

A Revolution for Post-16 Education - Part 2

How do Living Labs Work?

M Hassan Waheed

Executive Summary

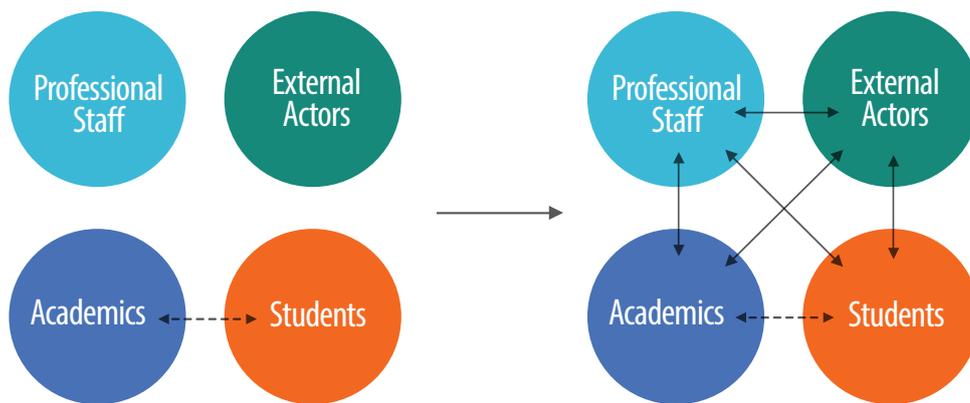
This executive summary provides a simple overview of the EAUC Living Lab model. As a whole, this document provides practical and applicable information on what Further & Higher Education Living Labs are and the diverse forms they can take.

The model takes a two-step approach to represent current or help design new Living Lab projects. It can also be used to describe or plan for the institutional Living Lab initiative as a whole.

Further and higher education institutions are represented through four main stakeholder groups.

	INSTITUTIONAL EMPLOYEES	INSTITUTIONAL PARTNERS
PRACTITIONERS	Professional Staff	External Actors
ACADEMIC ACTORS	Academics	Students

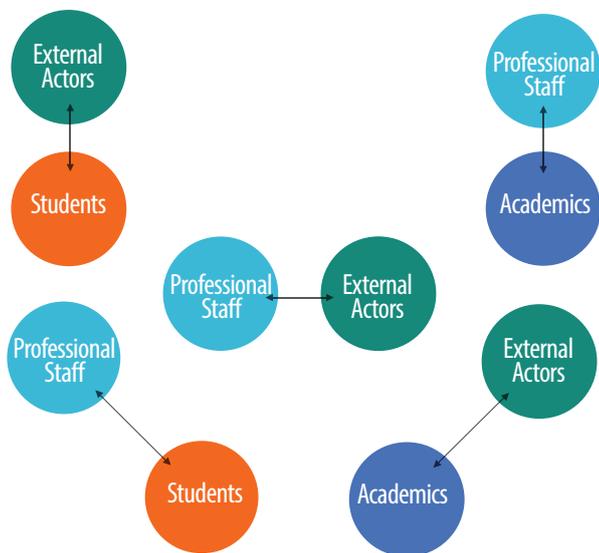
The first step, the ‘basket of relationships’, involves forming connections between four different stakeholder groups. It essentially describes **who** is involved in a Living Lab project.



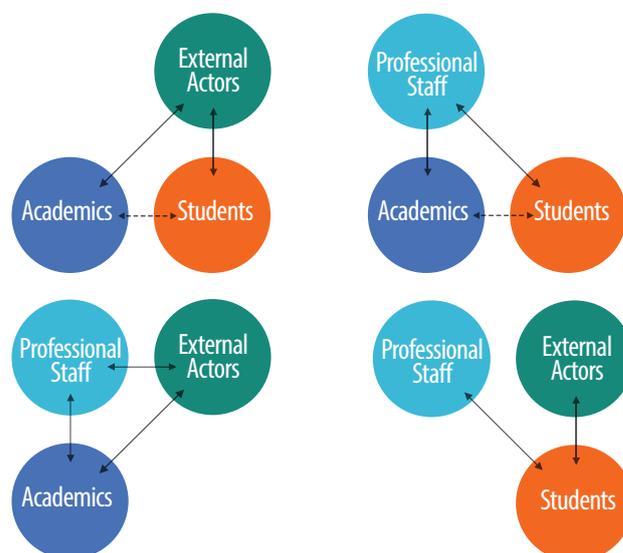
These diagrams represent the missing connections between the four stakeholder groups (left) and all the different ways in which a Living Lab can connect them in a project (right).

The ‘basket’ recognises the very diverse ways in which relations can be formed between the groups. Between the two diagrams above, there are over two dozen different ways in which Living Lab projects can involve participants from the stakeholder groups (some examples are highlighted on the following pages).

No particular type, number or order of relations or stakeholder groups is favoured, the ‘basket of relationships’ is flexible to different needs at different institutions. For example, a Living Lab may concentrate on projects with just one of these relations, or a select handful, or continually evolve to adapt any relation that suits relevant project opportunities. The model has no constraints, as long as all project relations involve at least one professional staff or external actor.



These are the five main types of **foundational** relations which involve only two stakeholder groups at a time.



These are some examples of **multi-stakeholder** relations, where participants from more than two stakeholder groups are directly involved in the project.

The second step involves the ‘basket of principles’. Principles essentially describe **how** a particular project is being conducted, i.e. what makes it a Living Lab project. There are seven principles that define the different methods and characteristics within the Living Lab approach. They are all summarised in the EAUC Living Lab definition (next page). As with the relations, selecting how many and which particular principles to incorporate within a project is a choice, but with one key exception. The only strong recommendation within the whole model is to assure that the three ‘**core principles**’ are incorporated. These give projects legitimacy as a Living Lab approach, with the key benefits and characteristics associated. The remaining four principles can be applied flexibly and through any combination. For example, one Living Lab project may incorporate all principles, another may include only five, and some only the three core principles. Although, all principles are important aspects of the Living Lab approach and should be considered wherever relevant and possible. Each principle is founded in established and evidenced Living Labs practice, along with its potential benefits.

Through a combination of the two-step approach, the ‘basket of options’ model offers a great deal of project possibilities, each with a unique combination of a relation and principles. This invites creativity, difference, flexibility and, above all, recognition of the diverse ways in which Living Labs can be implemented.



Core Principle **Real Sustainability Challenges**

All LL projects should address real sustainability challenges. These will typically be provided by professional staff and/or external actors.



Core Principle **Formal Participation**

Students can participate in LL projects through curricular activities (e.g. courses, dissertations, compulsory volunteering/projects) or formal extracurricular programmes (e.g. internships, summer schools); *academics* as part of their teaching & research; *professional staff* through their formal responsibilities; and *external actors*, if relevant and possible, as part of paid work.



Core Principle **Stakeholder Partnerships**

All participants in LL projects are equitably involved as stakeholders. Aspects to observe include: involvement in decision-making, active participation, and transparency.



Learning Loops

The LL project takes advantage of knowledge and outcomes 'looped' back into it from a similar/related LL project(s) in the past or present.

A Living Lab is where real-world sustainability challenges are formally addressed in stakeholder partnerships.

A Living Lab encourages co-creation & co-implementation of transformations through transdisciplinary efforts, over a series of learning loops, to sustainably develop a geographically-bounded testbed.



Transdisciplinarity

The LL project draws participants from various backgrounds (different academic disciplines and different practical areas) in mutual learning and knowledge production for addressing complex sustainability challenges.



Co-Creation & Co-Implementation of Transformations

The LL project aims to deliver real change, where stakeholders collectively research, experiment, prototype, test, create and implement practical transformations. These could be one-off 'solutions' for simple circumstances, ongoing projects, or 'situational improvements' for complex scenarios.



Geographically-Bounded Test-Bed

The LL project directly addresses sustainability challenges in a physical location designated as a LL. This geographic zone, with its infrastructure, processes, environment, and social life, is also subject to other past, present or future LL projects.

A Revolution for Post-16 Education – Part 2

How do Living Labs Work?



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Author: M Hassan Waheed

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Please direct all your questions and queries to:

Environmental Association for Universities & Colleges (EAUC)
University of Gloucestershire
The Park
Cheltenham, GL50 2RH
+44 1242 714321
info@eauc.org.uk
www.eauc.org.uk

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The EAUC hosts a Living Labs Community of Practice, which is open to all staff and students from EAUC member institutions. The community is a platform for exchanging knowledge and ideas about university and college Living Labs. To join the Community of practice, simply email info@eauc.org.uk with a request to be added to the Jiscmail.

Acknowledgements

Author's Remarks

I am thankful for contributions from members of the EAUC Living Labs Community of Practice. Their participation in this co-creation process has guided the development of this model toward a much greater relevance for education, research, operations, administration, and external engagement in further and higher education institutions across the sector.

I would specifically like to thank Dr Katja Brundiers (Arizona State University), Professor James Evans (University of Manchester) & Professor John Robinson (University of Toronto) for providing invaluable advice and critique on this work. Their feedback has helped to refine this research so it flexibly and effectively captures the essence of the further and higher education Living Lab.

Who Is This Model For?

Firstly, this tool describes the EAUC Living Lab model in depth. Secondly, it attempts to demonstrate the flexibility and relevance of the Living Lab model in the sustainability efforts of institutions. It is for practitioners and researchers aiming to gain an advanced understanding of the Living Lab.

The model can be used in different ways: e.g. for assessing the scope of current activities or for planning Living Lab projects. The model has been developed in collaboration with Living Lab practitioners from different backgrounds. As such, it is of relevance to and designed for both academics (teaching & research staff) and professional staff (operations, administration, other corporate services, academic support, external engagement etc.) interested in advancing the Living Lab approach within their institution (i.e. for Living Lab 'coordinators').

List of Abbreviations

EAUC	Environmental Association of Universities & Colleges
ESD	Education for Sustainable Development
FHE	Further & Higher Education
HR	Human Resources
LiFE	Learning in Future Environments (A tool developed by the EAUC)
LL	Living Lab
SDG	Sustainable Development Goals
UK	United Kingdom

Table of Contents

Introduction	.....1
1. Basket of Relationships	.....3
1.1. Four Stakeholder Groups in a Living Lab	.....3
1.2. Multi-stakeholder Relationships	.....7
1.3. Intra-stakeholder Relationships	.....8
1.4. Implementing the Basket of Relationships	.....9
2. Basket of Principles	.....11
2.1. Core Principle: Real Sustainability Challenges	.....13
2.2. Core Principle: Formal Participation	.....15
2.3. Core Principle: Stakeholder Partnerships	.....17
2.4. Co-creation and Co-implementation of Transformations	.....19
2.5. Transdisciplinarity	.....21
2.6. Learning Loops	.....22
2.7. Geographically-bounded Test-bed	.....23
Concluding Guidance Notes	.....24
Timelines	.....26
References	.....28
Appendices	.....30
A.1 Students	
A.2 Professional Staff	
A.3 External Actors	
A.4 Academics	

Introduction

The Living Lab (LL) concept has been adapted and reshaped by several actors, including educational institutions, businesses, local governments, and EU-funded bodies (Robles et. al., 2016: 21; Lepik et. al., 2010; König & Evans, 2013: 4). The concept originally transpired from a combination of different research methodologies from European and North American universities. It has since continually been moulded as it crosses sector and discipline boundaries. The concept recently returned to further and higher education (FHE) as a sustainability-oriented cross-cutting approach for education, research, practice and engagement (McCormick & Kiss, 2015; König & Evans, 2013). This latest resurgence is the most relevant form of the LL concept that this research builds on.

The EAUC Living Lab (LL) model is a combination of two interlinked parts: the 'basket of relationships' and the 'basket of principles' that collectively describe LL projectsⁱ.

Why a Living Lab model?

This FHE-specific LL model has three main purposes.

