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A Tool to Support the Sustainability Transformation of Universities

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From Living Labs on Campus to the Campus As a Living Lab: A Tool to Support the Sustainability Transformation of Universities

Annika Herth, Nina Vogel, and Michael Bossert

Abstract Higher Education Institutions can play a crucial role in tackling today's complex societal challenges through their innovation capacity. This capacity could be further unleashed by leveraging their vast knowledge base and opportunities for experimentation, collaboration, and co-creation on campus sites. In this regard, Living Labs represent a promising approach to solving complex social problems and are already being used in many Higher Education Institutions worldwide. However, there remains a need for a comprehensive understanding of their implications and implementation requirements, particularly when Higher Education Institutions aim to structurally harness their sustainable transformation potential beyond single initiatives. As such, there is a growing demand for concepts and tools that allow Higher Education Institutions to move from facilitating individual living lab initiatives to a more comprehensive approach. Responding to this demand, this chapter aims to support Higher Education Institutions in establishing the Campus as a Living Lab. Drawing on insights from an international Community of Practice, existing literature, and case studies, we offer a conceptualization of the "Campus as a Living Lab," distinct from the traditional approach of individual living lab initiatives. The Campus as a Living Lab is a comprehensive, connected, and firmly embedded approach, striving to create synergies, knowledge exchange, and cross-fertilization. The whole campus and the organization are understood as a living lab, providing fertile ground for sustainable experimentation and innovation. We clarify

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the development stages of implementing this approach and introduce a practical tool for launching the Campus as a Living Lab, adaptable to diverse contexts. This chapter encourages Higher Education Institutions to transition from hosting standalone living labs and experiments to an integrated approach, enabling them to utilize their unique position to make significant contributions to sustainable transformation processes.

Keywords Higher education institution · Role of higher education · Climate crisis · Transdisciplinarity · Living labs · Campus as a living lab · Sustainability transformation · Iterative process

1 Introduction

Higher Education Institutions (HEIs) have the opportunity to contribute significantly to speeding up the process of co-creating urgently required solutions addressing climate change and sustainability transformations by working with their faculty staff, students, and their broader stakeholder community (Findler et al. 2019; Trencher et al. 2014a; Cortese 2003). They can help shape new ways by tackling the grand challenges of our times, with the Sustainable Development Goals as a compass (Trencher et al. 2014b; United Nations 2015). In a world defined by volatile, uncertain, complex, and ambiguous conditions, HEIs are called upon to play a crucial role in identifying and mitigating these risks and co-developing tailored local solutions with affected stakeholders. Not only focusing on annual or quarterly turnover or election periods, HEIs have the unique chance to create and follow long-term strategies and plans. As knowledge hubs, they can simultaneously operate on several levels by collaborating with local and regional stakeholders (Trencher and Bai 2016; Leal Filho and Brandli 2016; Verhoef et al. 2017), mobilizing transdisciplinary solutions, connecting to industry (Mowery 2007; Watson-Capps and Cech 2014), and training students to become future sustainable leaders (Rosenberg Daneri et al. 2015).

In addition to research and education, the third mission of universities is to contribute to society and to distribute knowledge to a wider audience (Compagnucci et al. 2021; Göransson et al. 2022). Yet, this mission is often translated into 'commerciali[z]ing technical products rather than supporting more intangible complex social innovation activities' (Göransson et al. 2022, p. 15). Therefore, those actions and strategies need knowledge co-production that transgresses existing system boundaries through open research environments that operate in transdisciplinary work modes (Schneidewind et al. 2016). Here, HEIs play a key role by providing a knowledge base for learning, serving as visionary platforms, and enabling experimentation to understand mechanisms that may impact societal change (König and Evans 2013).

In this realm, so-called Living Labs provide opportunities for HEIs as they combine the expertise of different stakeholders to encourage the application of

knowledge (Leal Filho et al. 2020). Living Labs aim to solve complex societal challenges with transdisciplinary developed, co-created innovations. They are set in real-world environments with multi-stakeholder settings (public-private-people partnerships) and actively involve users (Greve et al. 2021; Hossain et al. 2019; Westerlund and Leminen 2011). HEIs may have a great capacity for hosting and facilitating constellations like Living Labs; however, HEIs seem to miss out on using Living Labs to their full potential (Lough 2022) due to numerous challenges with the implementation, operation, and scalability but also with boundary-spanning across Living Labs and complex decision-making structures (Herth et al. 2024; van Geenhuizen 2018; Tercanli and Jongbloed 2022). Some claim that HEIs are rather rigid hierarchical organizations grappling with opportunities for change (Leal Filho et al. 2019; Martek et al. 2022), making it difficult to integrate Living Labs into the prevailing structures.

