


A Systematic Review of the Literature on Living Labs in Higher Education Institutions: Potentials and Constraints

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Abstract: Living labs (LLs) have emerged as an interface for higher education institutions to collaborate with companies, citizens, non-profit and government organizations to address a variety of problems around social challenges and sustainable development. In this systematic literature review, we summarize the existing knowledge on how universities shape and manage the LLs they are associated with and how they align with their core missions of education and research and—in particular—their social missions. Following PRISMA guidelines for a systematic literature review (SLR), we analyzed journal articles, conference papers, and book chapters published between 2008 and 2020, capturing 93 university-governed LL experiences from across the world. Our findings show that LLs are developing from bottom-up initiatives, often at the fringe of higher education institutions, towards more self-standing entities implementing strategies to undertake social outreach activities. LLs require their host universities to intensify the relationships with their stakeholders and work on capacity building and focus on inter- and transdisciplinary research methodologies. Finally, our literature review points to the need for further research on the hybrid governance approaches displayed by LLs, particularly looking at the roles and responsibilities of academics involved in managing LL initiatives.

Keywords: higher education institutions; living labs; open innovation; organizational change; sustainability; third mission



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1. Introduction

Discussions have intensified in politics and academia on devising new modes of addressing grand challenges such as water scarcity, climate change, and aging societies [1]. Higher education institutions (HEIs) are increasingly expected to address such challenges and to reassess their research practices to collaborate with a diverse range of stakeholders [2]. Academics [3,4] and public organizations [5] have called for new models of knowledge production that integrate stakeholders' needs and expertise from diverse disciplines, addressing a more sustainable social development [6]. In this context, living labs (LLs) have emerged as a response to such needs and as research platforms for sustainable product and service innovations [7]. In this article, we focus on LLs created and led by HEIs, looking at their potential to undertake innovative activities involving the participation of diverse social partners.

The concept of LLs was introduced in academia in the 1990s by American scholars [8] and proliferated in Europe from 2006 onwards when the European Commission started promoting the concept as part of its innovation policies [9]. LLs are part of a broader family of laboratories that are operating in a real-world context (Urban Labs, Transition Labs and Challenge Labs) and employing innovative approaches for the co-creation of technology, products and services [10]. As such, they have roots in user and open innovation studies [11]. Many LLs are paying attention to the United Nations' (UN) Sustainable

Development Goals (SDGs) [11,12]. Urban LLs (ULLs) have emerged particularly to address challenges associated with climate change and to facilitate sustainability experimentation in European cities [13]. In the literature, such labs have been referred to as “inter-boundary spaces” [14], as they form intervention zones at the boundary between research, innovation and policy [15].

An increasing number of HEIs have incorporated LL approaches in their core missions and operations [12,16], treating them as anchors to embed sustainability in their organizations [17,18]. LLs established and governed by HEIs seek to offer unique capabilities that are reflected in their activities, structures, organization, and the outcomes they pursue. However, LLs require their own governance and organization mechanisms [19] to enhance learning [20], to increase knowledge in a specific field, to promote research and theory development and to foster innovation on campus [21]. It is this governance and management perspective that is the prime focus of this article, that also looks at the support provided by HEIs to LLs to encourage user engagement strategies [22], innovative methodologies and long-term development work [23]. LLs governed by HEIs (in short: HEI LLs) thus offer a collaborative platform for knowledge exploration with societal stakeholders and help them perform their activities outside the academic setting in a societal context [24].

While more universities are taking steps to tackle sustainability challenges, doing so may pose challenges to the HEIs [25]. The Talloires Declaration [26] made urgent calls for universities to become more socially engaged and address sustainability. In what came to be known as the third mission, the social responsibility of universities has since then featured prominently in policy discussions under the mantras of “relevance”, “engagement” and “social impact” [27]. Third-mission activities initially focused on university-business relationships and the commercialization of research [28], with engagement situated primarily in the HEIs’ “developmental periphery”, that is, their science parks and technology transfer units [29]. This resembled a linear, one-directional knowledge transfer model, whereas today’s social challenges are felt to require a systemic approach based on two-way interactions [30].

Integration of the economic, social, and environmental dimensions of sustainability in the missions of the HEIs may produce complexities in the HEI management [31]. Tackling sustainability challenges often requires a holistic approach [30] that calls for transformative engagement models, where the third mission is incorporated into the institution’s core activities of teaching and research as well as its governance structures [32,33]. New approaches to strategic and stakeholder relationship management are needed [34]. Given their loosely coupled nature [35] and their hosting of “academic tribes” [36] showing diverse practices, norms, and behaviors [37], the orchestration of a holistic engagement culture in HEIs is a complex undertaking, in particular for its leadership [38].

The primary aim of this literature review is to investigate how and to what extent HEIs implement LLs and how they use them as anchors for their sustainability-oriented transformations. While the research on LLs is quite extensive, very few studies have approached LLs from the perspective of HEIs. Most research has pursued a single discipline focus when examining LLs, looking at disciplinary areas such as innovation management, engineering and ICT [11,39,40], as well as urban governance [41] and public administration [42]. Reviews capturing how LLs have impacted the HEIs themselves have tended to focus on their role in knowledge transfer [33] or the evaluation of the labs [43]. Our study tries to make an original contribution by presenting an integrated review of the LLs governed by HEIs. We study the following research questions:

- (i) How are LLs interpreted and adopted in the higher education context?
- (ii) How are the core missions of HEIs (education, research, and third mission) connected to LLs and what outcomes and impacts are generated by the presence of LLs?
- (iii) What are the factors that influence the adoption of LL approaches in HEIs?

We undertake an in-depth qualitative analysis, carrying out a descriptive and thematic inventory of the literature (Table 1). Systematic literature review (SLR) is a suitable method for the investigation of the above research questions, as SLRs go beyond single case studies

that one frequently encounters in studies of LLs [44]. Our SLR departs from the open innovation literature in describing LLs and their defining principles and applies this perspective to the higher education context to discuss how (and to what extent) HEIs exploit the LL phenomenon to achieve their third mission and societal engagement goals. After addressing the research questions, we discuss the theoretical and practical implications of our findings and propose directions for future research. The intended audience for our paper comprises scholars of higher education and practitioners in HEI LLs, including their academics, managers, and their leadership.

Table 1. Structure of the literature review.

Research Questions	Corresponding Sections
(i) How are LLs interpreted and adopted in the higher education context?	Section 3.2.1. Definitions Section 3.2.2. Nature and status of LLs in the HEI environment
(ii) How are the core missions of HEIs (education, research, and third mission) connected to LLs and what outcomes and impacts are generated?	Section 3.2.3. Goals Section 3.2.4. LLs integrated in education, research and engagement activities Section 3.2.5. Evaluation of LLs Section 3.2.6. Outputs, outcomes and impact of LLs
(iii) What are the factors that influence the adoption of LL approaches in the HEIs?	Section 3.2.7. Factors that constrain and facilitate the impact of HEI LLs

The remainder of this paper is structured as follows. First, we present an outline of the SLR methodology. Next, we provide a descriptive and thematic analysis of how LLs governed by HEIs have been reported on in the international literature. Finally, we present the theoretical and practical implications of our study, the gaps in our work and directions for future research.

2. Materials and Methods

The methodological approach of this study consists of a descriptive and thematic literature review, as summarized in Figure 1. The data investigated refers to how HEIs shape and manage the LLs they lead and how they align them with their core missions of education, research and their societal (i.e., third) missions. In our SLR, we conduct an in-depth qualitative analysis, focusing on the contents of the literature identified. SLRs, initially used in the medical sciences, have become a popular approach in management and organization studies [45].