Firstly, it distinguishes the LL from other concepts which align or overlap, for example: open innovation; user innovation; LAB studio model; FormIT; experiential learning; applied research; action research; problem or project-based learning; solution-oriented sustainability learning; transformative learning; service learning; internships; independent student projects such as theses and dissertations (Beaudoin & Brundiers, 2017: 9; Heikkinen & Stevenson, 2016; Wiek & Kay, 2015; Ståhlbröst & Holst, 2012; Robles et. al., 2015). The LL is complementary with most of these models. However, it differs from them in a number of ways. **One** important distinction is

that no other concept incorporates all the principles and relationships that make the FHE LL as unique as it is. **Another** reason which distinguishes a LL is that it is much broader than an innovative research or teaching methodology. An FHE LL is equally relevant as a governance tool, practical sustainability tool or engagement methodology as it is a pedagogy. However, more importantly, it also has the potential to serve as a way in which an FHE institution operates and governs agendas. As such, a LL can become a part of transformative institutional change that draws on both top-down and bottom-up strategies. Therefore, unlike most other approaches, a LL can not only deliver change through the sustainability challenges it engages, but also through the way an institutions' primary activities are carried out; i.e. it can evolve the very methods with which education, research, external engagement and operations/administration are conducted. This holistic change can encompass policies, culture, behaviours, the physical environment, infrastructure and other activities and practices. Thus, in addition to serving as a methodology, a LL ultimately aims to systematically transform the very area that it is applied to.

However, the most attractive short-term enabler of a LL may be that most institutions already have pockets of LL or LL-related initiatives. These projects may employ one or more of the related concepts, and usually stand out as some of the most innovative and impactful work at the institutionⁱⁱ.

However, they are also likely to be isolated efforts, possibly with a lack of resources to sustain or grow in the long-term. A LL model can be an effective tool for identifying this set of projects with common principles and themes to connect and synergise them. It can

ⁱ 'Project' in this document denotes a specific activity involving participants engaged in work 'on-the-ground', and **not** the institutional LL initiative as a whole

ⁱⁱ Pallot et. al. highlight how some of these approaches may overlap with and through the LL (Pallot et. al., 2010). Although, the FHE LL model proposed by this research is much than the LL model that Pallot et. al. originally incorporated. The LL approach has since evolved and grown, but the paper remains conceptually relevant.

provide the impetus to build a launch-pad that raises the profile of LL and related work, legitimises it as a leading approach to sustainability in various areas, and attracts more resources to build on the LL approach with more activity. Ultimately, the model LL can be utilised as a catalyst that helps enhance the work of existing projects, while using them to build momentum for more LL projects.

The second purpose of the LL model is to fulfil the need for a shared sector-specific notion of what a LL is. Since LLs are interpreted and described in many different ways globally, a recognisable approach allows institutions to more easily confer, communicate and collaborate with each other. This FHE-specific model incorporates all the relationships and principles important in observing the important characteristics which define the LL approach at an FHE institution. It is also purposefully broad and interpretable through a range of colourful possibilities, without constricting imagination or setting a rigid outline. Thus, the model accommodates diverse needs, while being simple enough to communicate with.

Finally, there is a shift in the social contract of FHE institutions. As uniquely placed public bodies, FHE institutions are under increasing **external** pressure to be more proactive in helping to face the great sustainability challenges of our time. For example, effective community engagement; participation in policymaking processes; ‘on the ground’ impactful sustainability projects and research; and responsible investment are just some of the externally facing activities now expected of institutions.

At the same time, there are requirements to deliver more sustainability benefits **internally**. Institutions are expected to reform curricula so their graduates can deal with rapid societal change (e.g. systems thinking; leadership; real-world work experiences; professional and employability skills; avoiding technological unemployment etc.). Research

is expected to not only inform about, but also help solve the practical challenges facing society. Institutions are also expected to become examples of how organisations can operate sustainably against demanding economic challenges. Traditional modes of practice, teaching and research are no longer enough; society is demanding alignment with societal challenges. A LL is a critical way for institutions to respond to these challenges. Therefore, this LL model serves its purpose as a timely initial step to help the sector better understand what LLs are, how they can work to the advantage of FHE institutions, and how they can be implemented to respond to this changing social contract.

How this model works

The **first step**, the ‘basket of relationships’ categorises the four stakeholder groups, and describes how they can connect with each other in LL projects. The **second step**, the ‘basket of principles’ describes the different principles which LL projects can incorporate, i.e. the methods that make the projects a LL approach. These two ‘baskets’ are collectively referred to as the ‘basket of options’ modelⁱ.

This model draws from numerous sources, including FHE & non-FHE LL practical cases, academic literature, sector reports, interviews, and other sources referenced throughout this tool (McCormick & Kiss, 2015; Robles et. al., 2016; van der Walt et. al., 2009; König, 2013; Evans et. al., 2015; Beaudoin & Brundiers, 2017b). The model was also informed by several stages of feedback from: consulting academics and practitioners of FHE LLs in Europe and North America (Sep 2016 – Feb 2017); an initial survey of 20 members of the EAUC LL Community of Practice (Sep 2016); feedback from attendees of an EAUC LL event (Jan 2017); further feedback from the EAUC LL Community of Practice (Feb 2017); and further feedback from LL practitioners internationally (Feb 2017). It aligns several different perspectives to represent the needs of academic work as well as real world practice.

ⁱ The ‘basket of options’ phrase was coined by James Evans (University of Manchester)

Basket of Relationships

1.1 Four Stakeholder Groups in a Living Lab

The four stakeholder groups of a LL are derived from the structure of FHE institutions. FHE institutions are unique organisations whose main purpose is:

1. educating **students**, who are
2. taught by a body of **academics**, who also conduct research in the case of universities;
3. this teaching and research is enabled by **professional staff** who manage the institution's physical, administrative and functional aspects;
4. at the same time, institutions are publicly funded organisations obligated to function as a public good for both internal *and* **external actors**, specifically local actors surrounding them

Each of these four stakeholder groups has different needs, challenges and motivations with respect to their involvement in the institution. It can be helpful to understand these groups in the following way:

	INSTITUTIONAL EMPLOYEES	INSTITUTIONAL PARTNERS
PRACTITIONERS	Professional Staff	External Actors
ACADEMIC ACTORS	Academics	Students

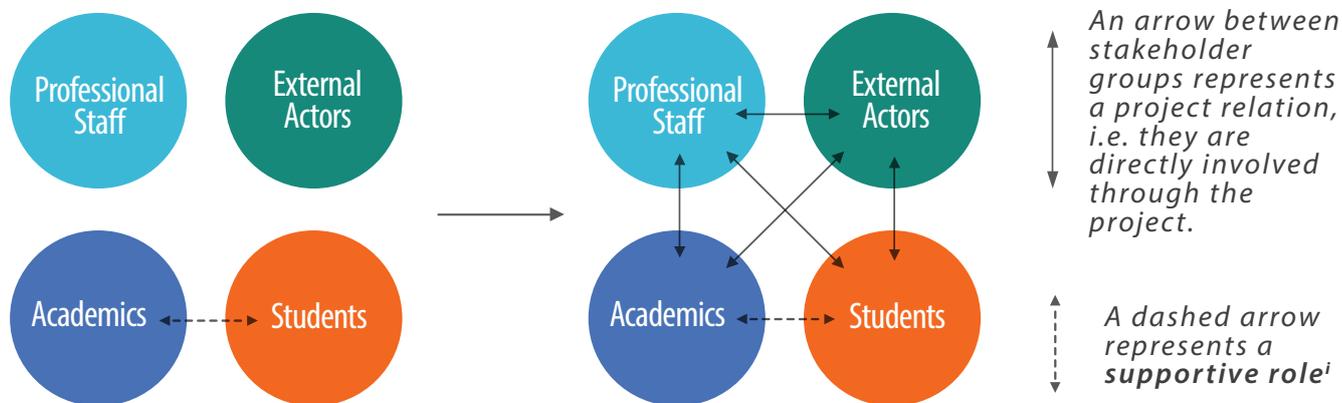
Each stakeholder group is summarised in the following table:

STAKEHOLDER GROUP ACTORS WITHIN THE STAKEHOLDER GROUP

Students	Individual students or student groups
Academics	Individual academic teachers or researchers; formal or unofficial research groups; institutes and research centres (including academy-based sustainability departments); schools; faculties; and any other internal authorities governing teaching and research
Professional Staff	Generally, this group includes individual staff, groups, departments and any other internal bodies not formally researching or teaching in the institution. These include administrative wings, academic support, operations, estates, community engagement, practice-based sustainability departments, finance, HR and other corporate services.
External Actors	Organisations the institution already directly or indirectly works with or supports, through either academics or professional staff. They are existing partners with a special business/financial relationship, such as local governments, charities, work contractors, and firms (architects, engineers, regulators, builders, suppliers etc.)
This is the largest group which can be split into 3 parts	Registered private, public and third sector organisations
	Individuals, families, communities and informal groups

Appendix A details each stakeholder group with examples of how they can be involved in a LL.

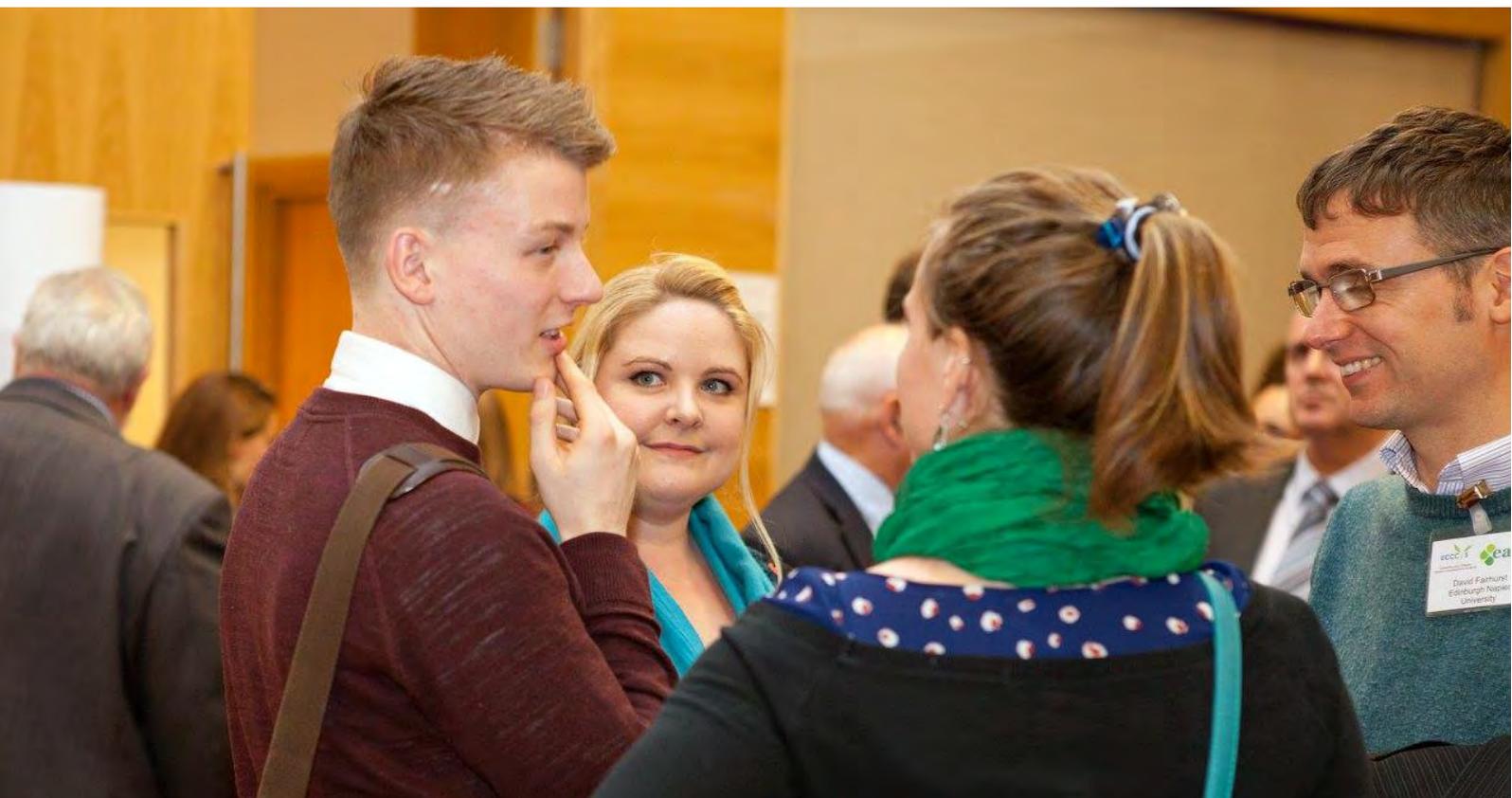
A FHE LL begins by forming connections between actors from the four different stakeholder groups. Currently, the only strong relationship reliably present in all FHE institutions is between students and academics. Beyond that, the nature of relationships considerably varies across each institution. Although, most institutions recognise the need and benefits in strengthening relations between some or all of the four stakeholder groups.