Nevertheless, university campuses are ideal spaces for Living Labs due to opportunities for interaction between various stakeholders. On campus, access to premises and infrastructure for research purposes is relatively easy, and state-of-the-art knowledge and a strong focus on innovation are present. Through Living Labs, HEIs can also showcase their research and prototype sustainability transition pathways within their organizations (e.g., Save et al. 2021).

Hossain et al. (2019) show that there are limited reference models for stakeholders who want to set up a Living Lab. This is particularly true for universities, as some even argue that living labs should not be used as tools for the HEIs, but rather, the entire campus should be used as a Living Lab (Leal Filho et al. 2022). Therefore, we aim to support HEIs in setting up an approach for a Campus as a Living Lab. We do this by conceptualizing the different notions of Living Labs on Campus and the Campus as a Living Lab. Next, we clarify the process stages of the Campus as a Living Lab approach. Third, we present a heuristic model to support HEIs during the incubation and set-up phases of a Campus as a Living Lab.

2 Theoretical Background for the Campus As a Living Lab

The notion of ‘Living Lab’ is becoming increasingly popular and resonates well with the open innovation claims to include external stakeholders in the overall innovation process (Chesbrough et al. 2006). A Living Lab fosters innovative collaboration among stakeholders to solve complex problems requiring a transdisciplinary methodology (Westerlund and Leminen 2011; Almirall et al. 2012). User-centric approaches encourage innovation through active participation and integrating knowledge of different users (Leminen et al. 2012; Eriksson et al. 2006). This participation and integration fit well with the transdisciplinary character of Living Labs.

During the last two decades, ‘Living Lab’ has developed into a term carrying diverse meanings and being used by researchers in multiple disciplines (Leminen and Westerlund 2019). According to the existing literature, Living Labs are an

interesting topic that offers numerous research opportunities and a novel design, methodology, and tool to overcome various challenges and address the needs of our time (e.g., Voytenko et al. 2016; Rodrigues and Franco 2018). There is an increasing number of actively operating Living Labs in diverse settings worldwide. This chapter focuses on Living Lab settings in HEI campus environments, not on settings like Urban Living Labs, Real-world Labs, or Sustainability Labs.

We view Living Labs as systematic approaches to innovation characterized by learning, reflection, and change management to accelerate the sustainability transformation. We consider the Quintuple Helix innovation model (Carayannis et al. 2012) as an appropriate foundation for a Campus as a Living Lab setting since it refers to solution-finding processes in the context of climate change. The five-helix structure's complexity includes interdisciplinary and transdisciplinary structures (see Fig. 1). All helices must be involved continuously from the entire disciplinary spectrum: from the natural sciences (because of the natural environment) to the humanities and social sciences (because of society, democracy, and economics) (Carayannis and Campbell 2010). It is an underlying innovation model for many Living Lab approaches, and in particular, the physical dimension of the site impacts processes transforming how our campuses are organized and perceived.

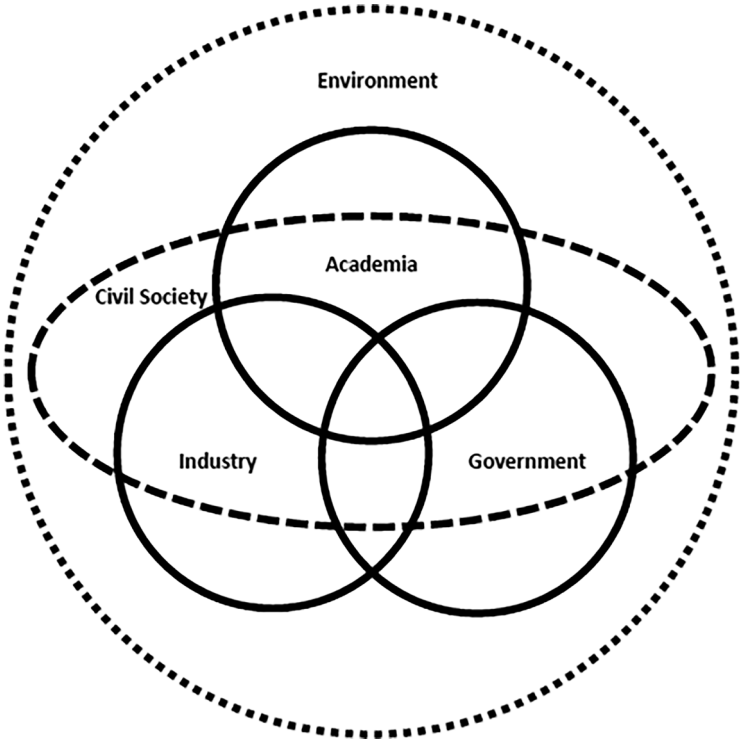

Fig. 1 The Quintuple Helix innovation model (Carayannis and Campbell 2022, p. 72)