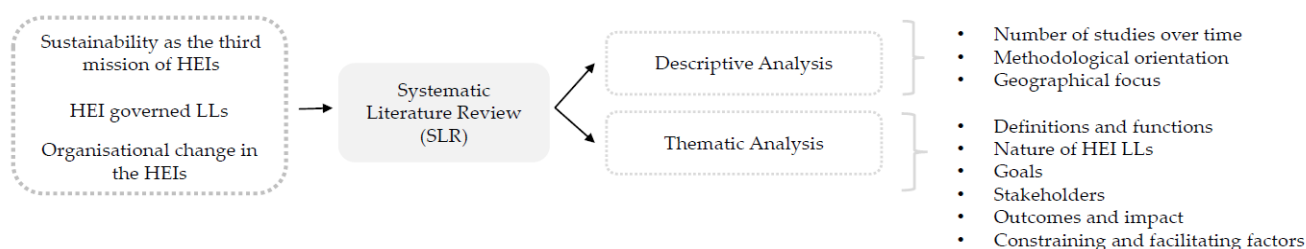


Figure 1. Summary of the SLR process.

2.1. Screening and Eligibility Assessment

To identify the existing literature on LLs, we searched for academic articles and first-tier grey literature in the form of conference papers and book chapters. We consulted the grey literature for two purposes: to extend the range of evidence of LLs in the higher education context, which only began to blossom in the peer-reviewed academic literature in recent years and, secondly, to address both academic and non-academic audiences concerned with LLs, including research, teaching, campus management and administrative staff. Our study aims to stimulate discussions in particular about organizational issues around LLs and their integration in HEIs. Our review covered articles published between 2008 and 2020. We

made this decision due to the increasing number of studies that have focused on LLs since the early 2000s onward, a period when the LL movement was connected with teaching and learning situations [8], and universities began to apply the methodology [43]. The PRISMA methodology [46] we utilized for our SLR can be shown by means of a diagram (Figure 2) that presents the inclusion and exclusion criteria applied in our study.

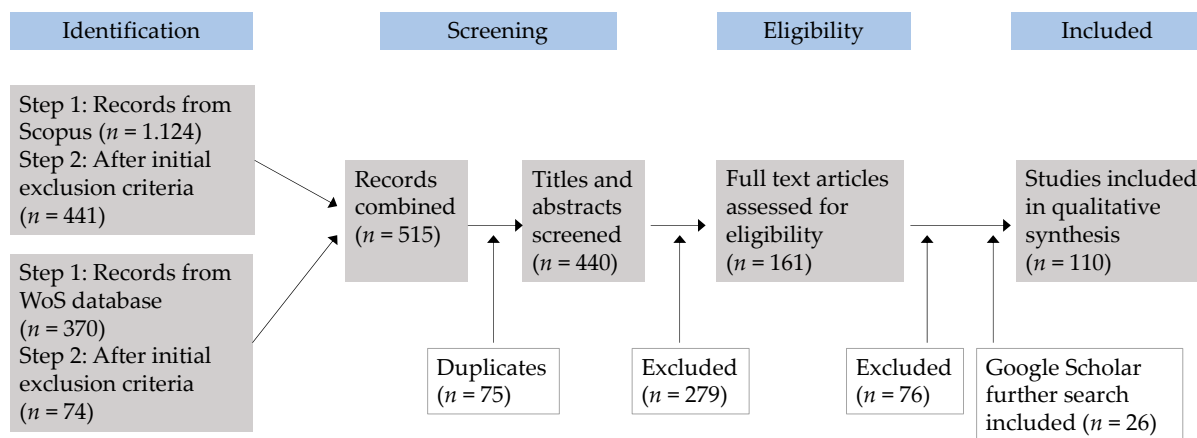


Figure 2. PRISMA model diagram [46].

We identified the relevant articles using keywords that are appropriate to the focus of our investigation. Keywords included “living lab*” and “living laboratory*”, used in combination with higher education-related keywords, such as “higher education”, “university”, “student*”, “campus”, “academi*”, “faculty”, “higher education institution*”, “learning” and “teaching”. The Scopus and Web of Science (WoS) databases were selected as the primary data sources. Search terms were applied to the articles’ title, abstract, and keywords fields, and a total of 1494 articles were identified, from both databases. We exported the articles to the EndNote software, to screen their title and abstracts. We applied our initial exclusion criteria first to the set of articles we exported from Scopus and, after, the WoS database. The first round of our exclusion process eliminated studies that did not have higher education as a field in its focus and those written in languages other than English. This resulted in 515 publications in total, with 441 articles extracted from Scopus and 74 from WoS databases. This was followed by the removal of the duplicates, resulting in 440 articles.

In our next rounds of screening, we eliminated the articles that only discuss HEIs in their role of consortium partners in LL initiatives, and not as leading organizations. This meant eliminating 279 studies. After reading the full-body text of the articles, we further excluded studies that did not discuss any role of LLs in the HEI research, teaching, and third mission activities as well as in HEI management, and therefore not touching on dimensions such as strategy, funding, and quality assurance. These criteria are in line with our goal to uncover how and to what extent the HEIs align LL principles with their management, education, research and social engagement activities as well as with our intention to identify facilitators and barriers to this alignment. We applied an additional criterion to exclude studies in which the authors discuss the same LL initiative in different years. In such cases, after a full review of the content, we considered only the latest versions of the articles. After applying the two criteria, we eliminated a further 76 studies.

In the final stage, we identified 26 additional studies from Google Scholar and added them to our final collection of articles. This additional set of articles included studies with two similar sustainability-oriented lab conceptualizations, namely real-world laboratories (RwLs) and urban LLs. The studies complied with the eligibility criteria and discussed labs governed by HEIs. Our final selection comprised 111 studies, including 54 journal articles, 33 conference papers and 24 book chapters. We completed our final selection in December 2020.

2.2. Content Analysis

The MAXQDA qualitative data analysis software package was used for the content analysis of the selected articles. The tool is recommended to extract meaning from underlying text data, allowing for transparency in the research process and the detection of hidden concepts. It thus can support reflections on and advancement of theory [46]. The software also allows for collaborative data analysis in team projects and qualitative data visualization [47]. Accordingly, we first transferred the selected articles from Endnote to MAXQDA in order to perform coding according to a preliminary set of categories informed by our research questions. Coding is an iterative process that helps us include new categories and to cluster them as the analysis proceeds. This coding approach constitutes a “coding phase with some high-level coding scheme but allows it to evolve as new themes and insights are obtained from the literature” [48]. Such inductive coding leads to additional categories and attributes, which allows the researcher to identify critical issues in the literature and to develop a future research agenda. We clustered the findings and presented them along with the dimensions that are relevant to the operation of HEIs associated with LLs. As the categories and codes emerged and were refined, we transferred the findings and frequencies into an Excel database to further analyze and visualize the data.

3. Results

3.1. Descriptive Analysis

The largest number of articles discussing LLs governed by HEIs were published in 2018. There was a steady increase in the number of papers from 2008 onwards (Figure 3). Over half the reviewed studies were published between 2017 and 2020.

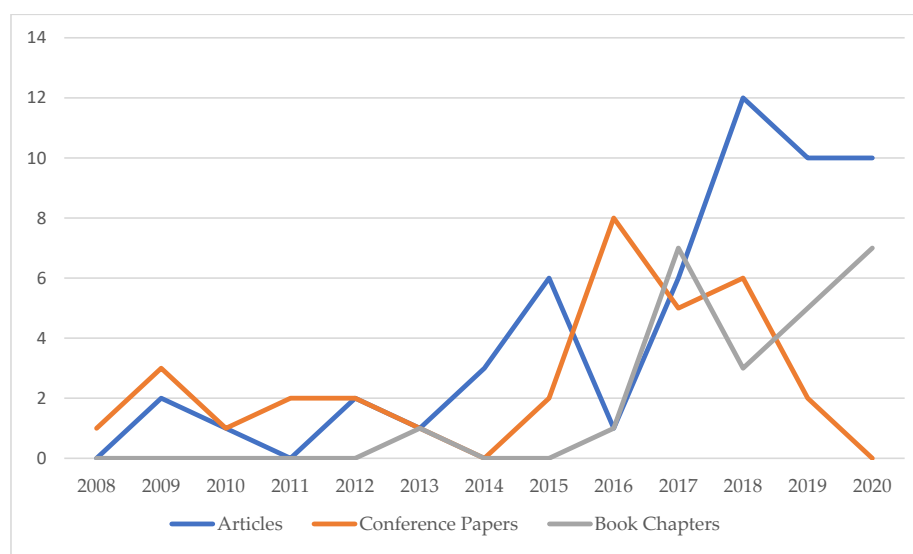


Figure 3. Number of LL studies over the years in the higher education context.

