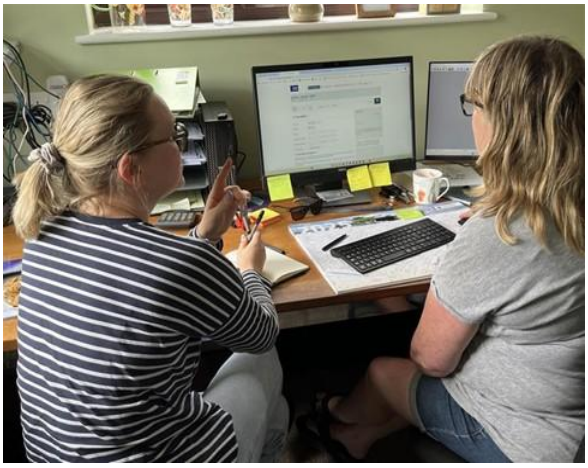

A Report from the LUNZ-Footprint Project

Project name	Land Use for Net Zero (LUNZ) Footprint: The 2050 Greenhouse Gas Accounting Living Lab
Deliverable	D2.1. Learning and capacity building evaluation framework: summary report
Date of report	31 October 2025
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Contents

The LUNZ Footprint project (BB/Z516351/1) is part of the 'Transforming Land Use for Net Zero, Nature and People' (LUNZ) programme, co-funded and supported by UKRI, Defra, DESNZ, DAERA, the Scottish Government, and the Welsh Government.

1 Context

This summary document is part of the Deliverable 2.1 conducted within WP2 in the LUNZ-Footprint project (August 2024 – July 2027). This project is part of the 'Transforming Land Use for Net Zero, Nature and People' (LUNZ) programme, co-funded and supported by UKRI, Defra, DESNZ, DAERA, the Scottish Government, and the Welsh Government.

2 Introduction

WP2 focuses on the extent to which the GHG assessment ecosystem builds the capacity of farmers and others to understand and use these assessments effectively. To achieve this WP2 aims to construct an analytical framework for assessing what shapes the learning opportunities and outcomes of conducting GHG assessments in the project, and more widely.

This framework addresses the evolving demands of achieving net zero, which call for new approaches to evaluating learning and the concepts underpinning it. It offers a structured basis for survey, interview and workshop data collection and analysis with farmers, advisers and other stakeholders, providing both practical guidance and a conceptual foundation for examining learning processes and capacity building within Agricultural Knowledge and Innovation System (AKIS).

The rationale for the analysis is:

- Increasing emphasis on net zero and the use of GHG assessment at farm level call for a renewed understanding of research approaches to analyse and evaluate learning and the concepts that underpin it.
- There is a need to move beyond a technical understanding of compliance or reporting to instead assess and support the capabilities of farmers and advisers to ensure GHG assessments are meaningful and used effectively to bring about change on farm.

This summary report sets out the key concepts, ideas, and project questions relevant for the WP2 assessment of learning and capacity building across the AKIS. The accompanying background paper provides a comprehensive review of the associated literature.

2.1 Concepts and theories

Learning involves changes in behaviour, knowledge, skills or attitudes and in farming it takes place through multiple forms, levels and processes. There is also a strong iterative relationship between learning and behaviour. While these processes are well studied, less attention has been given to the conditions, the institutions, resources and capacities that affect the ability to learn and to act on that learning. This framework addresses that gap, focusing on the specific demands posed by the transition to net zero.

A wide range of theories on knowledge and learning—from experiential and social learning to transformative approaches—highlight the importance of interactive, knowledge-intensive processes for sustainable agriculture. These approaches stress the need to build farmers' and

other actors' capacities, address equity and access, and empower them as active participants in systemic change. In the context of FOOTPRINT, tools and advisory services may play a key role when there is an opportunity for engaging the user, and where the focus is supporting learning as much as decision-making.

There is a large body of literature on knowledge, knowing and learning that can be applied to the net zero transition in agriculture. These come from different disciplines and perspectives: technology and innovation; natural resource management; education; learning economy; communities and social movements; organisations; transitions and innovation systems. Research on sustainable knowledge (know what, know why, know how, know who), competencies, capabilities and skills of land managers; and on knowledge processes including knowledge transfer; experiential learning, social and interactive learning; and structures and relations (networks and AKIS) contribute to this field. Equally there is a large literature on knowledge and learning required for: farm adaptation and mitigation practices, climate smart farming, carbon farming, sustainable soil management and regenerative farming. As Blackmore (2007:2) observes "There are many theories about what enables us to know or to develop knowledge. There is also a wide range of ideas coming from many different disciplines, about what constitutes learning".