Since HEIs are set in different contexts that need to be considered (see Quintuple Helix), they cannot be supported by a rigid model that strives for the most optimal solution. Instead, flexible and adaptable structures, such as heuristics, should support them. Heuristics are 'adaptive tools that ignore information to make fast and frugal decisions that are accurate and robust under conditions of uncertainty' (Mousavi and Gigerenzer 2017, p. 368). They can also be described as 'rules of thumb that do not require complete information search or exhaustive calculation' (Mousavi and Gigerenzer 2017, p. 367) and are thus attractive tools to save efforts but still deliver quite high accuracy. The success of a heuristic depends on the context in which it is utilized. At large, it depends on one's cognition to exploit the existing environmental structures and one's ability to deal with error (Gigerenzer and Gaissmaier 2011). Uncertainties are also given in the case of campus development, and the choice to follow a heuristic allows a more progressive engagement than a narrow model that may not fit the HEI-specific circumstances. Thus, we aim to offer guidance for actors in the early phases of a Campus as a Living Lab approach through a heuristic that highlights relevant tasks to support decision-making and governance.

3 Methodology

This chapter builds upon a triangulation of different knowledge sources and approaches, shown in Fig. 2. We iteratively co-developed and tested approaches and methodologies for the previously identified research gaps, focusing on Living Labs in the context of sustainability transformation, climate change, and the role of HEIs. We addressed these gaps at conferences and in tailored workshops and co-created possible solutions in an international Community of Practice (CoP) working on different Living Lab settings within academia and practice. This CoP was formed initially within the International Sustainable Campus Network (2017) and extended after the Amsterdam Institute for Advanced Metropolitan Solutions (AMS) intensified activities around Urban Living Labs and brought together international Living Lab practitioners at yearly summits (from 2019). The CoP performed literature reviews and further developed concepts, approaches, and methodologies theoretically and practically, tested them in different international settings and evaluated them in iterative feedback loops and peer-to-peer settings. As a result of the documented sessions, the CoP published tools, guidelines, and playbooks. Further, three international cases were used as inputs for this chapter: The Delft University of Technology (TU Delft) in the Netherlands, the Swedish University of Agricultural Sciences (SLU) in Sweden, and the Concordia University in Canada. The authors are affiliated with those universities. At SLU's campus Alnarp, we explored and evaluated the framework against ongoing campus initiatives. At TU Delft, we examined ongoing activities to create a governance framework to synergize campus living labs. In Montreal, the development of the PLAN/NET ZERØ initiative at Concordia University was used to test and evaluate the framework. The three

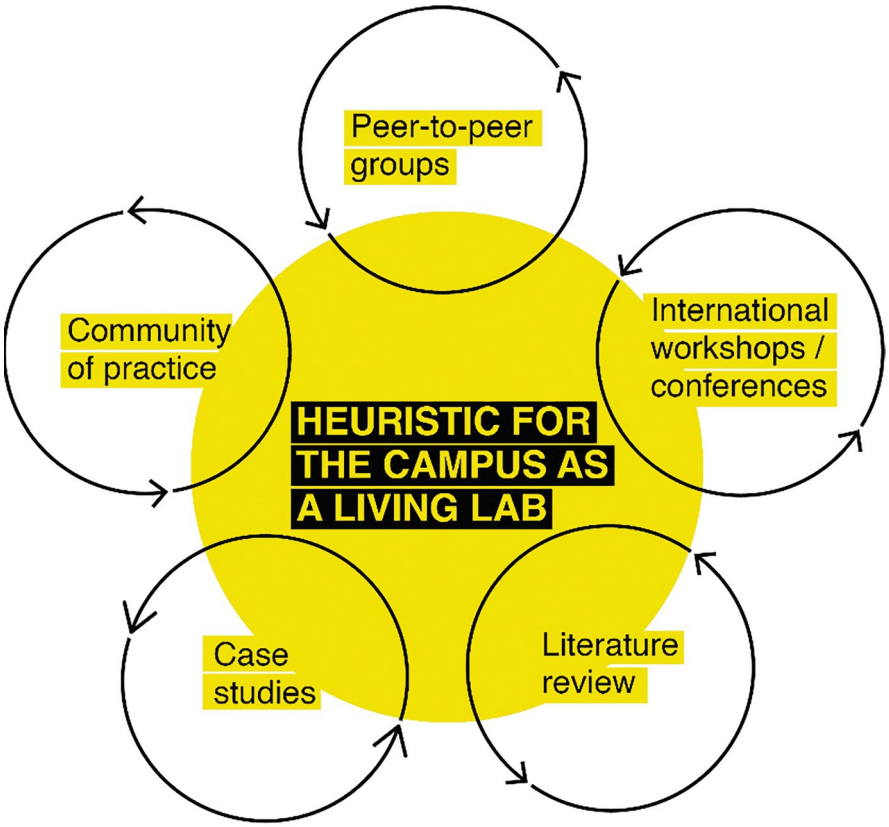

Fig. 2 Methodology of the development of the Campus as a Living Lab heuristic

universities are located in diverse settings and have different campus configurations: TU Delft's campus is connected to the city of Delft yet situated in a distinct area, whereas Concordia University is more integrated into the city of Montreal and spans across two campus areas. SLU's three campuses are located in different urban regions across Sweden and span from urban to peri-urban and rural landscape characters.