Articles have been published across a diverse range of platforms, covering several disciplinary areas. The majority of the journal articles were published in the journal *Sustainability*. Despite the higher education focus of the studies identified, only six articles were published in a higher education-oriented journal, namely *International Journal of Sustainability in Higher Education*. The publication series *World Sustainability Series* by Springer (2017, ongoing) includes the largest number of contributions in the form of book chapters.

In terms of our methodological orientation, we clustered the selected articles in three groups: descriptive studies (93 studies), prescriptive studies (12 studies), and mixed studies (6 studies). The descriptive studies include empirical research conducted on an established LL initiative and a focus, for example, on the effectiveness of LL approaches. Often in the form of case studies, they present detailed information on LL experiences, mostly of a

qualitative nature. The prescriptive studies are normative in nature, with proposals and recommendations concerning the adoption of LLs in HEI environments. Finally, there are studies that blend elements from the preceding two types.

Among the 93 descriptive studies reviewed, 51 are from Europe (55%), 14 from North America (14%), 8 from South America (9%), 4 each from Africa (4%) and Asia (4%), and 3 from Australia (3%). The disparity in the global concentration supports the notion that LLs are largely a European phenomenon [9]. As many as nine papers (10%) captured cross-border LL initiatives implemented by a consortium of HEIs with partners from multiple locations (Table 2). The highest number of LL case studies came from Italy, followed by the US, the UK, Germany, the Netherlands, and Brazil.

Table 2. Geographic focus of HEI LL initiatives.

LL Collaboration	Country	No. of Cases	LL Collaboration	Country	No. of Cases
intra-national	Italy	11	intra-national	Egypt	1
intra-national	USA	10	intra-national	Ireland	1
intra-national	UK	7	intra-national	Switzerland	1
intra-national	Germany	6	intra-national	Greece	1
intra-national	The Netherlands	6	intra-national	Belgium	1
intra-national	Brazil	6	intra-national	Mexico	1
intra-national	Sweden	4	intra-national	Korea	1
intra-national	Canada	3	intra-national	Mauritius	1
intra-national	Norway	3	intra-national	Poland	1
intra-national	France	3	international	Malta, Jordan, Cyprus, Greece, Spain, Germany, Turkey, Algeria	1
intra-national	Australia	3	international	New Zealand, Brazil, Australia, Italy	1
intra-national	Finland	3	international	Finland, China	1
intra-national	Ecuador	2	international	Canada, Israel, Italy	1
intra-national	South Africa	2	international	Tanzania, Belgium, The Netherlands	1
intra-national	Spain	2	international	UK, Spain, Sweden	1
intra-national	Denmark	1	international	USA, UK	1
intra-national	China	1	international	Denmark, USA	1
intra-national	Malaysia	1	international	Uganda, Kenya, Tanzania, Rwanda	1
intra-national	Taiwan	1			
Total					93

3.2. Thematic Analysis

3.2.1. Definitions

In our longitudinal analysis, we identified that the HEIs' objectives in starting LLs have evolved over the past decade, which brought different functions of the concept to the forefront in different time frames. LLs in the higher education context initially (2008–2016) referred to ICT-based research, testing user activities in real-life settings in the development of, for example, sensor-based innovations for assisted living, and smart building, city, and campus technologies. From 2017 onward, there was an increase in the number of studies that discuss HEI LLs as hubs and platforms for partnerships, teaching and learning environments and as governance frameworks for addressing campus sustainability.

With respect to our first research question, four categories of definitions of LLs emerged from the articles we reviewed. The definitions correspond to the management and the three core missions of HEIs (Table 3), functioning as the governance frameworks enabling HEIs to focus on sustainability, as experiential learning environments, user-oriented and transdisciplinary research methodologies and as hubs and spaces for knowledge and technology transfer. LLs adopted in the higher education context appear to fuse many facets of LLs and distinct definitions of this open innovation concept. Thus, following Bergvall-Kåreborn and Ståhlbröst [49], we argue that the definitions of LLs are particularly complementary for universities and cater to their diverse profiles and offerings.

Table 3. Definitions and functions of LLs in the HEI context (authors' own elaboration).

LLs as an Open Innovation Paradigm	HEI Domain	Component	HEI LLs Function for the Corresponding Domain
Organizations that provide <i>structure and governance</i> to the user involvement and methodologies, [50]	Management	HE governance framework	Form of experimental governance [12] Convening framework for HEIs that support formal intra- and inter-organizational governance [51]
Open innovation intermediaries that engage firms and public organizations in a <i>process of learning</i> and creation of pre-commercial demand [52]	Education	Teaching and learning environment	College campus at which students engage in experiential learning while contributing to sustainability [53] Realistic and powerful learning environment to nurture intrinsic motivation of students [54] Spaces for experimental education, where educators engage with learners in an experience and continuously reflect upon it [55]
<i>Methodology</i> , that is, processes such as data transfers and methods for user involvement [56]; innovation approach [49]	Research	Research design and methodology	Research approach aimed at open socio-technical innovation processes [57] Research theory and practice to support the co-generation of innovation in a university and city–community context [58]
<i>Environment</i> involving <i>technological platforms</i> and <i>user communities</i> [59,60]		Test environment/ experimentation space	Research and development infrastructure [61] Experimentation environment [55]
		Hub/platform for collaborative innovation	Meeting place for business, society, and academia [63] Living campus as a polygon for inventing, implementing, and evaluating new trends and potentials for future scenarios and sustainable development [64]
<i>Co-creation ecosystem</i> [20]; <i>network</i> [62]	Knowledge and technology transfer (Third Mission)	Transition arenas, neutral spaces, boundary-spanners	Social ecosystem or transition arenas in the context of university [65] Boundary-spanner between participating organizations that have different aims, interests, and cultures but intend to learn collaboratively [43] (Neutral) spaces to facilitate actor engagement [16,59,60]

3.2.2. Nature and Status of LLs in the HEI Environment

We classified the reviewed studies into five categories based on their description of the nature of LLs and their degree of integration in the HEI context (Table 4). We found a small number of studies that explored the concept of LLs and their potential for the development of a HEI-driven innovation and for providing the necessary infrastructure in regional and national contexts [57]. The second group of studies captured HEIs experimenting with LL structures and activities, for example, in launching sustainable campus energy infrastructures at the Malta College of Arts, Science and Technology [66] and expanding the role of existing centralized innovation units to mobilize campus-wide change in Laval University, Canada [67]. The third group of studies discussed LLs as HEI-led multi-sector partnerships, reporting interim results of experiments and communicating the final results. Partnerships in the former category discussed plans to deploy follow-up research, investigating, for example, community use and the impact of launched LL structures [68], participation in urban innovation [69], and the role of LL stakeholders [70]. The partnerships in the latter category have fulfilled their missions and presented results, such as for example, an ICT broadband model in rural South Africa [71], a pedagogical LL teaching approach [55], and support networks launched for the development of sustainable energy in university campuses [72]. The fourth group of studies referred to LLs as anchored structures in HEIs, including experimentation infrastructures, such as zero emission buildings, conservation houses, and wireless broadband setups; coordinating units and innovation centers; and study programs. The final group of studies defined LLs as organizational strategies adopted by the university management to advance engaged teaching and research missions in relation to sustainability goals, while exploiting campuses as learning and experimentation grounds.

Table 4. Nature of LLs in the HEI context.