These different literatures offer valuable insights into their respective domains of interest but do not provide a comprehensive understanding of learning processes in the GHG assessment context which is required for understanding the net zero transition in land use. This Deliverable reviews the relevant concepts, and combines them in an overarching framework (Fig 1) that will steer WP2 analysis, it is structured around these interrelated concepts:

1. The enabling environment which creates the systemic impediments or opportunities for learning about GHG assessments and acting on them
2. Opportunities for, and access to, learning about GHG assessment are determined by the enabling environment which affects the capacity to learn and change
3. Capability, competence, skills and literacy are determined by capacities, but also affected by motivations, learning processes and support mechanisms and interventions
4. Learning processes are conditioned by the enabling environment and capacities and build up capabilities and bring about different outcomes (learning and behavioural)
5. Interventions - mechanisms to support learning including GHG assessments and advisory support and build capacity and empowerment
6. Outcomes include learning - acquired knowledge and skills, confidence and empowerment and behavioural change (short, medium, long term) to meet the desired mitigation goals.

The interaction between these is captured in Fig 1. Table 1 sets out the underlying concepts, ideas, key authors and associated project questions that structure the framework. Given the

extensive literature, the focus of the analysis will be on the areas highlighted in green but incorporating an understanding of the role of the other dimensions.

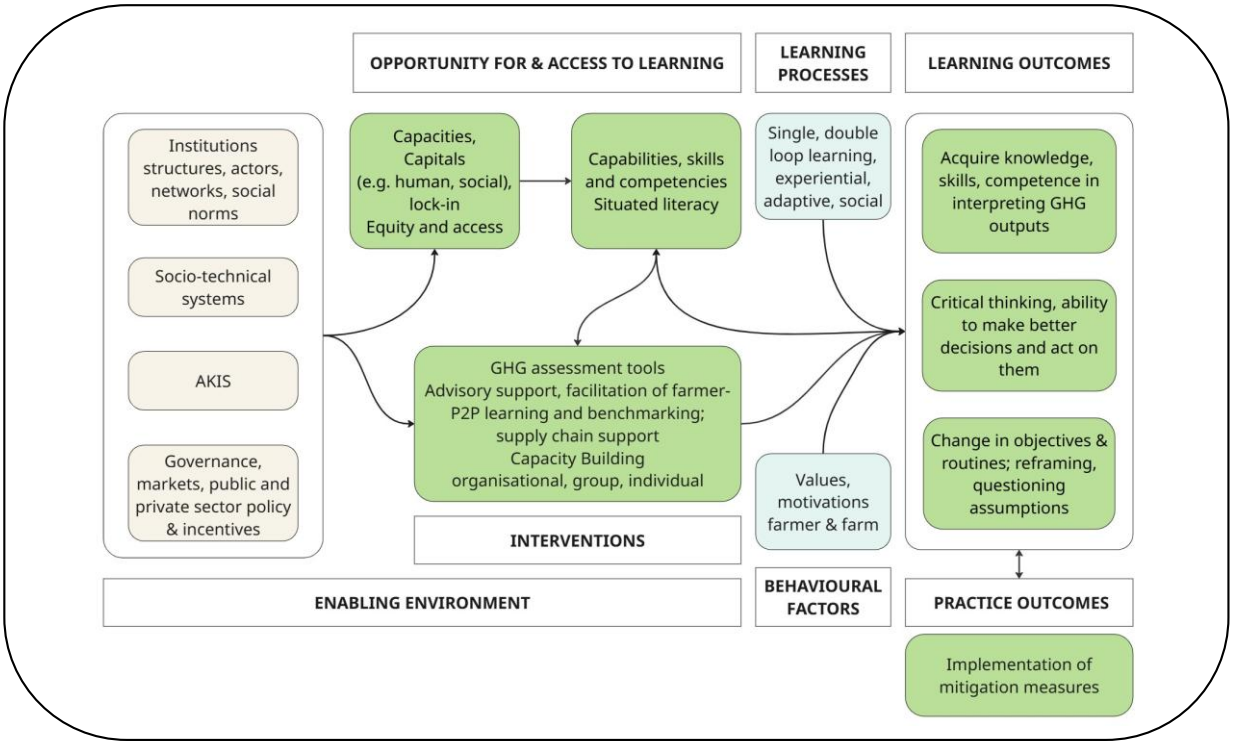

Fig 1. An analytical framework for assessing learning and action in the context of GHG assessment. The focus of the analysis will be on the areas highlighted in green but incorporating an understanding of the role of the other dimensions.