This represents all the different connections that can be made through a LL.

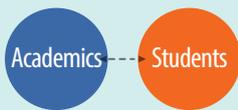
The basket of relations is the first step in this LL model; it basically describes who is involved in a LL project, and how the different groups link to each other. A relationship diagram essentially represents a LL project involving actors from those groups. The table below summarises the five **foundational** forms of LL relationships.

***i** A support role includes: mentorship, advisory, research support, teaching, facilitation of knowledge-exchange, guidance, training or other support provided to the particular stakeholder group, but not direct involvement as a project participant.*



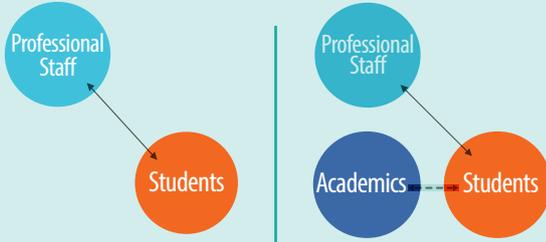
FOUNDATIONAL RELATIONSHIP

Students & Academic Staff



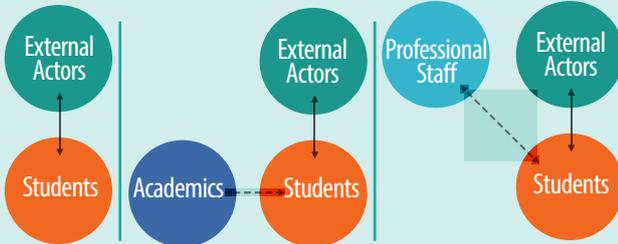
This relationship is the foundation of all FHE institutions. In itself, it is not a LL relation, but a 'support role' (teaching/mentorship).

Students & Professional Staff



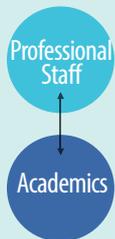
Students collaborate with estates, operational, academic support and administrative and other non-teaching/research staff on an institutional sustainability challenge. *Academics can be involved in a support capacity as teachers and mentors.*

Students & External Actors



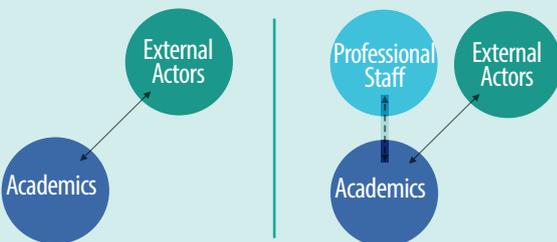
Students collaborate with external actors to face a sustainability challenge of an organisation, area, individual, community group, or otherwise. *Either academics or professional staff can be involved in a support role, whether that is through advice, guidance, teaching, research support or mentorship.*

Academics & Professional Staff



Professional staff and academic researchers collaborate to deliver benefits to the institution by addressing a sustainability challenge within.

Academics & External Actors



Academics collaborate with external actors on a sustainability challenge affecting an organisation, area, community or otherwise. *Professional staff can also serve in a supportive role; for example, by assisting with relation formation, practical services & experience, project management or practical research support.*

External Actors & Professional Staff



Professional staff collaborate with external actors on a challenge on- or off-campus, or both. *Academics can also serve in a support role through advice, expertise, research support, knowledge-exchange facilitation, or otherwise.*

All FHE LL projects involve at least one practitioner (professional staff or external actor), resulting in relations that cross between the academy and practical domains. However, there is one unique relation (represented in the final row of the table above) that involves professional staff and external actors. This is the only type of project which does not cross boundaries between the academy and the practical domains. FHE LLs must consider the importance of including academic actors in the LL as much as practitioners; they should typically have a crossover between the academy and practice in the majority, if not all their projects.

Although any stakeholder group may propose a project, practitioners will typically provide the sustainability challenge since they will be

facing them. It is advised to avoid a situation where a LL project administers a 'solution' onto those who are facing the challenge without fully involving them in the project.ⁱ

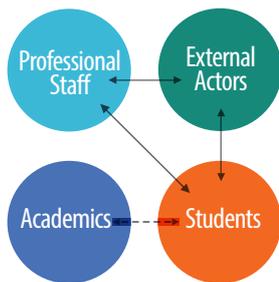
Involvement of practitioners in a LL ensures that sustainability challenges are real and projects have a very tangible potential of causing practical change. This is one of the key elements that make the FHE LL unique. It uses this important crossover to benefit both the practitioner and academic actor, while using the collaborative potential of both to achieve the high level of effectiveness against sustainability challenges.ⁱⁱ

-
- i 'See also: 'stakeholder partnership' principle (section 2.3) as a related discussion on how stakeholders should be equitably involved.*
 - ii This discussion links well with one important part of the transdisciplinary principle (bridging gap between theory and practice). However, the principle combines this aspect with others to offer an enhanced way of working (section 2.5).*

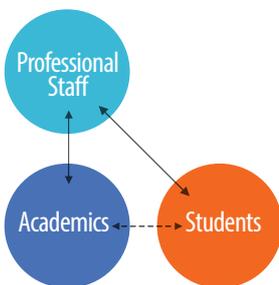


1.2 Multi-stakeholder Relationships

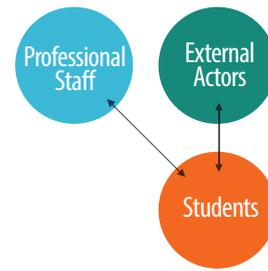
Moreover, institutions may build on top of the five foundational relations to bring together participants from diverse backgrounds. Three or four stakeholder groups may be involved in a project to form a 'multi-stakeholder' relationship (stakeholder groups in 'support roles' do not count towards 'relations'; for relations, there should be collaboration among project participants). Multi-stakeholder relationships can enhance knowledge, resources and experience available for a project, and also widen the scope of LLs. While they may be more challenging to organise and manage, they allow for projects with greater complexity and diversity of opinion. Some examples of multi-stakeholder relations are:



This multi-stakeholder project involves three stakeholder groups, all working with each other (academics are not directly involved through practice-based research, they are acting in a teaching or mentorship support role).

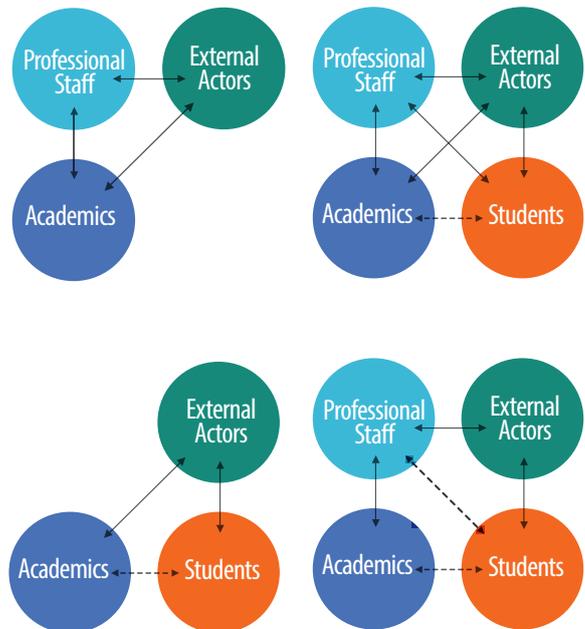


This multi-stakeholder project involves three stakeholder groups; academics are involved in a dual-role (conducting practice-based research on the project, and also teaching/mentoring students participating in the same project).



This multi-stakeholder project involves three stakeholder groups; the unique situation here is that two stakeholder groups are not directly working together, but both are collaborating with students, who are central to the project.

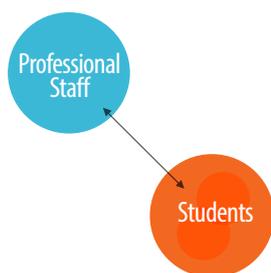
Other variations include:



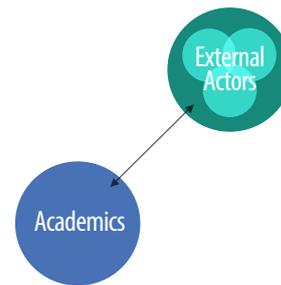
This is by no means a complete inventory of all the different multi-stakeholder relations possible. Institutions will continue to discover, catalogue and operate through the different possibilities. This range is there to recognise the diverse links possible in FHE institutions. Whether the differences in all these relations are subtle or large, it is important to show that institutions can connect in any ways they see fit for their circumstance.

1.3 Intra-stakeholder Relationships

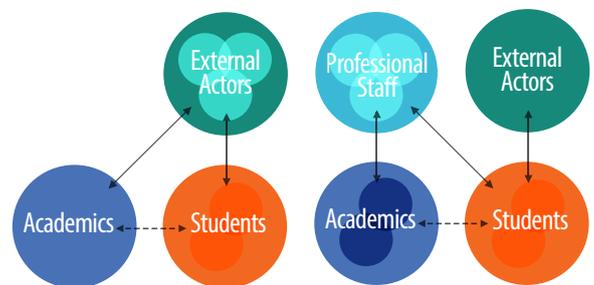
A layer of enhancement to relations involves linking different actors within the **same** stakeholder group, which can be termed as ‘intra-stakeholder’ relationships. This represents LL projects which bring different participants together to work with each other and actor(s) from the other stakeholder group(s). There is a vast number of different ways in which actors from the same stakeholder group can be connected together; this level of variation stems from the diverse and evolving contexts and actors across institutions. Participants forming an intra-stakeholder relation could be different sizes (e.g. individuals and groups), or of the same or different discipline/background. These relationships show that there is also variety within stakeholder groups that is important to recognise. Each stakeholder group is not homogenous, but has people of different backgrounds and experiences who would benefit by being connected through LL projects. Intra-stakeholder relations can be beneficial for peer-to-peer learning, pooling intellectual and material resources, introducing further diversity, scaling projects with more participants, and deepening the scope of the LL. Examples of ways in which they can be implemented includeⁱ:



This describes students in an intra-stakeholder relation (e.g. two separate dissertation students, or two course groups), working with a single professional staff unit (either one department or individual).



This example describes one academic unit (e.g. a single researcher) working with several different external actors in intra-stakeholder relations (e.g. business, charities, and government authority).



These examples describe multi-stakeholder relations with intra-stakeholder relations. They represent advanced and complex LL projects that typically involve several different participants from different backgrounds. There is no limit to the level of complexity that can be added to a LL project for institutions willing to explore and experiment.