Status	Description	Reference Publications
1. Exploring the concept of LLs	HEIs investigate the potential of LLs in the region or own institutions	[56,72–76]
2. Experimenting with LLs	HEIs experiment with capacity building in existing university structures to function as LLs	[66,77–79]
3a. LLs as partnerships: evolving	HEI LLs report interim project results and plans for further collaboration	[21,65,67–69,80–95]
3b. LLs as partnerships: concluding	HEI LLs report final project results, without any mention of further collaboration	[23,55,71,72,75,76,78–84]
4. LLs as anchored structures	LLs as anchored structures in the HEIs as transformative units	(i) Infrastructure [61,85–92], (ii) research and innovation unit/center [49,63,93–98], (iii) study program/course [54,65,99–102]
5. LLs as holistic strategies	HEI LLs as organizational strategies for teaching, research and engagement	[12,16,18,53,58,103–126]

3.2.3. Goals

Given that LLs are adopted by HEIs in different forms and have different functions, their goals and motivations will also be different. Our empirical analysis of the articles showed that HEIs pursue distinct yet interlinked layers of organizational goals with their LLs and leadership. They provide the following:

1. Fulfillment of third mission via participation in campus and urban sustainability initiatives [53,110,113,119], environmental and social justice [117], and open science [102] initiatives. HEI LLs contribute to urban development for cultural and social transformation [120]; support recovery in the aftermath of natural disasters [127]; help improve ICT literacy to curb the “digital divide” [81,84]; and increase self-sufficiency via campus regeneration [112].

2. Fulfillment of teaching and research missions through the adoption of novel scientific approaches, which include experimentation [116], transdisciplinarity [128], co-production [12], and co-creation competences among students, academics, and non-academic stakeholders [63,124]. Student bodies are increasingly vocal in demanding learning opportunities that focus on sustainability-related competencies. Thus, HEIs particularly find the hands-on and iterative nature of the LL projects attractive, as well as their capability of bringing together students with citizens and diverse stakeholders through complementary projects, and responding to sustainability challenges [12,53].

The highest number of HEI-governed LL initiatives focus on challenges in the areas of urban sustainable development, elderly care, and energy efficiency (Figure 4). In addressing the listed challenges, HEI campuses and their infrastructures are often taken as experimentation and learning grounds, which places campus sustainability in the second position on the list.

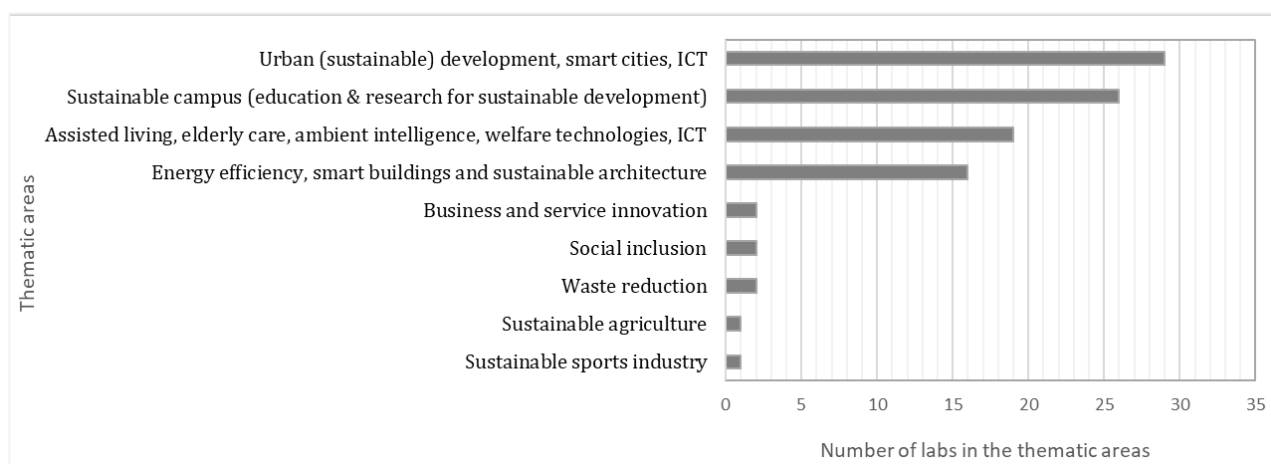


Figure 4. Challenges addressed and number of HEI LLs in the thematic areas.

3.2.4. LLs Integrated in Education, Research and Engagement Activities

Educational activities taking place in a LL environment appear in diverse formats, including anchored courses like the “Laboratory for Sustainable Architecture and Lifestyle” at UPC-Barcelona Tech, which offers transdisciplinary learning experiences in architecture and integrated energy design [65]; project-based course modules, as in Macalester College, offered as electives [108]; temporary arrangements for student participation in cross-sector LL partnerships, such as the one in the SoHoLab project of Politecnico di Milano, during which students engage in co-creation processes with urban stakeholders [129]; and, finally, students’ graduate thesis work [93] and internships [103] organized within LL environments. The studies we reviewed emphasize the centrality of experiential [53], problem-focused [130], and place-based learning principles [131] in achieving the intended learning outcomes. Place-based learning experiences instigated via LLs can help build stronger ties between the students and the community, foster exchange of knowledge, and hence educate students to become “engaged citizens” [124].

In conducting research, many HEI LLs embrace transdisciplinarity [128,132] and co-creation [63,102] as a design and ethical principle [124]. These research approaches can help with the acquisition of concepts such as inclusion and integration, and the acknowledgment of diversity by students and staff [54]. Interdisciplinarity practiced via LLs is a crucial first step toward transdisciplinarity within a university context [126]. LLs are often set up by HEIs to carry out applied research [12] and are exploited as test environments for researchers and students [55,93], comprising HEI campuses, neighborhoods, sports venues, churches, nursing homes, rehabilitation centers, and libraries.

Concerning engagement, we see LLs promoting a multi-stakeholder approach in universities in two layers: among and across the HEI's internal stakeholders (i.e., students, academics, campus services and operations staff, and senior management) and external stakeholders (i.e., public authorities, citizens, NGOs, education institutions, public and private organizations, chambers, associations, public and private R&D centers, and industrial and business partners). LLs facilitate networks between internal and external communities [16,113] thus function as boundary-spanning vehicles for the participating actors [43] (Table 5). HEI LLs bring a broad variety of stakeholders together to co-create knowledge. Although the co-creation is considered one of the core principles of LLs [133], we did not find it in all the studies we reviewed. Citizens as participants contributed to LL research in some cases as observed subjects and in others as co-creators of technological and social innovations. Such collaborations are characterized as public–private partnerships (PPPs) encompassing research institutions, industry, and small- to medium-sized enterprises (SMEs) [121]. LLs that involve companies, public agencies, universities, and citizens are often referred to as quadruple helix [98,134] and public–private–people partnerships (PPPPs) [135].

Table 5. HEI LL stakeholders and their roles.

	Stakeholder Category	Constitutive Group	Identified Roles
Internal actors	Academics	Researchers, educators, lecturers	Knowledge providers [77,78], incorporators [105], capacity builders [87]
	Students	Students, their associates (e.g., students' parents), and alumni (individuals and organizations)	Co-creators [54], users [81], collaborators [99]
	HEI admin	President, HEI senior management	Facility, technology [89,97], and funding providers [130]
	Campus services and operations	Administrative staff, including, for example, energy management units, estates and procurement, spatial planning analytics and visualization, IT department, bio-recycling center, landscape services	Collaborators [76], mediators between user needs, sustainability aspects and technological perspectives [57]; sponsors [118]
	Public authorities	Municipalities, city and provincial councils, local authorities, mayor, and governor	Funders [133], facility and advice providers [75,136], project leaders [107]
	Citizens	Elderly patients, older adults, rural and local communities, interest groups, tenants, professionals, students, civil servants	End-users [92], co-creators [23,49] co-designers [136,137], beneficiaries of services [125], participants [75]
	NGOs	Community partners, civil society	Collaboration partners [67,112]
	Education institutions	HEIs, schools, vocational education institutions	Collaboration partners [77,138]
External actors	Public and private organizations	Banks, hospitals, medical-social networks such as the Swiss Cross, nursing houses, care and housing organizations, and sports and cultural organizations such as libraries, theatres, stadiums, sports clubs, and churches	Collaboration partners [134,135,137], funders [80], experimentation and learning space providers [83,99,101,139]
	Chambers, associations	Business clusters, citizens' associations, professional associations such as the chamber of architects, elderly associations	Practice and transfer partners for implementation and scaling of solutions [110]
	Public and private R&D centers	Research centers, foundations for research and innovation, research networks	Technology and innovation research partners [97,140]
	Industrial and business partners	High-tech SMEs or large multinational companies on energy, aging, ICT, telecommunications	Funding [130], IP and commercialization expertise providers [80]

Academics are centrally positioned in LL initiatives, with their most frequent interactions taking place with students, HEI's operations staff, citizens, and public authorities, such as municipalities, and businesses. Not all LL initiatives involve an educational dimension that incorporates students. Our findings are visualized in Figure 5 utilizing the MAXQDA Code Map function, which calculates the occurrence of the coded segments in the same document referring to each stakeholder. The size of the nodes and the width of the lines represent the frequency of the links among stakeholders.