4 Results

Living Labs provide an opportunity for HEIs to collaborate with stakeholders in the community to address real-world challenges. They may either participate in (Urban) Living Lab partnerships in their region or may host them on campus. Instead of building separate laboratories to conduct experiments under controlled conditions,

HEIs now involve their campuses, staff, and students in experiments (Nyborg et al. 2021). Although several interesting Living Labs on HEI campuses have provided rich insights (see, e.g., Leal Filho et al. 2020; Evans et al. 2015; König 2013; Leal Filho et al. 2017), they were primarily stand-alone solutions that were not connected. A new, more impactful approach is needed to create effective connections, generate synergies between experiments, and provide a solid database for knowledge sharing and further innovative investigations. Rather than containing laboratories, HEIs are then themselves laboratories engaged in co-creative collaborative processes.

Therefore, there is a difference between the notions of Living Labs on Campus (LLoC) and the Campus as a Living Lab (CaLL). As a demarked physical space, the whole campus could be proclaimed a Living Lab where networks, coordination, and collaboration are inherently established in a transdisciplinary way. We call this 'Campus as a Living Lab.' In contrast, the approach with single Living Labs, which do not exchange knowledge and data nor follow an orchestrated approach, is seen as 'Living Labs on Campus.' While LLoC can establish a low threshold to get started and serve as proven reference examples, the CaLL can create additional value on various avenues. The unique characteristics of the CaLL approach are the continuous creation of synergies between projects, experiments, and testbeds to achieve joint learning, knowledge and data exchange, allowing informed decision-making and efficient use of resources. Moreover, CaLL can further data democratization, a topic that is gaining increasing attention and aims to empower community groups, allowing them to participate fully in planning and policy discussions and accelerate sustainability transformation processes while enabling informed decision-making processes (Sawicki and Craig 1996). That said, the CaLL leads to various organizational and cultural consequences and could function as a platform. The campus would then become a defined scientific and practical test site where innovation and learning come first. This would, in turn, contribute to transdisciplinary capacity building and cross-fertilization through learning across projects, experiments, and organizational entities.

To summarize, we identify the following characteristics as key elements of Campus as a Living Lab: The approach is framed around a shared vision/purpose and functions as a petri dish/platform for diverse experiments, labs, testbeds, and projects. The campus is used as an arena for co-production and -creation and transdisciplinary capacity building. CaLL utilizes open innovation processes to accelerate the implementation of experiments and pilot projects while leveraging all relevant (local) knowledge sources and, thereby, fostering and stimulating engagement and empowerment. Thus, the campus becomes a valuable forum for critically discussing values and ethical issues, grows trust, and provides a testbed for technological and social innovation. A science-based approach accompanied by practice-based research enables replication, knowledge transfer, knowledge mobilization, data democratization, and solution-finding for tailored (local) solutions by encouraging experiential learning processes.

The following diagram (Fig. 3) highlights the different approaches that support the sustainability transformation using the resources of a campus. Implementing the

CaLL approach can be challenging as HEIs are power-structure-driven organizations and are slow to change (Leal Filho et al. 2019). That being said, implementing CaLL also means moving forward in the direction of holistically integrating transdisciplinary research into organizational structures (Martek et al. 2022) and performing required change management processes. This means that a CaLL implementation provides not only the chance to mine for synergies between initiatives but also affects the way the HEI operates. Against this background, the Campus as a Living Lab is presented as the approach with the highest coordination efforts. However, the methodology allows for transdisciplinary collaboration, a precondition for co-creating scalable and replicable innovative and disruptive solutions to complex challenges.

A one-size-fits-all approach will not suffice for support and guidance as Living Labs move through different phases (e.g., Martek et al. 2022; Save et al. 2021; Steen and van Bueren 2017), and the distinct circumstances in those phases and the