Any number of intra-stakeholder relations can be added to any stakeholder group from any foundational or multi-stakeholder relation. Intra-stakeholder relations are a highly flexible ‘layer’ or tool that can be used to bring together people within a common stakeholder group.

ⁱ *Intra-stakeholder relations also link closely with the ‘transdisciplinarity’ principle. However, while an ‘intra-stakeholder’ relation simply describes that participants are working together, the ‘transdisciplinarity’ principle includes details such as mutual learning processes, knowledge-exchange and bridging disciplinary and practice-theory gaps (discussed further in section 2.5)*

1.4 Implementing the Basket of Relationships

In summary, there are three different types of relations. Firstly, a project may either have a **foundational** or **multi-stakeholder** relation, which collectively number over two dozen. Additionally, a project may also include **intra-stakeholder** relations within the stakeholder groups involved.

There is no prescribed amount, order or type of relation for a LL at any stage; circumstances vary across institutions. Each context is unique, and the relation(s) that would work best at each time and place cannot be determined out of that context. The purpose of the 'basket of relationships' is to offer guidance, clarity, flexibility and creative freedom for those making these choices within the institutional context.

RELATIONSHIP TYPE	DESCRIPTION
Foundational	A project directly involving two stakeholder groups . Any number or combination of actors from any of the four stakeholder groups can be involved in support roles. Adding a support role does not equate to a 'relation'; there must be direct participation in the project for a relation. Section 1.1
Multi-Stakeholder	A project directly involving three or four stakeholder groups . Any number or combination of actors from any of the four stakeholder groups can be involved in support roles. Section 1.2
Intra-Stakeholder	Any combination of participants from the same stakeholder group working together in a project. These are a layer built on top of any foundational or multi-stakeholder relation. Section 1.3 for details.

While one LL may concentrate on projects with one foundational relation and several intra-stakeholder participants; another may concentrate on all five foundational relations; another may only concentrate on one multi-stakeholder relation, and another may choose between several foundational and multi-stakeholder relations as suited to project opportunities. Deciding the number and types of relations that institutions wish to '**build**' from the 'basket of relationships' requires creativity and strategic insight.

Furthermore, project relations are not necessarily stagnant, and could evolve during the project. For example, a foundational relation could change into a multi-stakeholder relation, or vice versa. Even participants and stakeholder groups could change, all depending on the flexibility, design and agreements of the project.

The amount of options could potentially be confusing for those new to LL practice. In this case, it is recommended to focus on a few relations that are most relevant. **One way** to focus is to prioritise particular projects of relevance to the LL, and select a handful of relations that would best suit them. **Another way** is to prioritise the stakeholder group(s) most relevant for the LL and find projects that would suit, and the various relations would automatically become obvious according to the remit of the project.

Relationships are the primary and most important component of the LL; the nature of relationships defines a LL. A LL will only be as strong and effective as the relationships it hosts.

Another way is to establish relations of priority to the LL, and find projects that could involve stakeholder groups in that particular way.

Two separate LLs may look and operate as very different initiatives. For example, one may only host projects involving academics and professional staff, and the other may only have projects involving student and external actors. As such, activities, outcomes and the

very nature of their LLs will be dissimilar. These choices depend on differences in the relative strengths, weaknesses, opportunities and challenges of each institution. Thus, LLs can look very different.





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2

Basket of Principles

While the 'basket of relationships' describes **who** is involved in a LL project, the 'basket of principles' describes **how** the LL project is carried out. There are seven principles, which collectively form the EAUC LL definition:

A Living Lab is where real-world sustainability challenges are formally addressed in stakeholder partnerships.

A Living Lab encourages co-creation & co-implementation of transformations through transdisciplinary efforts, over a series of learning loops, to sustainably develop a geographically-bounded test-bed.

The principles describe the various aspects of the LL methodology which establishes it as a unique approach. Effectively, the principles 'apply' to each LL project to describe which aspects of the LL approach are being utilised. It is the **second step** of the two-step LL model. The definition provides recognition to

all principles that are important to the LL approach, however, the model does not stipulate that all of them must be applied in every circumstance.

As with relations, there is flexibility for how many and which principles to apply in each project. However, three of the seven principles are '**core principles**', which should be implemented in every LL project. This is the only strong recommendation of the whole model. The primary reason for this is to guide projects toward a legitimate LL approach that is based on the philosophy and historical practice of the LL field. This research finds and evidences below that these core principles are important to all FHE LL projects.

Core principles essentially assure that a LL project is adhering to core tenets of the FHE LL approach: i.e. projects address sustainability challenges within real circumstances, with participants working within equitable stakeholder partnerships, as a formal activity.

However, this model also recognises projects ‘on the road’ to LL. These are initiatives not yet able to adapt all three core principles into projects, but progressing towards that eventuality (whether that is due to lack of priority, resource, time, expertise or nascence). For these projects, there are two things this model recognises. **Firstly**, for initiatives that wish to transition into a LL, their successive projects will steadily graduate more principles along the ‘road to the LL’, until they incorporate all three core principles in LL projects. **Secondly**, to assure relevance of the LL to as many institutions as possible, there are degrees of flexibility within each principle, including the three core principles, to account for the non-uniformity among institutions. Principles should not be understood as rigid ‘frameworks’ or ‘conditions’; they incorporate room for interpretation and application in various ways, depending on the challenges, needs and context of each project (as discussed in sections 2.1-2.7).

The suitability of the other four principles may depend on the time, ease, or effectiveness with which they can be implemented, and potential benefits they could offer for a project. As such, any number and combination of these can be applied in LL projects. However, they are also important contributors to the LL approach, and should not be discarded. Each of these four also capture an important part of the LL essence to be considered wherever possible.

Principles, like relations, form a flexible ‘basket’. LL coordinator(s) and/or project participants will decide on the combination most relevant for their circumstance.

These principles draw from: academic literature concerning sustainability science; education for sustainable development theory and practice; FHE and non-FHE sector LL case studies and outputs; and other concepts such as open innovation and user-driven innovation. The principles are congruous and inform each other at various points. This makes the model as a whole better connected and more relevant to practice.

Complete basket of principles

PRINCIPLE	CORE PRINCIPLE
Real-world sustainability challenges	Yes
Formal participation	Yes
Stakeholder partnerships	Yes
Co-creation and co-implementation of transformations	No
Transdisciplinarity	No
Learning Loops	No
Geographically-bounded test-bed	No

Each principle will now be discussed individually.

Core Principle: Real-world Sustainability Challenges



The first core principle has two interlinked parts: a LL deals with problems and/or opportunities that are *sustainability-focused* and *real*.

2.1.1 Sustainability

Ståhlbröst & Holst argue that “the innovation processes supported by a Living Lab must address sustainability issues” (2012: 16). The EAUC LL model is in fact based on the very intentions of advancing sustainability within FHE education, research, engagement and practice. Thus, this model treats sustainability as a primary concern of any LL project designed through it.

However, this does not equate to a narrow approach to sustainability. Often sustainability is substituted by energy or carbon as a proxy. Although sustainable energy is a critical part of sustainable development and can be used as a theme for the LL as a whole, it is only one of many aspects that LL projects can address. A number of institutions already have sustainability strategies and policies in many areas where LL projects can be applied, including research (as applied research or sustainability research), education (as ESD or otherwise), finance & investment, estates, operations, HR, equality & diversity, wellbeing, external & community engagement and more. These areas could be combined as themes for LL challenges.

Sustainability ought to be a prominent theme in all LL projects, as has been argued by leading practitioners in the field (König, 2013).

The seventeen Sustainable Development Goals (SDGs) could also serve as a broad framework, offering institutions multiple options to focus on. This could allow projects to be categorised and communicated according to a robust, high-profile and internationally recognisable framework.

LL projects can also be aligned against LiFE (Learning in Future Environments), EAUC’s strategic management tool for holistic implementation of sustainability within a FHE institution. For users of the tool, LL projects can inform multiple ‘Activity Areas’ within LiFE Frameworks, such as ‘Link to curriculum’ and ‘Implementation’.

Challenges can originate from any area of sustainable development.

2.1.2 Real-World Challenges

The second part of this principle involves addressing ‘real-world’ problems and opportunities, typically faced by professional staff and/or external actors involved in the project. They could also be proposed by students or academics as long as they involve real challenges and participants who are facing them.

Where possible, students and academics should embrace practical work as part of the project. This has important implications for academic actors; mainly, developing crucial expertise in linking theoretical knowledge to real-world applications. These experiences involve “a lot more than acquiring isolated facts and procedures”; they require participants to draw “upon practice with applying new knowledge in situations while learning and practicing how to use and modify new

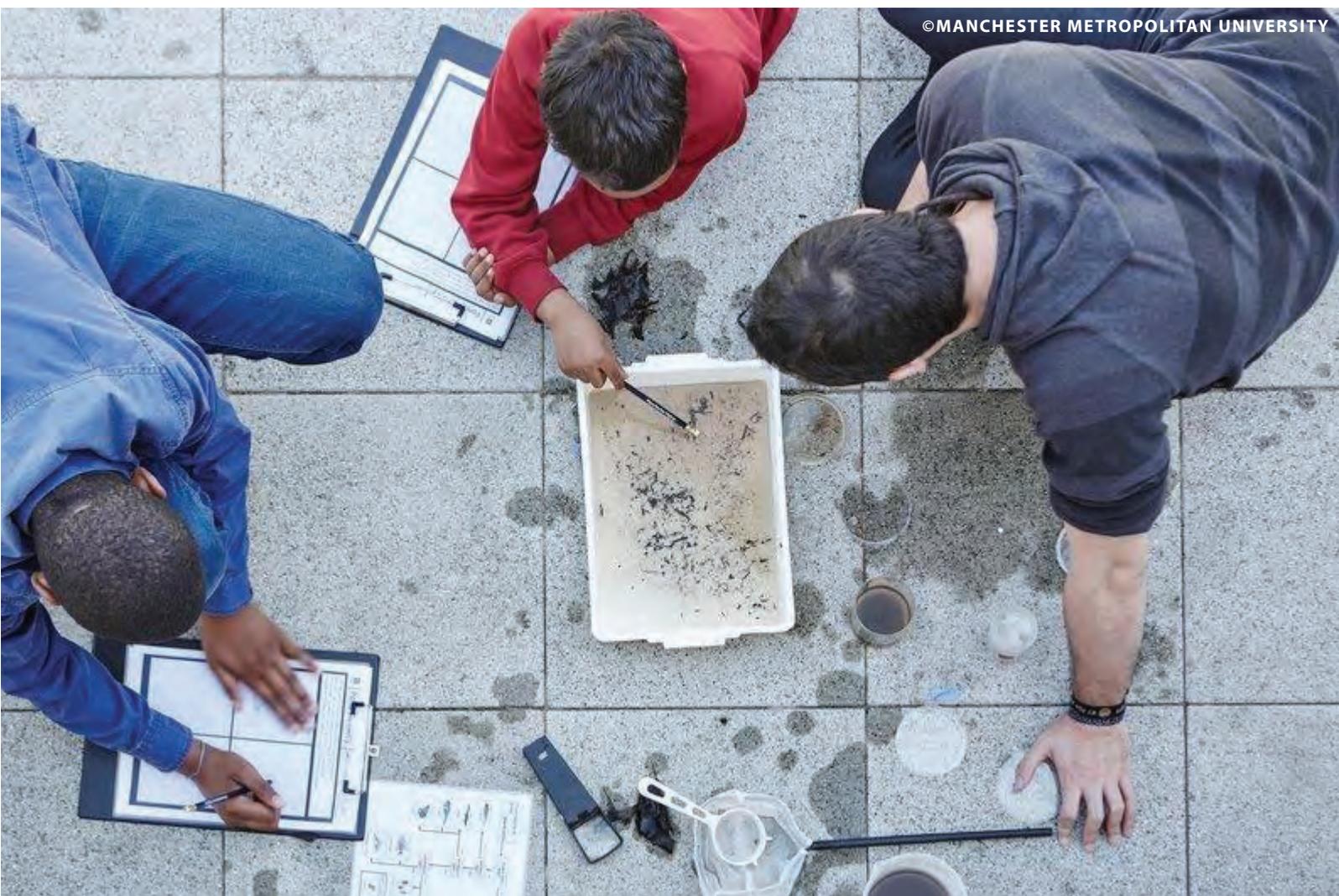
knowledge in authentic situations” (Budwig, 2015: 100). Working in a live setting goes beyond theoretical deliberation: it requires ‘learning through doing’. This challenges academics and students to bridge the gaps between their theoretical knowledge and the realities of the world. The balance of research and practical work may vary over LL projects, but both play important roles. Overall, a FHE LL maintains academic rigour, while utilising that to address real sustainability practice.