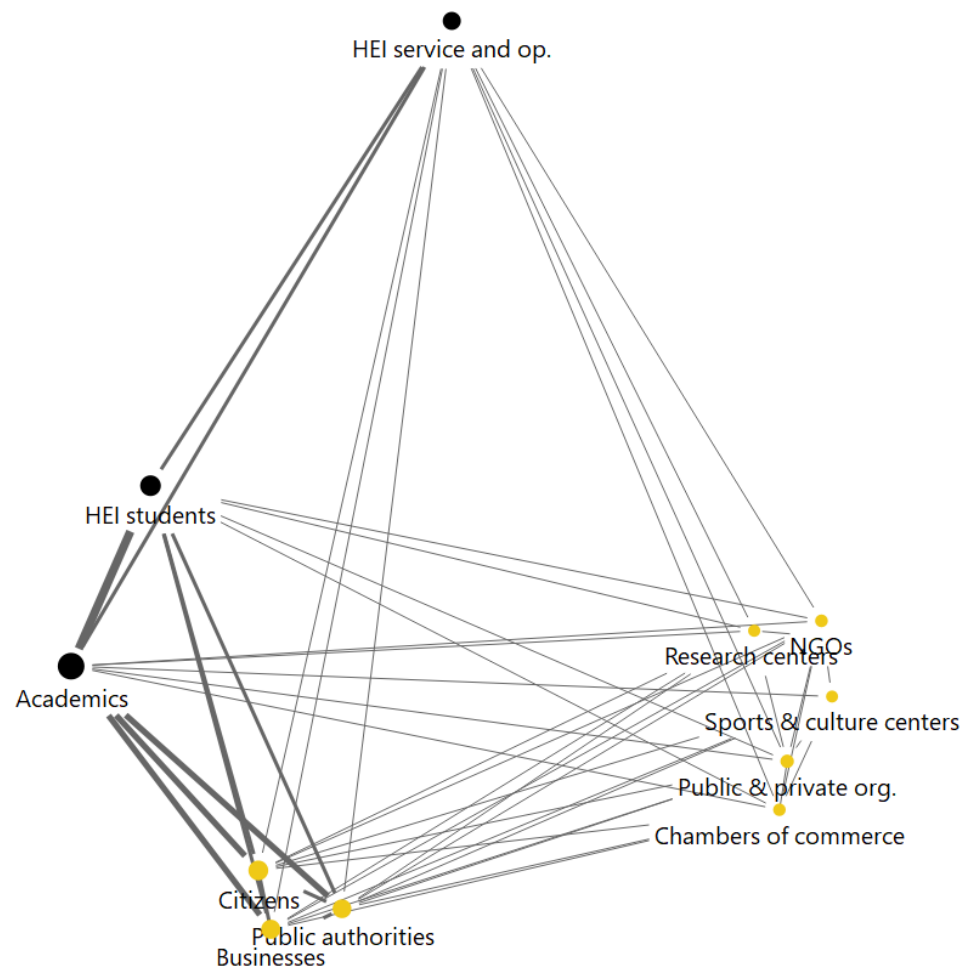


Figure 5. Code map of the HEI LL stakeholder engagement occurrences based on MAXQDA qualitative analysis.

Scope of LL engagement: Following our analysis of descriptive studies, we developed a matrix framework that reveals the stakeholder and geographical scope of LL initiatives governed by HEIs (Figure 6). The matrix shows the diverse character of LLs across six continents. The configurations reveal that most LLs were formed with urban stakeholders (64%), followed by initiatives comprising HEI-internal stakeholders, that is, on-campus LLs for sustainability (17%), multinational LL initiatives (11%), and finally initiatives with a regional/national reach (8%). Our findings showed that multinational LL initiatives focus on issues around sustainable energy, waste, and ICT, most of which are supported by supranational (European) funding.

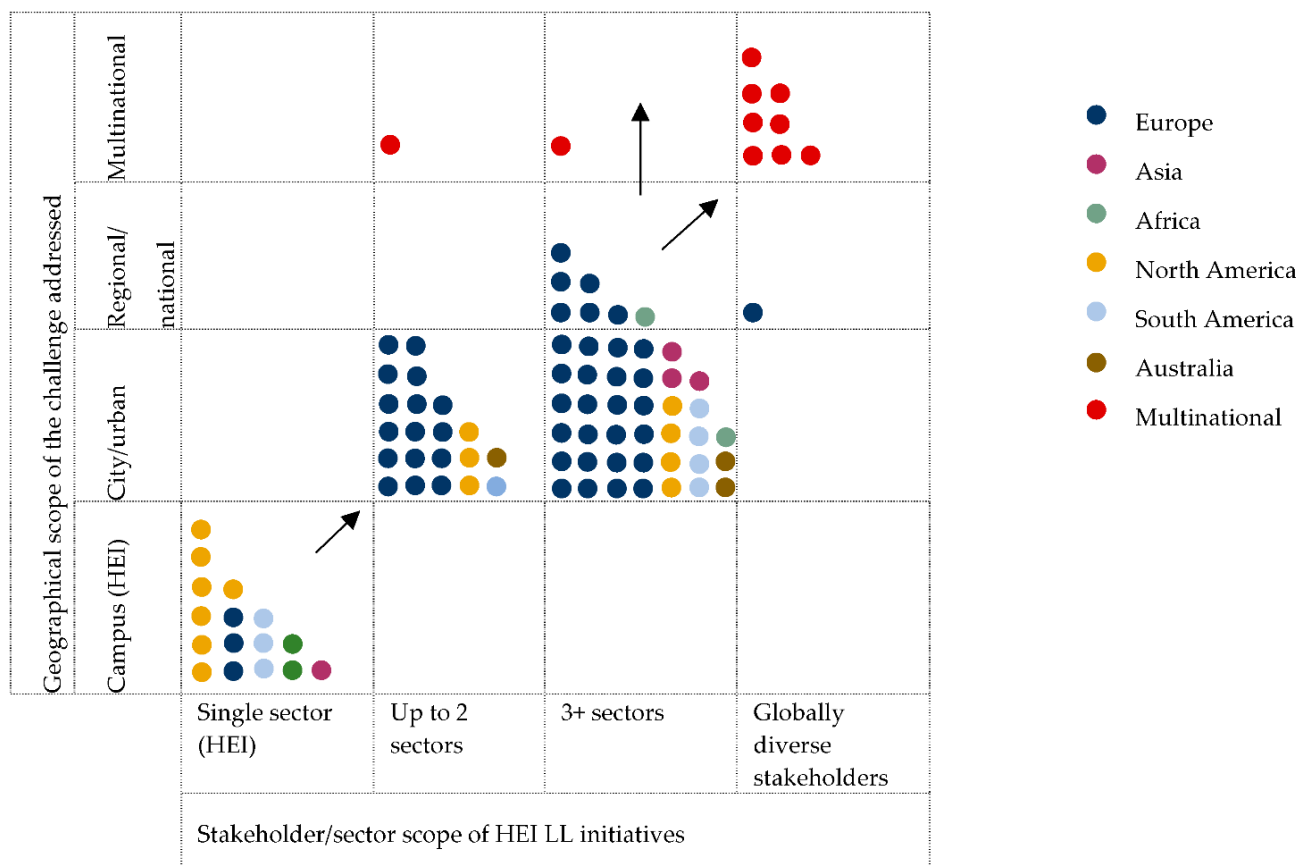


Figure 6. Stakeholder and geographical scope of LL partnerships (Framework adapted from [141]).