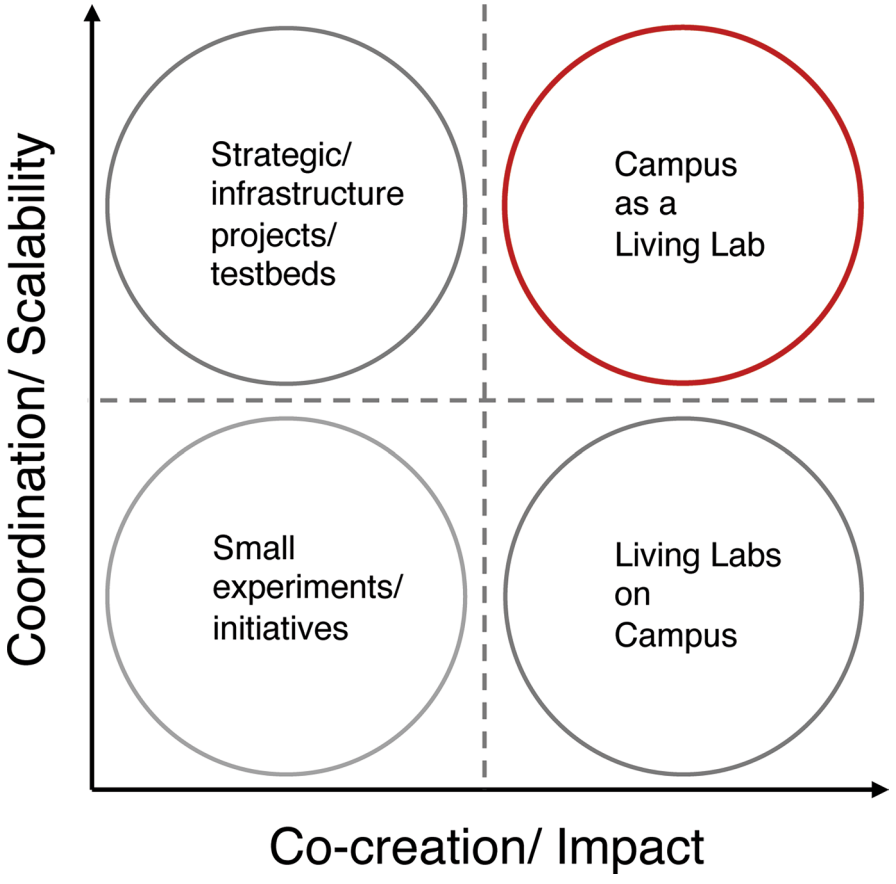

Fig. 3 Different approaches in utilizing the HEI's campus for the sustainability transformation

different contexts of Living Labs need to be accounted for. This is valid for all approaches (see Fig. 3). For this reason, we propose a dynamic heuristic model that facilitates reflexive processes during the progressive development process of the CaLL. The model comprises four overarching phases for a Campus as a Living Lab to move through (see Fig. 4).

The various phases, as shown in Fig. 4, are not to be understood as clearly delineated stages but rather mark levels of development or maturity. The CaLL model uses iterative co-creation and evaluation loops to drive the maturation process. Feedback and feedforward loops are primarily used for this purpose. In addition, evaluation processes take place in all phases in order to review and, if necessary, adapt the format, the framework conditions, and the mission statement. We visualized this by the infinity loops in each phase and the loops across all phases (Fig. 4).

During the first phase, the focus is on screening and establishing the preconditions for a CaLL, such as checking the availability of core, competencies in the university, getting a clear picture of internal and external key actors, discussing values framing a problem description, and potential impacts of the specifically chosen approach. The second phase involves the practical start of the Campus as a Living Lab. Many practical matters need to be addressed, e.g., the governance structure, the assignment of roles and mandates, responsibilities, resources, KPIs, monitoring loops, timelines, and a financial framework. This is to tailor and implement the CaLL into the organization. The third phase is when the CaLL is up and running and where the co-creation and value creation of the innovation process happens with many ongoing experiments, projects, and testbeds. Creating synergies and aligning with agreements set in previous phases or adapting them based on changes in

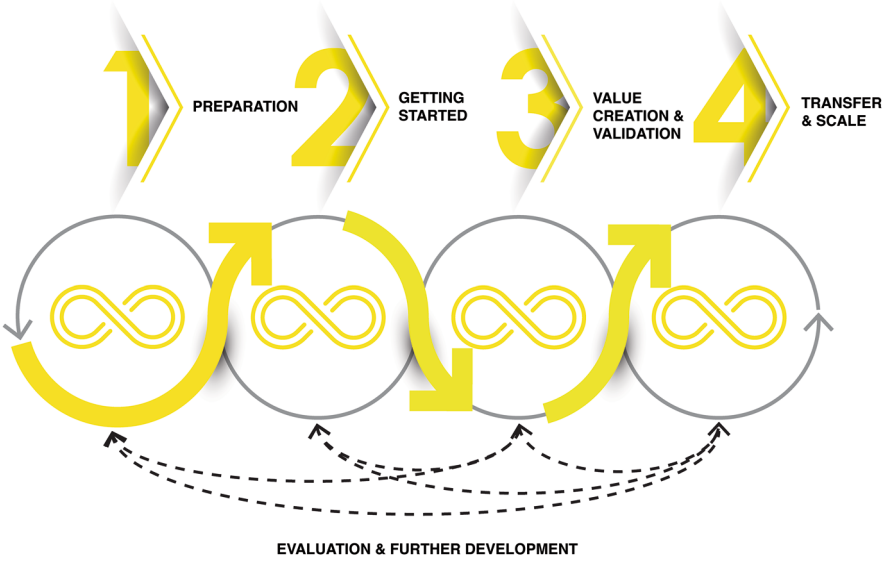

Fig. 4 Process and phase model of a Campus as a Living Lab

circumstances requires continuous co-creation, coordination, reflection, and evaluation processes. In the fourth phase, tangible and intangible outcomes are further refined to share, transfer, and communicate knowledge, adapt it to different settings, and get involved in policymaking and change processes.