Finally, this core principle strongly endorses, but does not necessitate hands-on practical work or ‘transformations’ of challenges as part of the project.ⁱ It requires these challenges to be addressed in an appropriate way and, where possible, for academic actors to

gain practical experience. However, the output of a LL project incorporating the three core principles could be solely non-practical; e.g. report, paper, workshops, or other work discussing how the challenge could be addressed.

Having real challenges which participants address is central to all LL projects.

ⁱ ‘Co-creation and co-implementation of transformations’ principle (section 2.4) requires practical work by all stakeholder groups involved to induce a transformation.



Core Principle: Formal participation in Living Lab activities



Sustainability within most FHE institutions is driven by a small cohort of staff, students and possibly external actors, many of whom also sacrifice personal time for the cause. This group is often disjointed and spread across the institution within a few clusters (e.g. sustainability departments and particular schools). As a whole, this group has limited resources to progress an agenda that is often uncomplimentary with institutional priorities. One of the key purposes of the LL approach is to offer an alternative approach that advances sustainability through established processes rather than temporary efforts.

A LL seeks to gradually integrate itself into primary activities of the institution, whether that is research, education, external engagement, administrative and physical operations, or a combination of these. It attempts to reorient **these** areas to incorporate sustainability as an agenda item in the long-term. This means that instead of a disjointed group, there is a strong cohort, and instead of lacking resources and support, the LL can formally draw upon the core resources and support offered at the institution. However, this is only possible by integrating the LL with the formal activities of staff and students.

Instead of challenging the system head-on, a LL attempts to reorient an institution towards sustainability from the 'inside'. To accomplish this, LL work needs to first gradually integrate itself within formal education, research, practice and/or engagement activities of the institution.

Furthermore, formal avenues of participation also help integrate the following advantageous aspects into a LL project:

- component of learning and research
- intellectual rigour and method to the project
- dedication from participants, who recognise the project as a serious undertaking
- accountability of outcomes, agreed actions, and benefits
- better recognition of work when fed back through formal channels

2.2.1 Students

For students, this principle means LL projects are either linked with the curriculum, or **formal** extracurricular activities. LL projects can be carried out through **curricular** activities such as:

- courses
- dissertations and theses
- credited assignments
- course-linked volunteering (i.e. compulsory voluntary work or project)
- other directly or indirectly credited activity
- other related components to the degree that students are required to do

Extracurricular programmes also offer opportunities through which students can participate. To be considered 'formal' according to this principle, these programmes should involve structure and some form of official commitment from students. While participation in these programmes is optional, the important distinction is that students treat these with a similar level of formality and significance as curricular activities. They include:

- structured internships and job placements (paid or voluntary)
- summer school courses
- contracted group or individual projects (paid or voluntary)

- other structured activities and arrangements with a strong formal component

Any of these channels can be utilised as part of this principle. Although it is recommended that institutions target curricular work as a priority wherever possible. Providing quality ESD through the formal curriculum is the most valuable and worthwhile long-term impact a LL can have on students. In such a scenario, “student work would be clearly documented and defined within the course materials... The work would have to support either course or institutional student learning outcomes” (Cohen & Lovell, n.d.: 11). This is a natural approach to a LL for some institutions, but could prove a difficult task for others. If there is a lack of resource or support for such curricular integration, it is suggested that LLs build legitimacy from formal extracurricular activities that they can target (as described above), and thereafter attempt curriculum-based LL projects. This does not mean that extracurricular LL activities would seize or diminish, only that a priority is established clearly. However, if

institutions do not wish to capitalise on the transformational ESD potential of the LL approach, this model allows freedom to make that option too.

Furthermore, a majority of institutions already have various ongoing sustainability initiatives in multiple areas. Some of these have the potential to directly support the LL by providing challenges, resources or avenues for curricular/extracurricular LL projects.ⁱ

2.2.2 Institutional Staff and External Actors

For academics and professional staff (and external actors where possible and relevant), a formal mandate means directly or indirectly integrating LL projects with their roles. In a formal arrangement, participants’ contributions run a lower risk of being undervalued (Polk et. al., 2013: 190), since the LL has to align with all participants’ agendasⁱⁱ.

ⁱ *Beaudoin & Brundiers (2017) is recommended reading for LLs that involve students. It will be of particular value to institutions looking for guidance on long-term development of the LL. The authors pay particular attention to the importance and process of integrating LL into the curriculum as a re-design approach (their term is ‘applied sustainability learning projects’, which can be considered a LL approach)*

ⁱⁱ *For incentives and ways in which professional staff and academics can be involved in a LL see Appendix A2 & A4, respectively*



Core Principle: Stakeholder Partnerships



It is important to reiterate that, above all, relationships make and define a LL. They are the foundations of a LL, around which this model is designed. While many parts of the model address them, this principle particularly concentrates on the development and characteristics of relations important for LL projects.

A major factor to account for relations between sectors and areas of expertise is the importance of knowledge and equal participation of all (Brundiars & Wiek, 2011). Project participants, regardless of stakeholder group, should be given an opportunity to be involved in as many stages of projects as possible. In addition, participants should experience this involvement through equitable stakeholder partnerships. Where possible, projects should be democratised to “integrate the best available knowledge from different sectors” (Brundiars & Wiek, 2011: 111). This allows representation of different experiences and perspectives, all of which help legitimise and encourage knowledge flow in all directions. Such partnerships will typically experience a greater likelihood of successⁱ.

Ståhlbröst & Holst developed a handbook for private sector-based LLs that promote sustainable innovation in businesses (2012). Three of their principles focussing on stakeholder engagement are particularly important for FHE LLs, and borrowed for this principle:

1. Project participants should make an effort to understand the needs and motivations of others (Ståhlbröst & Holst, 2012: 11). This increases the chances of successful collaboration and decreases the risk of miscommunication and an unwanted outcome.

2. Participants fully attempt to meet the agreed needs and requirements of each other (ibid: 13). All participants should be provided the space and opportunity to contribute as well as benefit. It is important to assure no participant disproportionately benefits, especially at cost to others, unless mutually agreed.
3. Finally, transparent and clear communication is essential to “gather a variety of perspectives that might lead to faster and more successful development” (ibid: 17). Projects should be organised with structures and timeframes that amplify openness in availability of information and decision-making. Clear face-to-face communication among participants through regular meetings, work-sessions, workshops and remote communication should reflect and help build this transparency.

Institutional LL initiatives and individual projects should not privilege a small group of actors and neglect others, but rather strive towards transcending existing models of governance-as-usual (Evans & Karvonen, 2014: 414). Regardless of stakeholder groups, participants should feel heard and be treated as important to projects they are engaged in. Particular care must be taken to avoid participants being treated as ‘subjects’ of the LL project (students and certain external actors are particularly vulnerable to this). The most potent experiences typically occur when participants operate and feel as equal stakeholders; where the project does not belong to one participant or group, but is collectively owned by all.

ⁱ Trencher et. al. (2015) evidence this with project case studies involving students and external actors.

In essence, a LL project should attempt to create valued experiences and outcomes for all participants.

Summary

This principle covers these broad elements to consider:

- Equitable and democratic stakeholder partnerships: involvement in decision-making
- Respect, courtesy, and treating others as they belong as much as oneself
- Knowledge flow in all directions, not just one
- Needs and agreed benefits of all understood, respected and accounted for
- All provided space and opportunity to contribute meaningfully
- Transparency and open communication
- Avoid single 'owners' or 'subjects' of LL projects, and balance power dynamicsⁱ

It is recognised that not all projects, especially new projects or those with time and resource constraints, will be able to incorporate all of these attributes. Thus, some institutions may treat these as stepping stones on the 'road to a LL'. However, these attributes are part of the 'core principle', and need to be incorporated as critical attributes of LL projects. They have been incorporated in this model directly from established philosophy and practice of LLs.

ⁱ See Appendix A.4 for further discussion on power dynamics



Co-Creation & Co-Implementation of Transformations



The principle of co-creation and co-implementation of transformations is an **integrated process** that is applied to LL projects. It essentially combines and adds to the core principles of 'real-world sustainability challenges' and 'stakeholder partnerships'; i.e. it is the next level of practice from those principles. It allows participants to "intervene in order to contribute to a better implementation...and deal with the unpredictable processes by reflecting on and consequently adjusting their own methodology" (van der Walt et. al., 2009: 423). In other words, this principle involves a constant cycle of experimentation, where ongoing research informs development of ideas that are constantly prototyped, tested, and re-tested in a collaborative effort.

Having participants remotely liaise, conduct research *for* another, or 'deliver' a solution does not constitute 'co-creation' or 'co-implementation' as recognised by this principle. Ideas should simultaneously be co-created and co-implemented by participants, who are involved in the process to the most relevant degree. This principle helps enhance innovation, mutual learning, and the probability of finding a viable answer that is also agreeable to all.

The two parts are best treated and applied as one principle in practice.

Resulting '**transformations**' from this co-production process can be anything that **practically** and **meaningfully** addresses the sustainability challenge:

- campaign, artwork, multimedia (video,

- audio, images/poster)
- software (app, technology, ICT solution etc.)
- physical product, technology, physical transformation of area/infrastructure
- business, enterprise, social scheme
- presentations, guides, tools, materials
- new/changed processes, practices, policies, strategies
- behaviour change and system change interventions
- or any other means of addressing the defined challenge

Transformations could be one-off 'solutions' for simple circumstances, ongoing projects, or 'situational improvements' for complex scenarios. They should be of significance and positive physical, social, and/or economic consequence to the challenge. In many cases, there will be mistakes, failures and errors that result in challenges not being addressed. This does not mean that there is no 'transformation', as in these circumstances the 'transformation' is regarded as the increase in knowledge, experiences, and understanding of participants. Failures are critical elements of the learning process, and will often teach participants some of the most valuable lessons a LL project can provide. Such FHE LL projects should not be written-off as complete failures. The specific failures should be recognised, understood and fed back into the process for the same or future LL projectsⁱ.

Evans et. al. summarise that "the pragmatic reality of co-production is that it requires considerable time and effort towards the start of a process that can be off-putting in terms

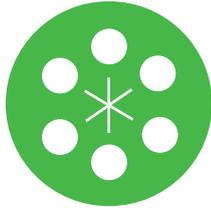
ⁱ This learning process is supplemented by the 'learning loops' principle (section 2.6). It recognises that partial or complete failures in achieving set objectives is part of the practical realities of the world. The most important outcome in this scenario is to loop the learning from these mistakes to reach the transformations intended.

of both its resource demand and unfamiliarity” (2015: 5). In this regard, there are several barriers may be presented to one or both parts of this principle, as not all projects will be able to both co-create and co-implement transformations. Barriers include limited time and resources, lack of expertise/training of participants, lack of funding, mismatching timeframes, lack of trust among participants, lack of skill or experience of the LL coordinator, and others. Therefore, applying this principle is challenging, but its benefits can

be very attractive for LL projects with an appropriate context. Furthermore, if a LL project is able to incorporate only one part of this principle, that may still be more desirable than not incorporating the principle altogether. While the model recognises these challenges, in the long-term, LLs ought to work towards this as a ‘core principle’ that features in as many projects as possible. Co-production is one of the defining parts of the LL approach.