In the HEIs in which LLs are embedded as organizational strategies, the constellation of stakeholders and geographical scope of the challenges addressed are of a dynamic nature. The University of Manchester involved a growing number of non-academic stakeholders in its LL environment, including Siemens, Manchester City Council, and Transport for Greater Manchester [12]. Similarly, Agder Living Lab (ALL), based in the University of Agder eHealth Centre and set up for the testing of technical systems and requirements of a medical cloud system, planned to expand to its broader region [135]. Originally situated in the “south-western” quadrants, these and similar cases are thus on course to start engaging with a broader group of stakeholders, in scaling up their activities to the local, national, and international levels and thus increasing their impact.

3.2.5. Evaluation of LLs

Previous research highlighted the fragmented nature of evaluations in LL processes and outcomes in the campus environments [43]. Our review captures a few structured attempts, supported by external organizations. At Macalester College, the strengths and weaknesses of LLs are evaluated based on a framework introduced by the Sustainability Education and Economic Development (SEED) Centre [108]. Similarly, the Association for the Advancement of Sustainability in Higher Education (AASHE) and its Sustainability Tracking, Assessment, and Rating System (STARS) self-evaluation tool; and the International Sustainable Campus Network (ISCN) integrate LL evaluation criteria in their evaluation frameworks for sustainability-oriented learning, research, and campus development activities [104,142]. In project-based LL initiatives, outputs of the LLs are often evaluated based on user satisfaction surveys [80], or empirical and experimental procedures, psychometric testing, questionnaires, and behavioral observations [74]. Protocols and key performance indicators are used to evaluate, for instance, the performance of smart buildings in retrofitting projects [68,121]. Communities of practice formed as

part of LLs are instrumental in establishing a long-term vision for partnerships and in evaluating outcomes and impacts of the projects for different stakeholders [138]. In cases where students participate in LL initiatives, the learning process and its outcomes are less well-defined. In LLs as learning environments, assessment approaches such as reflection seminars, group discussions, and course evaluations emerge as important methods for describing the extent to which learning outcomes have been achieved [93].

3.2.6. Outputs, Outcomes, and Impact of LLs

LLs cover various innovation activities that seek to produce social, economic, and environmental outcomes with benefits both for the university and its wider community (Table 6). It appears that LL outputs are primarily technology-based innovations in the areas of urban development, elderly care, health and welfare, and energy efficiency. This is consistent with our findings that over half the LL initiatives (58%) are driven by the faculties of natural and applied sciences, including computer science, engineering, and medicine. The remaining 39% are driven by interdisciplinary research groups that bring together researchers from natural and applied sciences with researchers from the humanities, business, and social science fields. A very small fraction (2%) is driven by the faculties of business and social sciences.

Previous research suggests that a large proportion of LL innovation outputs are incremental, entailing step-by-step improvements and minor changes in processes/products, and that a small fraction of outputs are radical innovations that propose drastic changes in the sense of enabling new designs and channels of distribution [8]. Our review offers supportive evidence that most HEI-governed LL outputs are indeed incremental. The innovations include, for example, prototypes, system analyses, pilot trials, and collaborative processes that are produced within formalized networks and through the involvement of a limited number of end-users. HEI LLs so far produced only a few innovations that can be considered radical, such as way-finding technologies, intelligent wheelchairs [138], and telemedicine solutions [135] developed with the involvement of diverse stakeholders and a wide geographical uptake of technologies. However, considering that innovations in LLs are not static [19] and that our review is a snapshot in time, the innovations we considered incremental may be evaluated differently in the future.

Regarding organizational impact, the major outcomes of the LL initiatives appeared to be less tangible. HEI LLs help internal and external stakeholders familiarize themselves with participatory research designs such as co-creation and multidisciplinary approaches [138]; they help develop active pedagogy, cooperative learning, critical thinking, and problem-solving skills [105]. They also contribute to the growth of a shared and increased understanding of sustainability [75], and the build-up of collaboration networks [97].

Table 6. Reported outputs, outcomes, and impact of LLs.

Domain	Outputs	Outcomes and Impact
Management		
Expanding networks, coordinating services	New partnerships [97], launch of LL facilitating physical and virtual infrastructure [82], including open innovation spaces [112]	Integration of local innovation potential with the national system of innovation [143]; increased synergies among students and societal stakeholders [65,114]; international recognition [126]; university boundaries and residential community becoming an experimentation field for social innovation [136]
Research		
Testing, trials, experiments (on and off-campus)	Proof of concept and pilot trials for sensor-flooring in elderly housing [85,144]; usability and feasibility studies [111]; adaptive collaborative decision-making processes [134]; prototype of a Web portal for public communication [49]; measurement of energy consumption in buildings [104]; system analysis of campus energy micro grid [66]	Strengthening participatory action research [138]; reducing costs of making poor decisions in product development processes [145]; academic exposure to multidisciplinary research [126]; academic acquisition of new knowledge, research, and opportunities in publishing [100]
Education		
Curriculum development and learning support	Interdisciplinary modules [12]; bachelors programs across faculties of natural and social sciences, and humanities [123]; new face-to-face and online courses, student advisory groups [124]; Master's level training programs linked to an embedded energy testing infrastructure [87]	Anchored LL-based learning as a regular part of the curriculum [14]; staff developing collaborative teaching skills, such as instruction, advice, monitoring processes, and facilitating reflection [120]
Student projects, thesis, and internships	Student capstone projects [101,117]; Master's and PhD projects [65,93]	Academic internships and research projects integrated in LLs [108]; development of active pedagogy, acquisition of cooperative learning, critical thinking, and problem-solving [105], systems thinking and co-creation skills [54]; increased awareness of sustainability [121], and energy efficiency and green technologies [88]
Knowledge transfer		
Technologies	Telemedicine solutions [135]; virtual reality environments and training programs, way-finding technologies, and intelligent wheelchairs [138]; optical networks [127]; regional ICT infrastructure [71]	Improvement in open and transparent urban governance; building of urban heritage communities [134]; enabling innovation through interactive knowledge co-production as alternatives to corporate-driven, technologically deterministic smart city narratives [98]; municipal innovation [109]; increased awareness among citizens of sustainability in personal environments [75]
Digital platforms and services	E-Senior platform comprising e-learning courses and the crowdsourcing module [69]; high-tech platform for public transportation [95]	
Campus technology and facilities	Campus energy monitoring technologies and virtual LL Platform [110]; smart microgrid and garden irrigation system, automatic light and presence sensor systems, charging stations, electric vehicles, bike parking lots [121]	

3.2.7. Factors That Constrain and Facilitate the Impact of HEI LLs

HEI-governed LLs can be more complex because of their diverse portfolio of activities, from engaged student teaching and research, and their building of on- and off-campus communities, to the management of common interests across partnerships [12]. We identified constraints and facilitators across five clusters of factors that may influence the performance and impact of HEI LLs. These clusters consist of (1) exogenous factors; (2) organizational factors; (3) resources and capacity factors; (4) planning and implementation of LLs; and (5) individual and group factors. In terms of exogenous factors, HEI LLs might find a thriving ground in regions where there is political and ecosystem maturity that allows local governments to scale campus sustainability innovations in the cities and allows HEIs to establish synergies with social partners and proactively engage with citizens. In the opposite cases, where there is political uncertainty, change in local governments or no tradition of inter-organizational collaboration, an impact might become hard to attain. Organizational factors deal with whether enabling mechanisms are present within the HEIs. This involves a strategic direction embracing sustainability; the presence of a culture of inter-/transdisciplinarity and, hence, an embedding of LL principles in teaching, research, and third mission activities; and participation in sustainability charters or networks. HEI resources and their capacities are another factor that might influence the impact of LLs. This refers to the availability of dedicated finances, human resources, and infrastructure for the successful management of LLs, as well as knowledge capacities on the part of both academics and students in inter- and transdisciplinary research. Here, funding appears to be a central topic, especially for HEI faculties that lack institutional support and that rely on external grants. In our studied cases, most LL collaborations were launched through the acquisition of specially earmarked green funds or stimulus subsidies from institutional, regional, national, and supranational sources (Table 7). Funds appear diversified, comprising subsidies, pay-per-service and cross-finance income generated by HEIs. In a small number of cases, LL initiatives are launched as part of internal (HEI) strategic goals, stressing sustainable campus development and adoption of sustainability-oriented teaching and research practices.