3 Concepts and project questions

Table 1 WP2 LUNZ FOOTPRINT LEARNING FRAMEWORK

CONCEPT	MAIN IDEAS	AUTHORS	PROJECT QUESTIONS
ENABLING LEARNING			
Enabling environment - system approach	Institutions Systems thinking - levers Carbon governance Inequalities	Kalfagianni (2014); Cavanagh et al. (2021)	Project questions: To what extent does this enabling environment affect learning and meaningful use of GHG assessments and mitigation practices? Where are the main barriers and enablers and what changes are needed to make improvements?
Agricultural Knowledge and	Organisational capacity, relates to		

Innovation System (AKIS)	adviser skills and training		
OPPORTUNITIES FOR AND ACCESS TO LEARNING			
Capacities	Capacity is the potential of a system, while capability is concerned with how this potential is exploited, they are interdependent Multiple analytical levels (individuals, networks, etc.) are used to understand capacities	Sen (1997); Samerwong et al. (2020)	Project questions: How are social, financial and physical capitals combined to provide the means for farmers to access learning and act on that learning? To what extent does farmer lock-in prevent this with regards to GHG assessment and mitigation practices? What are the social influences and physical influences that affect farmer opportunities for learning and implementing mitigation practices?
CAPABILITY, COMPETENCE, SKILLS, LITERACY			
Capability	Capability as cognitive and physical skills Farmers' carbon capability (behavioural)	Guan et al. (2021)	Project questions: To what extent do farmers and advisers have the capability, required competencies, skills and literacy to seek out, comprehend, evaluate, and use GHG assessment information to make informed choice about mitigation practice? To what extent are farmers and advisers knowledgeable and skilled in conducting and interpreting assessments? To what extent are they finding assessments meaningful and useful for being able to act on their outputs/recommendations? How can institutions and governance be strengthened in the enabling environment to improve any weaknesses? Can we characterise and enhance net zero literacy in the farming and advisory community?
Competence	Competence- "the capability of a person or an organisation to reach specific achievements" Adviser competence	Mulder (2001) Charatsari et al. (2023)	
Skills	Someone recognised as being capable and effective in their farming. Can be performance related to wider	Glover & Sumberg, (2025)	
Situated literacy	The wide range of skills and competencies that individuals or groups need to seek out, comprehend, evaluate, and use information to make informed choices. Situated literacy - embedded within specific social, cultural, and contextual situations	Gray (2018); Barton et al. (2000)	

LEARNING PROCESSES			
Single and double loop learning	Single -'following the rules' while correcting errors by changing routine behaviour, without major changes in mental models Double- alters underlying values, rules, and assumptions	Argyris & Schön (1996)	Project questions: What sort of learning does the intervention of GHG assessment prompt? To what extent do farmers need to shift towards double loop or transformative learning to bring about long term changes that effectively reduce GHG emissions? Can social learning initiatives (including benchmarking) support learning about GHG emissions?
Experiential and adaptive learning	Experimental- individuals' reflections on new experiences provide the impetus for learning which leads to further active engagement or experimentation Adaptive - Learning is thus not seen as an objective attempt to understand the 'world out there', but as based on a relational understanding of reality: learning allows for a new perspective of challenges and for perceiving new possibilities"	Kolb (1984); Darnhofer et al. (2010)	To what extent does experiential and adaptive learning through observing the effects of mitigation practices reinforce learning and practice change?
Interactive learning	Social Farmer-led Benchmarking	Sumner et al. (2018)	
Farmer-centric innovation and on-farm experimentation	Farmers themselves are key sources of innovation as they routinely experiment and collect data as part of their production processes	Macmillan & Benton (2014)	
INTERVENTIONS- MECHANISMS TO SUPPORT LEARNING & BUILD CAPACITY			
Decision Support Tools enabling learning		Allen et al. (2017); Jakku & Thorburn (2010); Eastwood et al. (2012)	What are the most effective features of the tools (e.g. scenarios, follow up action plans) and the way in which

Capacity building - individual, group		Waddington et al. (2014)	they are delivered (face to face, online)? What are the farmers'/advisers' experiences of the three tools in the project and more widely? What builds capacity to foster improved analytical skills, critical thinking, the ability to make better decisions, and strengthens confidence and farmers' self-reliance? What are the social, organisational and institutional structures and processes that shape practice, routine norms and values, as well as steer (and be steered by) governance?
Capacity building - organisational capacities		Brix (2018)	
LEARNING OUTCOMES AND BEHAVIOURAL CHANGE			
Learning outcomes	See learning processes		
Behavioural change	Behavioural change theories COM-B model Motivations Farm carbon capability framework (social–psychological theories)	Michie et al. (2018); Guan et al. (2021)	
	Factors that influence GHG, footprints and carbon behaviours	Block et al. (2024); Jebari et al. (2024; 2025); Yuan et al. (2025)	
Assessing outcomes			Project questions: To what extent are they finding assessments meaningful and useful and act on their outputs/recommendations? To what extent are farmers sharing experiences with and learning from peers? To what extent are farmers thinking about changing practice (or have changed) as a result of interventions (e.g. specific assessment outputs, one-to-one support to develop action plans, baseline data, knowledge transfer)? How critical is upskilling the advisory community in supporting farmers in assessment completion and interpretation?

4 Conclusion

As noted in section 2, with such an extensive literature it is necessary to identify the key elements relevant to the project's analysis. The framework will be developed as the research progresses.

Acknowledgements

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