Transdisciplinarity



Transdisciplinarity is crucial for sustainable development. Real sustainability challenges do not respect disciplinary boundaries or theoretical models, and therefore cannot be effectively addressed through these narrow lenses. “For sustainability projects to succeed, a more comprehensive, holistic, synergistic and trans-disciplinary approach is needed” (McGibbon & Van Belle, 2015: 86). Transdisciplinarity has been argued to provide a basis for participatory (or mutual) knowledge production and systems thinking important to sustainability research and practice (Robinson, 2008). It bridges two types of gaps:

- gaps between theory and practice
- gaps between different fields of knowledge (interdisciplinarity).

It encourages better interaction and integration among people to develop answers that reflect as many different perspectives as possible. Having a diverse group of participants encourages divergent and convergent thinking, which in turn provides a compelling environment for innovation (Hua, 2013: 51).

While transdisciplinarity may seem to overlap with ‘intra-stakeholder’ relations, it goes beyond. Lang et. al. provide a valuable definition of transdisciplinarity that distinguishes it as a principle:

“(a) focussing on a societally relevant problem;
 (b) enabling mutual learning processes among researchers from different disciplines [. . .], as well as actors from outside academia;
 (c) aiming at creating knowledge that is solution oriented, socially robust [. . .], and transferable to both, the scientific and social practice.” (Lang et. al., 2012: 27)

Transdisciplinarity means that participants working across disciplinary

and theory/practice gaps are also involved in mutual learning processes, i.e. they exchange and co-create knowledge through diverse perspectives, which is both academically relevant and practically applicable to challenges.

While transdisciplinarity has been strongly connected to ESD (students) and sustainability research (academics) as an indispensable principle (Clifford & Petrescu, 2012; Brundiers & Weik, 2011: 111; Vilsmaier & Lang, 2015), it is equally relevant to sustainability practitioners (professional staff and external actors).

Applying this principle means that a LL project draws participants with different disciplinary and theory/practice backgrounds.

To be transdisciplinary, LL projects do not have to require ‘intra-stakeholder’ relations. For example, a project with a single researcher working with a professional department could be transdisciplinary, if the researcher works with professional staff from different disciplines and they incorporate the above-mentioned attributes. Such a project is transdisciplinary in practice, but does not have intra-stakeholder relations as only two entities are involved. Additionally, ‘intra-stakeholder’ relations on their own don’t necessarily become transdisciplinary. For example, several different individual researchers, all from the same discipline, could be working on a project with several different professional staff with a similar practical remit. They are involved in intra-stakeholder relations, but if they are not crossing, both, gaps of **disciplines** and **theory/practice** as well as incorporating the attributes highlighted above, the project is not transdisciplinary.

Learning Loops



“The idea [of a LL] is that knowledge increases through iterative interactions between phases and people” (Ståhlbröst & Holst, 2012: 23). LL projects can serve as a cycle of iterative experimentation where new approaches are “tried, monitored and learned in order to inform successive experiments” (König & Evans, 2013: 8). A LL is knowledge-driven in principle (Evans & Karvonen, 2010: 11), and knowledge from completed projects can provide the ability to ‘loop’ the lessons back into new projects that revisit the same or similar subjects. This will enable the originally successful projects to be built on, and unsuccessful projects to be repeated or improve upon.

Learning loopsⁱ can play an important part in strengthening the knowledge-production processes of a LL. They allow successive sets of actors to improve processes, address past failures, and consistently increase the impact of LL projects “through a recursive process of experimentation” (Evans & Karvonen, 2014: 414). They also allow knowledge and methodologies in academic and practical fields to be consistently updated with successive projects as LL projects build on the previous learning.

A learning loop is incorporated in a LL project when it utilises subject-connected knowledge, transformations, outcomes or people from a past or present LL project.

As a LL initiative develops, it can host ‘**longitudinal programmes**’ that run multiple projects of different sizes/scopes, all incor-

porating learning loops and aimed at the same challenge(s) (König, 2015: 96). **Firstly**, such programmes can be simple, and entail a series of projects that all aim to address the same challenge(s). The first project may only embody the three core principles and result in a report; a second project may incorporate transdisciplinarity as a principle to help formulate a practical answer; and successive projects may involve co-creation and co-implementation of a transformation. In this case, learning loops can serve as a crucial recursive process that increases the potency of each project through previous learning, and ultimately builds up to practically addressing the challenge. **Secondly**, longitudinal programmes with learning loops can be complex, large and diverse. They can address increasingly grander challenges through simultaneous projects, all working together to deliver greater impact in a shorter space of time (with inevitably more resource investment).

A repository which stores outcomes and learning of all LL projects can become critical to applying learning loops (Appendix A.2 & A.3 discuss this further). Learning loops can help build transferable knowledge, and also help improve the impact, reputation and integration of the LL at the institution.

ⁱ The term ‘learning loops’ was proposed by James Evans (University of Manchester)

Geographically Bound



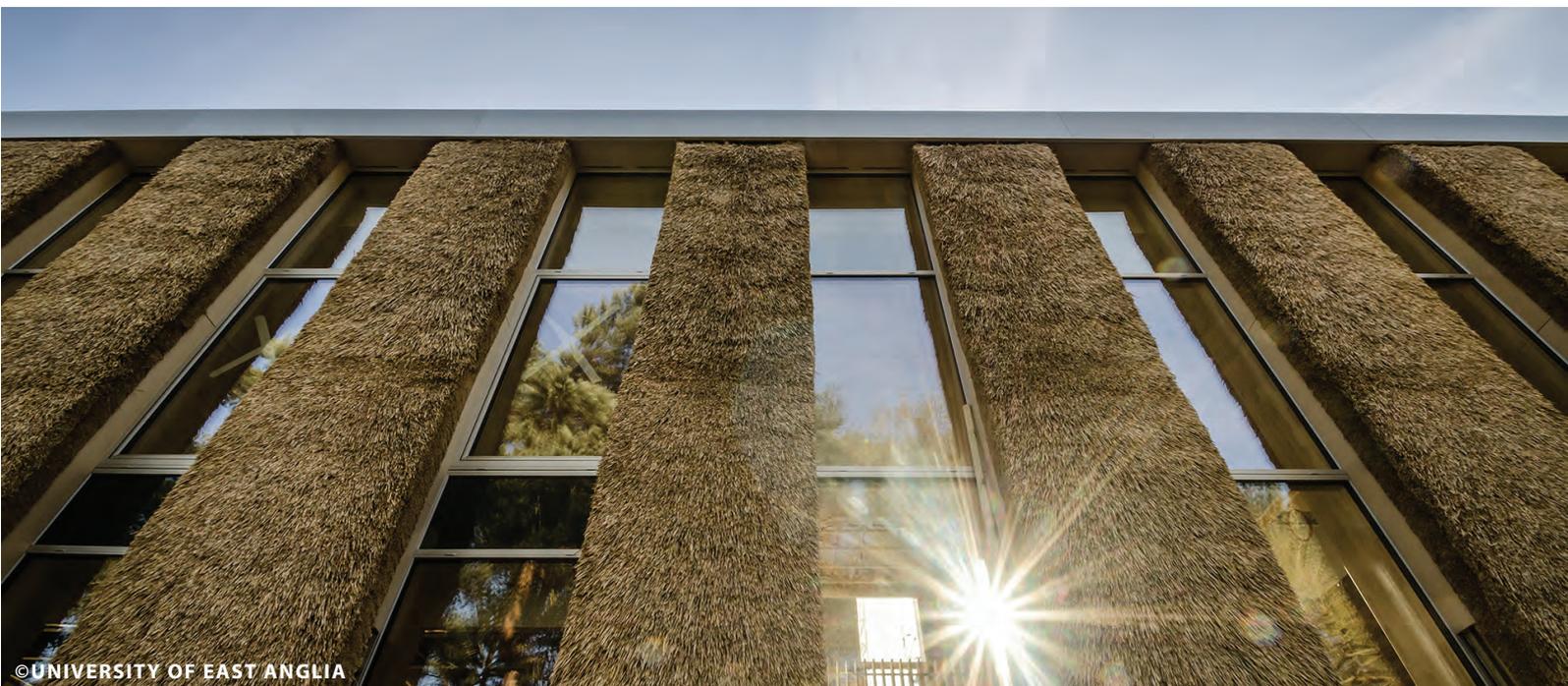
It is an important feature for a LL to be a specifically designated location for experimentation and innovation of ideas (Evans et al., 2015: 2; McCormick & Kiss, 2015: 45). At the same time, a LL can be both a **methodology** and a **physical area** designated as the LL. The infrastructure, environment, social life, people, operations, and other properties of the area become subject to the LL methodology. The people operating and living within the designated LL are also ideal participants in LL projects.

- The **methodology** is the combination of relationships and principles applied
- The **physical area** is the designated test-bed within which projects are concentrated

LL projects incorporating this principle directly address sustainability challenges in the physical location that is designated as a LL. This area should be subject to multiple projects over time

that aim to address one or more of its key sustainability concerns.

Depending on resource availability and scope of a LL, this locus can be a portion of the campus, the whole campus, a neighbouring area(s), the campus and neighbouring area(s), or even larger. Typically, a LL will grow its geographic influence from a part of the campus or a neighbouring area outward. However, it may also be reasonable to include distant areas of influence. An institution may have strong partnerships with external actors in other parts of the UK or internationally who may benefit from projects based in the LL methodology. Examples include research partnerships or student projects with other institutions and international development work. However, FHE institutions should set an example by making their own campus and local area the subject of transformation through a LL before proposing to influence the practices of others.





Conclusion

This final section offers guidance on implementing the Basket of Options model.

Firstly, while this model has concentrated on describing LL projects, it can also be utilised to represent and compare:

- a series of LL projects
- a LL initiative
- other sustainability-based programmes
- initiatives in the institution as a whole

The relationships and principles in operation at the project level can simply be extrapolated to represent a higher-level picture of the LL. For example, projects which involve the same (or similar) relations and principles can be compiled into a summary of relations and associated principles that the initiative focusses on. Certain LL initiatives may even have relations and principles that most or all their projects follow, in which case a high-level summary would be simpler to establish. Carrying out such an assessment can be a valuable part

of analysis and planning for a LL. However, increasing the breadth of perspective does decrease the level of detail.' The 'timelines' below demonstrate how some of these visual summaries can be represented. However, this is just one way in which this model can represent a more strategic picture; institutions are encouraged to explore other ways in which this model can be applied or generalised.

Secondly, it is the role of institutional LL champions to guide the development of their LL. If an institution decides to dedicate to the LL approach, a LL coordinator may be particularly helpful. The role of such a person could include: project management; selecting participants for projects; establishing relationships and projects around suitable challenges; training and guiding participants; removing administration and other burden from project participants; implementing principles; explaining the relevant LL principles to the participants;

i For example, Intra-stakeholder relations, and the ratio of projects implementing each principle needs to be clarified for decision-making and detailed analysis.

plan for, scale and strategically expand the LL; communicate with the different stakeholder groups; create buy-in for the LL approach among a wider audience; and other tasks. The LL can be a small and simple initiative, or a large and complicated undertaking, depending on the interests of the institution.

A coordinator of the appropriate skill-level may make the task of implementing the LL much simpler.ⁱ

Thirdly, there are many ways to grow a LL initiative that has been established. The key ways in which this can be accomplished are:

- *Adding more principles to successive LL projects is typically the best way of growing impact.* If possible and relevant, it may be useful to work on consistently enhancing LL projects with more principles.
- *Increasing the number of projects is the major way of growing scale, physical size, presence and number of participants.* This involves adding more participants to current projects, and adding more projects.
- *Adding more relations and stakeholder groups is another way to scale, and the best way to diversify the LL.* Firstly, institutions can involve all three or four stakeholder groups if they haven't already. Secondly, institutions can find new ways of connecting existing stakeholder groups and participants by exploring the various foundational, multi-stakeholder, and intra-stakeholder relations that can be created through new projects.
- *Institutions will typically carry out a combination of the above.* Such an approach can be highly effective, and has already been discussed as 'longitudinal programmes' (section 2.6).