Table 7. Funding models of HEI LLs as found in the descriptive studies.

Funding	Definition	# LLs
Combination of sources	European grants, such as Horizon 2020, Intelligent Energy Europe, 7th Framework Programme, European Union ACP S&T, Edulink II, and Interreg; national research and development grants, such as government excellence initiatives, green funds by the Ministries of Research, Education, Culture, Science, Environment, Family Affairs, Senior Citizens, Women, and Youth, state agencies of energy, technology and innovation; and associations, such as higher education councils, foundations for hospitals	64
	Subsidies, that is, public and private funding generated within LL partnership	
	Pay-per-service, that is, income earned from LL services provided	
	Cross-financing, that is, profiting from physical assets	
HEIs' own initiative	LLs are internally funded as part of sustainable campus development initiatives that are embedded in study programs, LL infrastructure	29
Total		93

Table 8 presents the constraining and facilitating factors that influence the impact of HEI LLs. In terms of the cluster of LL planning and implementation factors, the table highlights a number of management issues concerning the operationalization of the HEI LL initiatives. These factors point to whether academics are able to strike a balance in managing diverse stakeholder interests and carry out joint research, to conduct a formal monitoring and evaluation of LL activities, to create a pool of community participants, and to adhere to ethical guidelines. Beyond organizational and operational level concerns, individual and group factors might also play a crucial role in driving the impact of HEI LLs. These factors involve the attitude of HEI staff and students towards LLs and participatory methodologies, alignment among HEI staff regarding their political leanings on sustainability, and the sharing of mutual goals among LL consortium members.

Table 8. Constraining and facilitating factors influencing the impact of HEI LLs.

Constraints		Facilitators
<p>Political: HEI LLs forming long-term linkages with local government and related organizations in times of political uncertainty [80], change in local governments and conflicting views on LL projects [107] Ecosystem: Weak LL ecosystems in the Asian context that prevent HEIs from establishing synergies with local stakeholders [145]; risk of failure in the replication of campus innovations in the city due to complexity of technologies, missing networks, and standardized regulations [43]</p>	Exogenous factors	<p>Ecosystem: Tradition of sustainability activism in the region, with engaged citizens who are ready to get involved [124]; Policies: Presence of supranational/regional/national sustainability policies in energy [76,90], urbanization [82]; national science policies proposing the use of LLs as the ideal research concept for sustainability missions [110]</p>
<p>Strategic: Disconnect between LL and existing organizational boundary units [108] Administrative: Increased legal responsibilities for the campus operations staff in building management [43]; short semester periods preventing the finalization of the co-creation cycle for students [99,113]</p>	Organizational factors	<p>Strategic: Organizational mission and vision addressing sustainability [12,18], and adoption of LLs as ideal means to realize organizational goals in research, teaching, and third mission [113,114]; bottom-up push by academics and students [115]; recognizing leadership from students and stakeholders [16]; changes in career evaluation criteria for academics toward sustainability and transdisciplinary research [18]; Sustainability networks: Participation in sustainability charters [110,113]; climate communities [117]</p>
<p>Finances: Limited funding [113,137]; translating the value the HEIs create into feasible business models [70]; Infrastructure: Weak IT network infrastructure posing challenges for smart campus LL initiatives [126]; Time: Projects being time consuming and financially demanding [65]; Knowledge: Lack of knowledge and experience toward inter- and transdisciplinary research [73,80,110]; reductionist research designs and lack of competency for inter- and transdisciplinary communication between researchers and users [57]</p>	Resources and capacities	<p>Finances: Commercialization of LL innovation outcomes, launching spinoff businesses [61]; ensuring sustained financial support [53]; Human resources: Assignment of devoted HEI LL coordinating units and work teams [53,146]; capacity building of students on participatory research skills [99], and HEI staff and LL stakeholders on transdisciplinary research [57], sustainability topics [75], and operations [147]; Infrastructure: Availability of ICT campus infrastructure facilitating cooperation among LL stakeholders [106]</p>
<p>Management: Finding a balance in incorporating practitioner and academic research [54,113]; maintaining a balanced approach to stakeholder management given disparate identities and values [73]; managing diverse activity domains, including teaching, campus services, and community engagement [12]; Evaluation: Lack of formal monitoring [75,145] and evaluation [74] of the impact [138] of the LL processes and assessment of learning outcomes [93,99]; Ethics: Challenges in accessing data when HEI services staff hesitate to share information with researchers due to confidentiality concerns [113]; ethical concerns in data collection while working with vulnerable populations, particularly with medical-level data in the health-focused LL initiatives [77]</p>	LL planning and implementation	<p>Management: Thematic projects based on problems associated with the campus [147]; clear administrative procedures and continuous communication established with partners [94]; involving all stakeholders in the LL processes from the start [99]; increasing stakeholder commitment and alignment via voting, drama performance, gamification, and participation in the supervision of prototypes [136]; Engagement: Creating a network of users through existing institutions [77,148]; having a “door-opener” to connect with communities [137]; research findings presented to the public [61]; Ethics: Presence of an ethics committee and privacy protocols [94]; adhering to legislative provisions and ethical guidelines [80]</p>
<p>Attitudes: Lack of interest among academic staff [126]; personality barriers in participative methodologies [81]; divided political views among academic staff causing the refusal of strategic collaborations with municipal authorities [114]; academic resistance in the paradigm of sustainability because of political leanings [100]</p>	Individual and group factors	<p>Attitudes: Strong interest among students in sustainability [128] and LL projects [12], academic interest [138]; Goal alignment: Sharing of mutual goals and trust [118]</p>

4. Discussion

The purpose of this SLR was to provide an in-depth overview of existing knowledge on LLs governed by HEIs. We identified the LLs' potential and the challenges for LLs as new entities that are working on innovation in higher education, and the factors that influence HEIs in adopting LLs. We selected 111 articles on HEI-governed LLs for our investigation, capturing 93 cases from universities across the world. Our findings contribute to the higher education management and third mission literatures, producing insights about LLs as enabling spaces for open innovation.

4.1. Theoretical and Empirical Contributions

4.1.1. Interpretation and Adoption of LLs in the Higher Education Context

Our findings support and build upon the premise of LLs as attractive platforms through which sustainability strategies and policies are being implemented in HEIs—thus helping them fulfil their third mission [28]. The LL as an open innovation concept is translated in the HEIs in each of their management, research, education, and knowledge and technology transfer domains. In the cases where LLs are adopted as an organizational governance framework, sustainability (and the SDGs) emerged as a strategic orientation of the third mission. In the same cases, LLs enabled the embedding of engagement in the HEIs both horizontally and vertically by involving internal and external communities in teaching and research. This process commences in different forms in different organizations, for example, through the adoption of a LL approach as an education or research strategy, or the launching of intermediary units and the assignment of contact persons to mediate sustainability-related conversations across and beyond the HEI. LLs in the HEIs evolved from test-beds to frameworks for project-based initiatives and, finally, to organization-level strategies for promoting sustainability. LLs thus appear to support HEIs in their move from economic development-oriented “entrepreneurial” institutions towards becoming public good-oriented “civic” universities in which engagement is embedded across the whole institution [149]. Thus, LLs enable a shift in the roles and responsibilities of HEIs from knowledge producers to anchor organizations, facilitating bi-directional knowledge exchange with their social partners [31].

