, doi: [10.18174/448662](https://doi.org/10.18174/448662).
- Ståhlbröst, A. and Holst, M. (2012), *The Living Lab Methodology Handbook*, Luleå University of Technology and CDT, Sweden.
- Stephens, J.C. and Graham, A.C. (2010), "Toward an empirical research agenda for sustainability in higher education: exploring the transition management framework", *Journal of Cleaner Production*, Vol. 18 No. 7, pp. 611-618, doi: [10.1016/j.jclepro.2009.07.009](https://doi.org/10.1016/j.jclepro.2009.07.009).
- Svensson, L., Ellström, P.-E. and Brulin, G. (2007), "Introduction – on interactive research", *International Journal of Action Research*, Vol. 3 No. 3, pp. 233-249, available at: <https://nbn-resolving.org/urn:nbn:de:0168-ssolar-356352>
- Swedberg, R. (2020), "Exploratory research", in Elman, C., Gerring, J. and Mahoney, J. (Eds), *The Production of Knowledge, Enhancing Progress in Social Science*, Cambridge University Press, pp. 17-42, doi: [10.1017/9781108762519](https://doi.org/10.1017/9781108762519).
- Tromp, C., Beukema, L. and Almekinders, C. (2009), "Research in action: the core business", Almekinders, C., Beukema, L. and Tromp C. (Eds), *Research in Action: Theories and Practices for Innovation and Social Change*, Mansholt publication series, Vol. 6, pp. 221-242, available at: <https://edepot.wur.nl/123348>
- Tulder, R. and Keen, N. (2018), "Capturing collaborative challenges: designing complexity-sensitive theories of change for cross-sector partnerships", *Journal of Business Ethics*, Vol. 150 No. 2, pp. 315-332, doi: [10.1007/s10551-018-3857-7](https://doi.org/10.1007/s10551-018-3857-7).
- Turnheim, B., Asquith, M. and Geels, F.W. (2020), "Making sustainability transitions research policy-relevant: challenges at the science-policy interface", *Environmental Innovation and Societal Transitions*, Vol. 34, pp. 116-120, doi: [10.1016/j.eist.2019.12.009](https://doi.org/10.1016/j.eist.2019.12.009).
- VHL (2018), *Grenzeloos Groen, Institutional Plan 2018-2021*, Van Hall Larenstein UAS, Velp-Leeuwarden.
- VHL (2021), "Growing as experts in transition, institutional plan 2022-2025", Van Hall Larenstein UAS, Velp-Leeuwarden, available at: https://issuu.com/menc_hvhl/docs/instellingsplan_hvhl_2022-2025_en?e=1398183513/91108429
- Wals, A. (2020), "Sustainability-oriented ecologies of learning: a response to systemic global dysfunction", in Barnett, R. and Jackson, N. (Eds), *Ecologies for Learning and Practice: Emerging Ideas, Sightings and Possibilities*, Routledge, London and New York, NY, doi: [10.4324/9781351020268-5](https://doi.org/10.4324/9781351020268-5).
- Weick, K.E., Sutcliffe, K.M. and Obstfeld, D. (2005), "Organizing and process of sensemaking", *Organization Science*, Vol. 16 No. 4, pp. 409-412.

- Westerlund, M. and Leminen, S. (2011), "Managing the challenges of becoming an open innovation company: experiences from living labs", *Technology Innovation Management Review*, Vol. 1 No. 1, pp. 19-25, doi: [10.22215/timreview/489](https://doi.org/10.22215/timreview/489).
- Wiek, A., Withycombe, L. and Redman, C.L. (2011), "Key competences in sustainability: a reference framework for academic program development", *Sustainability Science*, Vol. 6 No. 2, pp. 203-218, doi: [10.1007/s11625-011-0132-6](https://doi.org/10.1007/s11625-011-0132-6).
- Witteveen, L., Ewig, R., Smits, T. and Voskamp-Harkema, W. (2016), "Design principles for living labs aiming at sustainable development: the role of higher education in living labs", paper presented on the 'Competence 2016 Wageningen Conference' on competences, theory and practice, Wageningen, available at: <https://tinyurl.com/2th8fn4j> (accessed 21 July 2021).
- Wittmayer, J., Loorbach, D., Bogner, K. and Hendlin, Y. (2021), "Transformative Research: Knowledge and action for just sustainability transitions", DIT Working Paper for positioning transformative research, Impact Transition Platform, Erasmus University Rotterdam, doi: [10.13140/RG.2.2.28485.99047](https://doi.org/10.13140/RG.2.2.28485.99047).
- Wollaert, P. (2017), "How to operationalize the SDGs in practice", NEDWORC meeting on 19 September 2017, Karidoor, Utrecht.

About the authors

Annelies Heijmans is a Senior Lecturer–Researcher at Van Hall Larenstein University of Applied Sciences in Velp, The Netherlands, at the Department of International Development Studies. Her work relates to transdisciplinary collaboration methods and sustainability transitions in contexts of disasters, climate change and conflict. Annelies Heijmans is the corresponding author and can be contacted at: Annelies.Heijmans@hvhl.nl

Rik Ewig is a Professor of Applied Sciences at Van Hall Larenstein University of Applied Sciences in Velp, The Netherlands. His professorship is about Regional Transitions towards Circular Farming Systems and designing Transition Pathways towards sustainable rural regions.