As an initial step towards establishing a CaLL in HEIs, we focus in this chapter on the first two phases of setting the stage and getting started. By its exploratory nature and, to some extent, its long-term management and coordination needs, we situate this chapter in a very contemporary context and practice. To that end, we introduce a heuristic in the form of canvases for those two phases. The fields of both canvases were inspired and partially derived from sessions of the CoP, as well as a literature review of Campus Living Labs (e.g., Herth et al. 2024, 2025; Martek et al. 2022; Save et al. 2021; Steen and van Bueren 2017; Verhoef and Bossert 2019; Du Preez et al. 2022). Notably, the following content is neither a strict order of to-do points nor exhaustive. Instead, the canvases must be understood as a compilation of the most essential components that each HEI must take into account and answer individually. They are designed to trigger and support iterative and creative thinking by developing and reflecting on one's own organization and structure. With the canvases and their exploratory reflective and progressive modules, we thus contribute to this dynamic journey and allow a joint learning and development process.

4.1 Phase 1: Preparation

As described earlier, the necessary conditions are established during this phase, which can be viewed as the incubation phase. It involves co-creation events and cycles to establish a commonly supported shared understanding of what is envisioned with the intended CaLL and why. The following canvas (Fig. 5) provides practical oversight and reference during this first phase, presenting points to discuss, reflect on, and consider when embarking on a CaLL approach. It comprises, e.g., the analysis of available competencies, developing a common understanding of a transdisciplinary way of working and the nature of a CaLL, scouting for resources and capabilities, identifying key actors (internal and external), and assessing the value of the chosen approach and its potential impact.

A brief explanation of the different components mentioned in the canvas of Phase 1:

Analyze the Existing Setting (see Fig. 3) of Performing Living Labs/Projects/Testbeds/Experiments This field is intended to be used to elaborate and reflect on the status quo of ongoing activities on the campus that could be onboarded in one way or another to create buy-in and use existing momentum and resources. The aim is to get a clear picture of what is present already and what needs to be created. Analyze if a CaLL is feasible, viable, and desirable.

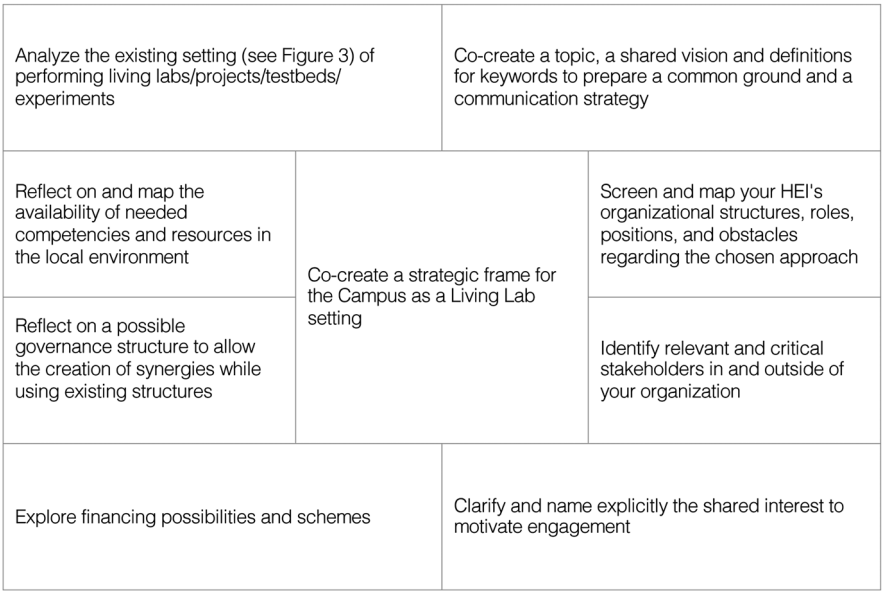

Fig. 5 Canvas for Phase 1 of the CaLL approach

Co-Create a Topic, a Shared Vision, and Definitions for Keywords to Prepare a Common Ground and a Communication Strategy To start the process, the core group to drive the development of the Campus as a Living Lab needs to agree on wording and definitions and ensure that all stakeholders have the same understanding to prevent misunderstanding right from the beginning.

Reflect on and Map the Availability of Needed Competencies and Resources in the Local Environment This module aims to get an overview of existing and required core competencies within the campus premises. Also, which competencies does the accessible innovation ecosystem provide (external stakeholders). This mapping exercise will help to identify who needs to be involved in the process from the beginning.