The LL initiative itself can also take different forms, depending on the context. It can either be a separate entity, like a hub, physical space/infrastructure, or otherwise. Otherwise, it can be integrated into policies or strategies, learning/research frameworks, guidance or other governance procedures. Additionally, a LL may evolve to change through these, or adapt a combination of approaches.

Finally, there are over two dozen different types of 'foundational' and 'multi-stakeholder' relations. In addition to the three 'core principles', there are four principles that can be applied in different combinations and through different interpretations. Further, there are 'intra-stakeholder' relations that account for all the unique connections possible in different institutional contexts. In two simple steps, institutions can arrive at one of hundreds of different types of LL projects. Therefore, there are plenty of options for institutions wishing to experiment with the possibilities of a LL. Due to this diversity, there is no combination of relations and principles that can be recommended for implementing this model. Applications and contexts across institutions vary too much for any specific advice to remain meaningful. There is no 'right' or 'wrong' way; there is strength in diversity. The model offers flexibility, freedom, simplicity and clarity for institutions to design, plan, implement, and analyse their own unique LL projects, LL initiatives and pathways in the most appropriate way(s).

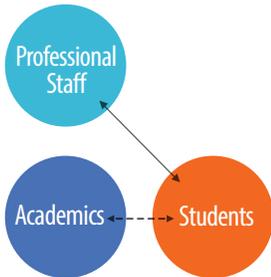
TIMELINES

The following two pages show examples of just four of these possibilities loosely based on real institutions. They depict 'timelines' of institutional LL initiatives, and not single projects.

ⁱ Brundiers et. al. (2013) is recommended reading. It highlights the role and benefits of a LL coordinator in taking the burden away from academics, professional staff and students, facilitating links and projects, and acting as a 'sustainability broker' (authors refer to the role as the 'transacademic interface manager (TIM)'. Beaudoin & Brundiers (2017) provide further detail on the tasks such an individual accomplishes in a student-based LL.

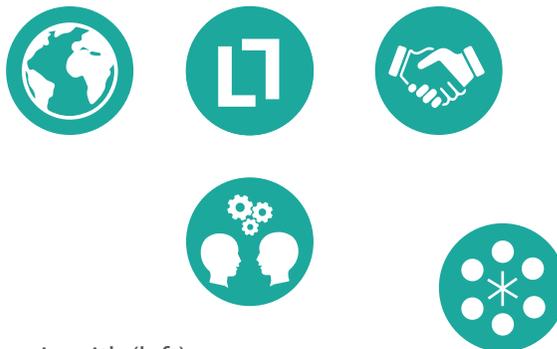
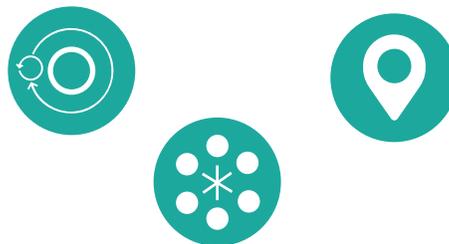
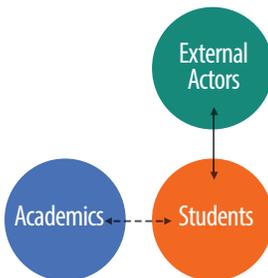
TIME

Example Institution A



Institution A represents a **curriculum-focussed and student-centred LL**.

The LL begins with student and professional staff projects (generally, academics in a supportive role with students representing curricular support, e.g. teaching as part of course/assignment, but could also mean mentorship in unique extracurricular projects).



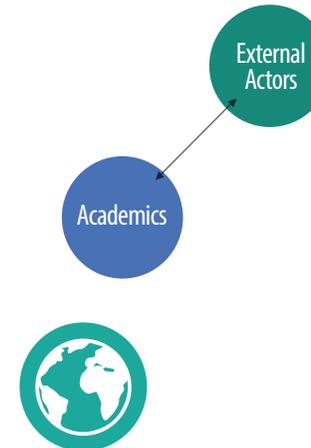
Projects incorporate only the core principles to begin with (left), until the campus is designated as a LL and it starts incorporating more transdisciplinarity, and linking projects through learning loops. At a similar time LL projects with external actors begin (right), which soon thereafter start co-producing transformations in transdisciplinary teams, but are not operating in a designated LL or conducting projects with common themes.

Example Institution B



Institution B depicts an **academic-based 'road to the LL'**.

Before the LL, academics were carrying out formal research on real-world challenges that their university (and possibly also the sector) faces. After recognising their potential to transform the institution, academics and professional staff partner in diverse on-campus LL projects. Over time, researchers and professional departments of different backgrounds begin transdisciplinary research and practice.



As with any university, academics are already volunteering for projects that address real-world challenges, e.g. providing advice and informally assisting. Academics begin LL projects with external actors by adapting the other two core principles. Soon thereafter, they also incorporate the principles used in campus LL projects.



1 YEAR

2 YEAR

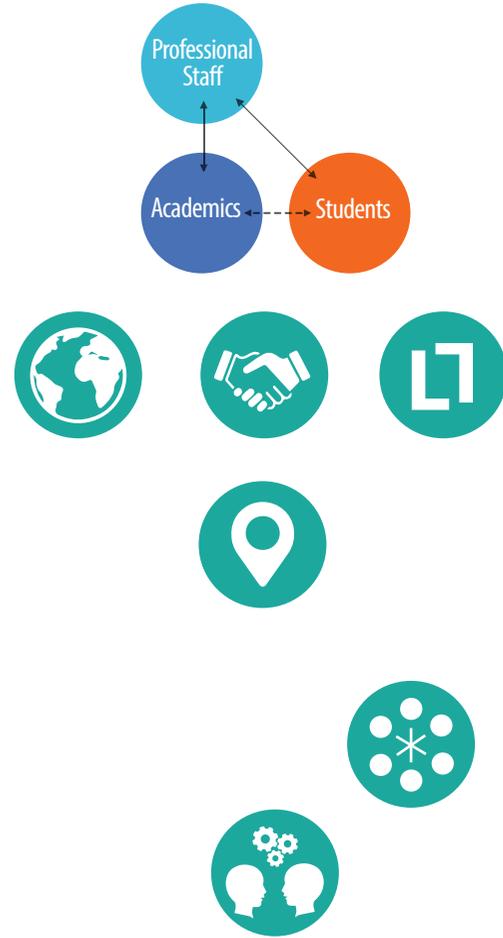
3 YEAR

TIME

1 YEAR

2 YEAR

3 YEAR

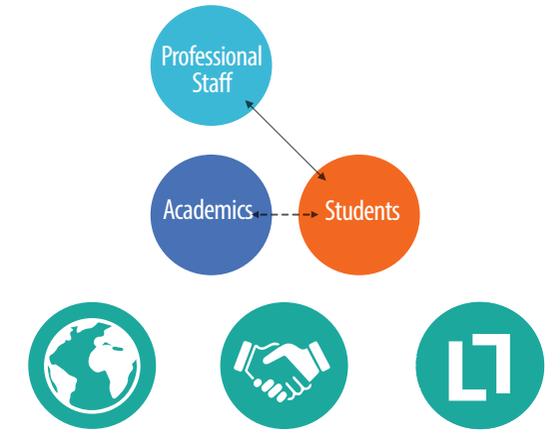


Example Institution C



Institution C depicts a dedicated effort to establish a LL that involves **all four stakeholder groups**. The campus is designated as a LL soon after pilots, and there is an ongoing effort to incorporate different types of principles into LL projects. This LL also places a focus on students wherever possible.

Example Institution D



Institution D depicts LL projects that follow a very similar process and form. This LL could either be focussing on scaling the number of projects, or simply maintaining ongoing efforts.

General note: These relationship-based summaries (institutions A-D) do not represent that every listed principle is incorporated in all LL projects. In fact, none of these summaries describe how many projects have been undertaken, and how many times each principle has been incorporated. Their purpose is just to show a broad picture of the different routes, shapes and focuses LLs can take. At this stage, the model does not provide tools to analyse LLs in further detail. However, more detail could be added if needed (e.g. counting the number of projects with each relation, scoring principles according to the number of times they feature etc.).

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Appendices

Each of the four stakeholder groups are discussed in further detail in the following sections.

A.1 Students

Students are a primary concern of any FHE institution. Involving this stakeholder group early on can be incredibly valuable for a LL. This is not only because students will cause the most profound long-term changes, but also because they are the most numerous, and potentially the least resource intensive group to involve. Students are also generally the most flexible, available, and enthusiastic about sustainability. Evans et. al. estimate that students in the UK “could offer 375 m hours or 42 808 years of research time per year” (2015:1). They are also more prone to challenge actors and ask naïve questions that could lead to unexpected yet fruitful outcomes. Furthermore, they are also the least challenging group to build trust with and through, since they are the most relatable and least complicated to work with. Their semi-formal way of operating, simple project demands, requirements to meet outcomes, enthusiasm, and mouldable learning requirements make them an attractive stakeholder group for any FHE LL.

A LL can gain ground quickly by demonstrating students’ ability to catalyse change through projects and, more importantly, the impact on student experience and learning.

Involving stakeholder group

Students can be involved in a number of different ways. **Firstly**, LL projects can simply emerge from modifying existing or creating new courses. Group-work, peer-to-peer exchange, and collaborative and transdisciplinary learning are currently deficient across the FHE sector, and are also priorities for ESD. Courses with LL projects can often meet these requirements on all accounts by enhancing an existing or adding a practical component. There are courses in most institutions that already facilitate LL or similar projects. In this case, it can be beneficial to find and better support and enhance this established work before trying something new.

Academics passionate about ESD and innovative education, who are willing to experiment or are already carrying out work in the same vein, are the typical ‘go-to’ or starting point for curriculum-based LL projects.

The University of Edinburgh is an interesting example of this type of collaboration. The Department for Social Responsibility and Sustainability engages with various academics to offer challenges within university operations as learning opportunities for courses and dissertations. For example, the ‘Cases in Sustainable Development’ Masters level course is based on providing students operational sustainability challenges to solve. Over the course of 10 weeks, students must present their solution to stakeholders as an assessed course outcome (Cooper, 2017). The department is utilising such existing links and activities as evidence and inspiration to scale LL work; over time, LL is becoming an important feature of the university’s sustainability work. Similar regular or special courses (e.g. summer schools, courses with compulsory volunteering, etc.) will be present in many institutions, and it could be helpful to use them to legitimise and build on a wider LL approach.

Secondly, students can be involved through dissertations and theses, with their research efforts channelled into a LL project. These can make for highly effective projects since students are graded on the quality of their research on a topic of interest. They are more likely to attract students with high interest in both the subject topic and making the project a success. Additionally, independent student research, practical work, and critical thinking are important skills that LL projects can enhance.

The 'Seed Sustainability' programme at ETH Zurich is an effective example of how this can be initiated with minimal resources. In 2004, students established Seed Sustainability as a project to gain more practical experience as part of a more well-rounded educational experience that they believed the university was not offering. They formed projects based on dissertations on sustainability challenges faced by external actors. Students, together in partnership with external actors, addressed challenges through more than 40 projects in government, businesses and non-profit sectors. These projects also included multiple coordinated dissertations addressing different parts of challenges. Since then, the programme has been formally incorporated as an important part of the university's sustainability work. It has spawned different programmes and more sustainability projects all focussing on providing high-impact opportunities for students to connect and work with practitioners (Brundiers & Wiek, 2011).