4.1.2. Integration of LLs in the Core Missions of HEIs, and Their Outcomes and Impacts

Despite the increasing interest, core LL principles, such as transdisciplinarity, citizen involvement, and multi-stakeholder collaboration, are not yet fully integrated into the fabric of HEIs. In that, project-based LLs may be seen as the preceding steps toward embedding of LLs more firmly in HEIs, through building interdisciplinary work capacities, propagating values of sustainability and behavior among students, and activating local stakeholder networks. To achieve such a vision, the HEIs can start by building upon success stories at the faculty level and rewarding micro-practices, rather than placing the major emphasis on a wider organizational-level change. Our findings indicate multiple instances of academic distance and resistance to interdisciplinary work that appear hard to address only by means of strategies and centralized structures set up to coordinate LL activities.

Our findings signal missing opportunities, and potential risks and challenges in the stakeholder engagement exhibited by LLs. First, students so far are not consistent participants of the HEI LLs. LL settings can be used to design experiential and co-creation-oriented learning experiences to both prepare students to be active and engaged citizens [63] and to address the competency needs desired by industry and public sectors [149]. Second, HEIs reported challenges in the recruitment and engagement of citizens. This could pose a risk in decisions being made on behalf of citizens, rather than LLs fulfilling “citizen-centric” goals [150], which might call into question the public value of the innovations. Factors such as the voluntary nature of citizen participation and lacking mechanisms in the HEIs for public engagement remain to be addressed. HEIs as “neutral” innovation ecosystem

actors may help overcome some of these challenges by rebalancing unequal power relations among citizens and other community stakeholders [151].

The outputs of the HEI-governed LL initiatives are found to be incremental, largely because of the temporality of the LL projects, and the lack of long-term strategies and sustainable business models for LLs. To create their desired social impact, partners involved in the LLs need to generate a diversified funding base, thus reducing the LLs' dependence on temporary project grants and subsidies [152]. In less mature ecosystems, however, this might require HEIs to engage in strong lobbying to involve local stakeholders, including municipalities. The impact of LLs relies on the scalability of (campus) innovations, and the testing thereof in broader geographical and social contexts. Undoubtedly, this will require legitimization that could be provided by local governments, taking on a "municipal leadership" role, in which they engage in practices to place sustainability issues on the local political agendas [153] and to create the regulatory conditions for the implementation of the related experimentations [43]. To ensure the LLs' impact and sustainability, the HEIs can further build on the already existing "entrepreneurial" capacities in their institutions, such as technology transfer offices and industry networks. However, our results have shown that only in a few cases the HEIs were prepared to tap into their own resources or generate revenues, for instance via, pay-per-service models or subsidies, which would allow them to create public and business value. The excess capacity of laboratory environments at HEIs can perhaps be exploited as experimentation grounds or meeting spaces, which can open doors to new revenue streams.

4.1.3. Factors That Influence the Impact of LL Approaches in the HEIs

A systematic assessment of HEI-governed LLs is crucial to be able to make broader claims about the value of this innovation approach. Our review has identified only limited attempts to evaluate LLs across the HEI domains. In campus living labs, monitoring frameworks are mainly provided by sustainability oriented (higher education) network organizations, which were taken up by a few of HEIs, according to the studies we reviewed. The value of such networks comes from their provision of tools for LL performance assessment, the presentation of awards to highlight accomplishments, or the creation of spaces for knowledge exchange and cross-border scaling of practices. In the majority of the cases LLs reported quantitative outputs and short-term impacts limited to the lifetime of their LL funding. Evaluation frameworks will be needed to further support context-specific and tailored development strategies towards sustainability.

HEI LLs have a dual function in facilitating organizational learning and change, and coordinating co-creation efforts for producing social impact. LLs have also emerged in the higher education sector as temporary organizations [154] that are structured as time-restricted projects exploiting on or off-campus spaces as labs, and formal organizations in the form of research units or innovation hubs that facilitate intra- and inter-organizational collaborations to produce innovations. In both forms, HEI-governed LLs seem to occupy a *hybrid boundary space* that bridges knowledge producers (scientists, engineers, and economists), and knowledge users (city managers, consumers, or policymakers), engaging them in a collaborative, user-driven dialogue to link knowledge with sustainability-oriented action. HEI LLs demand strong leadership both in managing diverse stakeholder groups with competing interests and steering transdisciplinary knowledge production. As boundary actors, academics in their role as LL managers can communicate internally and promote the values of participatory innovation approaches, thus contributing toward bottom-up organizational change in their organization. Furthermore, when LLs are designed as an area protected against organizational pressures and as "experimental space" [155], campus staff and academics in HEI LLs can distance themselves more easily from everyday routines and develop networks and ideas for sustainability-oriented transformations in their own institutions.

However, for LLs and co-creation methodologies to gain acceptance among academics, incentive structures in the HEIs have to be reformulated. These include the ways, for example, in which new knowledge is legitimized and academic career progression is shaped. The current challenge with LLs involves having to deal with complex and uncertain issues in iterative steps, which contradicts traditional academic career progression structures that value continuous publication streams. Finally, unlike other social actors, HEIs can accommodate strategic objectives that stretch over a long period of time [19]. This, combined with financial and other resources as well as skills, can help HEI-governed LLs have greater social impact. The HEI's mechanisms for social engagement and innovation will need to be reconfigured to accommodate LL approaches, and new positions should be created for individuals who can steer the dialogue across the faculties and external communities.

4.2. Conclusions and Future Research

Our study has a number of limitations that need mentioning. First, we considered English-language studies only. Second, we limited our search terms to LLs, thus excluding studies of other forms of laboratories in a real-world context that could also be relevant. We also might have excluded studies that discussed a laboratory approach to innovation in the HEIs yet did not refer to any particular conceptual terms. Finally, we limited our review to the academic and grey literature published over the past 12 years. Our review therefore excluded studies published before or beyond this timeframe.

We propose a number of avenues for future research. HEI-governed LL initiatives harbor numerous tensions in bringing diverse stakeholders together, with each of them having their own demands and expectations. Future research might focus on how this diversity and the resulting competing values and demands can best be managed in LLs and their leadership to produce the most beneficial organizational and social outcomes. The implications of different business models for LLs, the design of participatory evaluation methodologies, and the impact measurement frameworks for LLs are highly relevant research areas because the existing literature is, so far, scant on these issues.

HEI LLs can provide useful contexts to empirically investigate distributed instructional leadership, as we observed examples of educator roles in LLs expanding and extending to internal (e.g., campus service and operation staff) as well as external non-academic partners. Future research can focus on how instructional leadership positions and structures can be organized in LLs to facilitate student co-creation. This is linked to a need to identify the educational outcomes that are expected of students who are involved in the LL activities. It also points to a need to better understand the changing roles and responsibilities of HEI educators in LL partnerships, with educators acting as equal partners next to students in the co-creation of sustainability-oriented interventions.

More generally and going beyond LLs, the literature is unanimous on the potential of HEIs for helping build capacity for multidisciplinary research and education. However, our knowledge is still limited on how HEIs perform in this role. In light of the challenges reported, future research will need to focus on how the relevant competences for trans- and multi-disciplinarity can be developed among academics and their non-academic partners. This can support them to successfully participate in the co-creation taking place in LLs. Finally, given the increased risks around campus data acquisition and data sharing as part of LL initiatives, we see a need for future research to investigate how privacy issues in the LLs' activity portfolio can be handled.

Finally, and foremost, we hope that this literature review will help in formulating a research agenda that more broadly addresses the overarching question of how new organizational structures, such as LLs connected to HEIs, and their stakeholders (academics, students, citizens, and professionals) can collectively produce impactful knowledge and work towards achieving the SDGs.

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