Reflect on a Possible Governance Structure to Allow the Creation of Synergies While Using Existing Structures For the Campus as a Living Lab approach, the governance structure and the buy-in from key stakeholders are relevant. To put the approach on a stable foundation, it is vital to start early to frame possible governance approaches to allow an informed and promising course of action.

Screen and Map Your HEI's Organizational Structures, Roles, Positions, and Obstacles Regarding the Chosen Approach Contrary to the working modes of Living Labs, HEIs are highly structured and formalized organizations. To stream-

line a CaLL approach and to enlarge the support base, it is important to integrate CaLL fundamentally into the existing structures and to avoid creating parallel ones.

Identify Relevant and Critical Stakeholders in and Outside of Your Organization A CaLL approach asks for specific (eventually new) internal and external competencies and resources tailored to the HEI's local environment. Therefore, it is important to know if the intended activities align with those of local innovation drivers, e.g., from the private sector, the municipality or regional government, citizen groups, or even other HEIs, or if it is required to frame it in such a way that it differs or complements the activities of others.

Co-create a Strategic Frame for the Campus As a Living Lab Setting Start reflecting and developing the strategic frame. It should be co-created to set up a robust foundation that embraces diverse stakeholder groups and focuses on impact generation and value creation in the local environment.

Explore Financing Possibilities and Schemes Financing schemes and opportunities need to be explored from the beginning so that the CaLL can start with adequate financial resources. Additionally, an overview of diverse resources that can be leveraged over time should be created so that the CaLL does not fail due to financial hurdles at a later stage.

Clarify and Name Explicitly the Shared Interest to Motivate Engagement The key to creating momentum is understanding the drivers and, specifically, the different stakeholder groups' shared interests and what topics and outcomes can keep these groups engaged.

4.2 Phase 2: Getting Started

After clarifying the preconditions and taking some important strategic decisions during the previous phase, the second phase focuses on well-directed actions to get the CaLL started and deeply anchored in the organization. Several practical issues need to be addressed, e.g., clear mandates, roles and responsibilities need to be assigned, resources to be allocated, and goals and timelines established. The following canvas (Fig. 6) guides the process by presenting the key elements of this phase.

A brief explanation of the different components mentioned in the canvas of Phase 2:

Co-create the Visions/Mission Statements and Develop Success Indicators Using all relevant outcomes of Phase 1 to develop further and fine-tune the vision/mission statements and to define success indicators for the process.

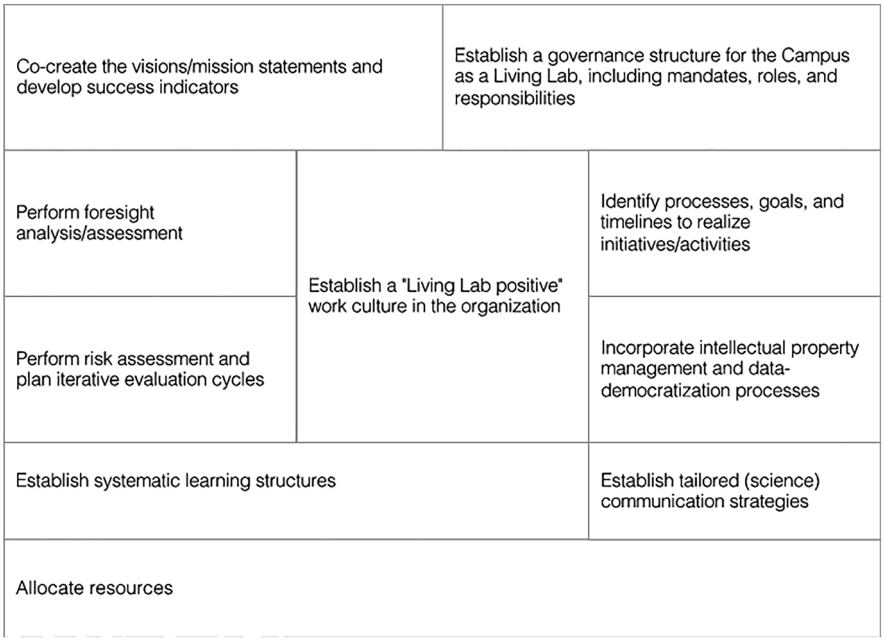

Fig. 6 Canvas for Phase 2 of the CaLL approach

Establish a Governance Structure for the Campus As a Living Lab, Including Mandates, Roles, and Responsibilities A well-documented governance structure should be developed and implemented to run the Living Lab setting smoothly and transparently, allow promising innovation and idea management processes, and create synergies and cross-fertilization.

Perform Foresight Analysis/Assessment Set up the framework for the Campus as a Living Lab in such a way that it allows agile processes to deal with future predictable and unpredictable developments. Aim to design for serendipity.