Finally, students can also be involved through other curricular and extracurricular activities, e.g. paid/voluntary internships and structured and formal activities (see section 2.2.1). Although, it must be noted that, by far, the most profound long-term impacts will likely result from incorporating and expanding LL work within the formal curriculum (discussed section 2.2.1). Therefore, it is recommended to prioritise incorporating LL projects within curricular work (and if it is not possible in the first instance, it could form an important target in the long-term).

An example of how combining these efforts can be a potent way of approaching the LL is the Oberlin Project, at Oberlin College. There is an ongoing effort to provide students with opportunities to act as 'change agents' for the whole town. These include:

- project-based group learning: examples include the 'Environmental Studies' degree programme which involves students in community engagement projects with external actors through courses to transform a proposed problem.
- thesis-based individual projects: thesis projects that help produce knowledge as well as help implement practical changes where possible
- internships: interns get involved in various 'hands-on' transformational projects. For example, interns have been largely responsible for the design and draft of the city's climate change plans adapted by the council.

Projects in all three areas have involved different types of relations and principles. They demonstrate that LLs can host very diverse combinations of relations and principles to provide students with the opportunity to deliver change and gain enhanced learning experiences (Daneri et. al., 2015).

These are three main ways in which students can be involved in LL projects. There will be more general and context-specific ways to involve students at each institution.

A.2 Professional Staff

Professional staff include all operational, estates, administrative and academic support roles. Their purpose is to directly or indirectly support teaching and research. Among this group, estates, operations and sustainability departments are often most involved with the institution's visible sustainability efforts. Nationally, a significant proportion of LL coordinators also hail from these departments. However, these departments are not the only areas of concern; actors within this stakeholder group also include administrative, academic support, HR, finance, careers, libraries and other corporate and support departments. Sustainability is not a matter for just the estate, even though that is a central area of concern a LL may form around. It ought to be a concern for every part and the entire institution.

Modern universities and colleges are complicated in function, and many as large in population as a village or town. Professional staff possess a great deal of expertise to manage the continuous and effective operation of these large entities. Simultaneously, they also possess the ability to unlock this 'village' or 'town' as a locus for innovative teaching and research. On the one hand, a great deal of respect and dialogue is required from academics in approaching and working with professional staff. On the other hand, professional staff are required to adopt an open-minded approach to LL to unlock significant potential benefits for their work.

It is important for the academics to recognise the value and immense potential for professional staff to contribute to the research and teaching activities.

Involving stakeholder group

One major way of initiating this stakeholder group is by involving willing professional staff or departments already grappling with a challenge that could be appropriately addressed through a LL project. These 'problems' and 'opportunities' can serve as an

ideal way to connect other stakeholder groups who could help resolve or improve the situation. Keeping an updated list of topics (or specific research briefs) on which professional staff would like to progress can be a useful engagement tool. This **inventory of challenges** can be made internally or publically available, attracting actors from other stakeholder groups who would be willing to initiate LL projects on their topic of interest.

An example of operating through such a match-making process is the University of Cambridge Living Lab. The LL coordinator liaises with professional staff from different departments to track sustainability issues, which are then matched with appropriate student(s) to work on as dissertation or internship projects (UoC, n.d.). Although, keeping a detailed inventory updated requires dedication of time and resource. However, it allows smooth project relations to be established from the outset, with relatively little time wasted for either stakeholder group.

Another major way of involving this stakeholder group is by locating a sustainability issue that professional staff either don't have time or research capacity/expertise to work on. By aligning with the economic, social or institutional agendas, a collaboration among actors can become attractive.

A valuable example is Georgia Piedmont Technical College's first LL exercise in 2008. A student course project involved studying an air conditioning system that demonstrated no signs of self-regulation. When the project demonstrated savings of a few hundred-thousand dollars and an immense amount of carbon, the LL was swiftly mandated at the senior level. The students carried on to design, plan and install the building management system upgrade in collaboration with academics and professional staff (Cohen & Lovell, n.d.).

The final major way of engaging this stakeholder group is through initiating a funded practical project, and integrating LL as a relevant core component of it. This is rare in the early stages of a LL, but can be possible if funding becomes available to the LL or in a project where LL can be integrated.

For example, the Urban Sciences Building and its surrounding area at Newcastle University is a £58m project that is designed and designated as a LL (under construction at time of publication). The building (and its surroundings) serve as a transdisciplinary research hub that incorporates various technologies, prototypes, experiments and tests by academics. These include a smart energy grid, water management systems, and collaborations with students. The building manager works closely with academics to support their practical research that helps improve the performance and sustainability of the building. In fact, the design and construction process has been, and the future operation will be, a collaboration between academics and professional staff (NU, n.d.).

A.3 External Actors

External engagement within the FHE sector is often a significant challenge due to time and resource constraints on staff. While institutions are increasingly recognising themselves as ‘anchors’ within their communities, they still experience disconnects with the area and people surrounding them. Yet at the same time, external engagement is recognised as an activity that provides social purpose to the institution, boosts reputation, and also provides long-term economic benefits. Thus it may be interpreted as a costly desirable by some, and as an unreachable necessity by others. Furthermore, as public bodies, there is an ongoing shift in the social contract of institutions that requires institutions to be more proactive in the society that hosts and funds them. Not many colleges and universities exemplify a level of external engagement that is required of a ‘socially engaged institution’. However, the LL can, firstly, demonstrate external engagement to be quite the opposite of burdensome and, secondly, as a result, convert its image from ‘desirable’ into ‘essential’.

FHE institutions are often surrounded by a large number of private, public and third sector organisations, as well as individuals, families, communities and informal groups. Within this group are also organisations the institution already directly or indirectly works with or supports, such as local authorities, charities, and business contractors (architects, engineers, waste collection, regulators, builders, suppliers etc.). Each external actor has their own area of expertise, needs, challenges and barriers for engagement. There is no recommendation for institutions to prefer engagement with one group over the other due to the sheer variability of cases. However, a diverse portfolio of engagement could be beneficial for distributing attention, increasing engagement across the spectrum, incorporating a variety of perspectives, opening various channels, and improving the institutions reputation and value across the board.

External actors are the most diverse stakeholder group and one with the greatest number of possibilities.

External Actors

This is the largest group which can be split into 3 parts

Organisations the institution already directly or indirectly works with or supports, through either academics or professional staff. They are existing partners with a special business/financial relationship, such as local governments, charities, work contractors, and firms (architects, engineers, regulators, builders, suppliers etc.)

Registered private, public and third sector organisations

Individuals, families, communities and informal groups

Involving stakeholder group

One way to initiate a relationship is to work with external actors that the institution is already working with in other capacities (e.g. existing research partnership, curricular/extracurricular collaboration, or contractor). This may provide a good starting point since there is already a positive relation established, and for some institutions could be the most effective way of involving external actors within the LL.

The Mistra Urban Futures project at Chalmers University is a good example of increasing engagement with familiar bodies. A LL consortium was initiated by researchers to undertake a number of projects surrounding multi-level governance processes. Beginning with familiar partners, the consortium developed to include a multi-institution academic research group, the city government, regional authorities, and a

research institute. The projects over time amounted to a programme that trained politicians and civil servants as well as producing robust research and guidelines for issues in governance (Polk et. al., 2013). Working with existing partners in this way can also provide a useful platform to launch LL projects with external actors as a whole.

Another way of involving this stakeholder group is through involvement in challenges in the local or regional area. Projects can be identified either through dialogue with external actors, invited from external actors, or proposed by other stakeholder groups or the LL coordinator. A webpage to display project examples and opportunities, and to invite project proposals, could be a particularly useful communication tool. It can help align efforts, link different LL projects, and avoid replication or conflict among different efforts. Hosting this publically for actors from all four stakeholder groups could help build enthusiasm and partnerships for external engagement.

An example of such a platform is the Skills Bridge online platform from the University of the West of England and the University of Bristol (Skills Bridge, 2017). The institutions encourage external actors to propose projects that are posted to an online page targeted at students. It has grown over time into a database of past examples and current opportunities that can evolve into LL projects. The scope of such a platform can be broadened to include researchers and professional staff, and by allowing different stakeholder groups to propose projects. This is similar to the suggested inventory of challenges facing the institution (section A.2). In fact, one system could combine the stakeholders and projects in different ways, depending on the needs and scope of the LL.

Another way to involve external actors is by inviting them to collaborate on institutional initiatives, i.e. bringing external actors to collaborate on sustainability challenges within the institution. This requires a very progressive and sincere approach to the LL that integrates external actors and local communities into the fabric of the institution itself. Such LL projects would offer external actors a participatory role in the functioning of the institution.

An example of this is the Pennsylvania State University Student Farm. Educating students about sustainable food systems using a live sustainable food system is the main purpose of the farm. The farm itself is a multi-stakeholder 'longitudinal programme' (c.f. section 2.6) project involving three stakeholder groups. Students collaborate with professional staff and external actors (while being supported from academics as part of curricular work). External actors helped play an important part in the farm's establishment. They were initially involved in the project through a community forum when the farm was being planned. Since then, external actors have continued to participate with on-farm LL projects and other non-LL activities. Participants include neighbours, families, and community members of various ages and backgrounds. These external actors have become valuable partners of an institutional project which delivers sustainable benefits for all. Importantly, these external actors also contribute to the institution's core mission of education (PSU, 2016).

A.4 Academics

Academics' important role within the institution is also reflected in their importance to a LL. They include all teaching and research staff over all schools, departments, and groups. A number of LL initiatives nationally also have coordinators based in the academy. It is advised that, along with experience in relevant practical projects, LL coordinators have an academic background, or be experienced with the needs and processes of research (and ESD, if students are involved). This allows them to deal with academic requirements and culture of the FHE institution (e.g. familiarity research process, student learning outcomes, barriers & constraints etc.), while also being experienced with limitations and challenges of practical projects.

It would be beneficial for a LL coordinator (whether a professional staff or academic) to establish strong partnerships with key academic colleagues across the institution early on. This could be in the form of a steering or advisory group, or a community of practice. If there is a lack of involvement or disinterest from academics, the progress of a LL will be hampered in the mid-long-term.

Academics ultimately have access, and the greatest share of responsibility, to transform the direction of research and the curriculum at the institution.

By its nature, academics are vested with a lot of power within an FHE institution. Additionally, their expertise, knowledge, titles, status, and social perception contribute to the 'ivory tower' effect. It is crucial for academics in a LL to be cautious with their communication and demeanour of engagement through a LL, paying attention to the 'stakeholder partnerships' principle (section 2.3). Regardless of their anticipations, it is important for academics to understand and expect this power disparity as a commonplace perception, but also aim to thoroughly dismantle it through effective engagement, humility, listening, and often withdrawing from leadership roles in LL projects.

Further, Clifford & Petrescu discuss dynamics of power surrounding academics, specifically in projects with external actors (2012). They highlight the need for researchers to work to address "power imbalances" more aggressively (Dempsey, 2010 in C&P) by paying close attention to other participants' needs, contributions, roles, and perceptions. Disparity can be reduced by balancing "between expert knowledge versus community knowledge, and by establishing equity of contribution and return" with other project participants (Clifford & Petrescu, 2012:83). Knowledge should not be considered as a currency solely exclusive to the researcher. Practitioners' knowledge and experiences should also be accounted for.

Involving the stakeholder group

Close involvement of academics is recommended from inception of the LL. Clearly communicating the idea and intentions of the LL to gain support of a critical mass of academic colleagues will be instrumental for long-term success. Key colleagues include those:

- who display passion for innovation, sustainability research and/or education, and potential willingness to participate as researchers within LL projects
- with the potential to allocate time or resources in support roles
- who can form links, offer advice to the LL coordinator, or serve as champions of the cause
- who can raise the profile or gather resources and support for the LL

Prepared and delivered by