Perform Risk Assessment and Plan Iterative Evaluation Cycles Experimenting and secure and reliable campus operations are not easy to bring together. Therefore, it is vital to establish and maintain a setting that allows for both while undertaking rigorous risk assessment and iterative evaluation cycles to balance both needs.

Identify Processes, Goals, and Timelines to Realize Initiatives/Activities To coordinate multiple interlinked initiatives that can take place within CaLL, there is a need to define processes for selection, guidance, synergy generation, data collection, and evaluation.

Incorporate Intellectual Property Management and Data-Democratization Processes Transparent and clear agreements for eventual IP rights and data man-

agement should be made right from the start to prevent major judicial interventions.

Establish a 'Living Lab Positive' Work Culture in the Organization Traditional work structures in HEIs are hierarchical and do not match the agile needs of a Living Lab way of working. To create a 'Living Lab positive' culture that emphasizes transdisciplinary co-creation and collaboration, it is necessary to start implementing change processes to allow for that kind of innovation and value creation.

Establish Systematic Learning Structures Once Living Labs are running, this is often an omitted point, even though it holds much value and potential. Learning is one of the vital parts of Living Labs, so those structures need to be established from the beginning. Especially experiential learning is of high value and can have significant impacts also to bridge silos and boost cross-fertilization.

Establish Tailored (Science) Communication Strategies In the CaLL process, tailored communication about ongoing activities and initiatives is a crucial component. Different stakeholder groups require tailored information provision to stay informed and engaged. In addition to being listened to, information is a significant driver. Further, the HEI also accomplishes its third mission.

Allocate Resources In addition to the commitment of senior leadership, it is crucial to allocate adequate resources (financial and human) to enable the smooth operation of impactful activities. This is important to get started and to ensure the continuity of the CaLL in the long term.

5 Concluding Reflections

This chapter aimed to support HEIs through a heuristic model in their targeted engagement in a Campus as a Living Lab approach for sustainable innovations with real-world impact. By applying a co-creative, transdisciplinary, and iterative research approach, we adopted key elements of Living Labs in our way of working. We drew on a pool of knowledge from an international Community of Practice for Living Labs, interactive conferences and workshop sessions, and the current body of literature to conceptualize both the notions of LLoC and CaLL. While the current landscape of HEIs' approaches reveals a prevalence of the LLoC approach (as defined in this chapter), this study marks a significant evolution from the LLoC model to introducing and establishing the concept of CaLL. Doing so lays the groundwork for a shift in how HEIs approach Living Lab initiatives. Herein, the four-phased CaLL process model provides HEIs with a structured and self-reflective framework to guide their efforts in implementing and navigating that endeavor. Furthermore, introducing the heuristic model for the initial two phases of a CaLL's establishment addresses a critical gap in existing literature and practice. It equips

HEIs with tangible guidelines, responding to the need for a systematic approach when implementing CaLL.

While this study contributes valuable insights into integrating the CaLL within HEIs, it is essential to acknowledge certain limitations. The study engages in only two of the four identified CaLL phases, leaving potential gaps in understanding the complete and iterative process. Hence, there is a clear opportunity to add to the comprehensive understanding of the entire CaLL process by developing phases three and four. The predominant focus on conceptual work leaves the practical application untested, yet planned case studies are on the horizon. Future research could explore use- and reference cases to gain insights into the heuristic's practical utility and effectiveness in diverse HEI settings and the role of knowledge exchange in networks and Communities of Practice as part of the reflection processes. This would enrich the conceptual foundations established in this study and contribute to further developing applicable guidelines.

Emerging Communities of Practice at various scales demonstrate that collaboration between the Global North and South, as well as knowledge exchange within local, national, and international networks, are crucial for the success of the Campus as a Living Lab. These communities overcome the historic competitive mindset among HEIs and foster mutual learning, vital for accelerating local sustainability transitions. At the same time, HEIs can serve as bridges for international knowledge and experience exchange and overcome the "not invented here" phenomenon. In that, the CoPs could provide extensive international use case studies for the phase model and the heuristic, including Global South perspectives and innovative solutions.

The Campus as a Living Lab presents a promising change towards a more dynamic and comprehensive paradigm and holds the potential to be a significant advancement and more impactful approach. It can be a catalyst for innovation and change in the university, as well as the surrounding (innovation) ecosystem. The study's results facilitate cross-fertilization and unlock currently unused potential within HEIs, fostering a collaborative, reflexive, and innovative approach to sustainable development. In conclusion, this research conceptualizes CaLL and offers practical construction elements for HEIs seeking to embark on this transformative journey. As institutions continue to refine and adapt these concepts and deploy the heuristic in their local organizational contexts, the journey toward a Campus as a Living Lab will undoubtedly progress, marking an exciting and transformative era for HEIs worldwide.

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