Final report

A review of global adoption practices and outcomes, and recommendations for implementation within the Australian Red Meat Industry

Project code: L.ADP.2110

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Abstract

This project aimed to identify successful novel strategies, programs, and practices that could be implemented to support the continuous improvement of approaches for adoption in the Australian red meat sector. The project was identified as a priority area of work by the Meat and Livestock Australia (MLA) Producer Adoption Reference Group (PARG) in 2020. The project has involved a review of 245 articles covering national and international extension, adoption and engagement practices across agricultural and non-agricultural industries and interviews with 22 key informants in five continents. Complementing the desktop review of extension and adoption methods across the globe, the project approach was strongly participatory, connecting stakeholders directly with practitioners involved in the innovative models in Australia and overseas via designed interactive on-line sessions. From a shortlist of three design concepts, four activities were identified and scoped based on the innovative approaches reviewed. These activities are ready for implementation as pilot projects by MLA and the red meat sector.

The three design concepts were:

1. Understanding target audiences and contextual factors in adoption (farmer segmentation and tailoring of approaches e.g. *Service Design Teams - UK, Young Farmer Business Program – AUS; Resource Consulting Services – AUS).*
2. Supporting producer peer-to-peer learning and producer leadership in adoption design (co-design/co-innovation/farmer action groups e.g. *Red Meat Profit Partnership – NZ*, *Extension 350 – NZ, AgriLink Living Labs - EU*).
3. Strengthening the capacity of the advisory sector (advisor mentoring, training e.g. *Dairy Australia national programs - AUS*).

Based on these concepts, the four activities proposed for implementation were:

1. engaging with southern rangeland producers,
2. designing a collaborative program to support wide adoption of pain relief in animal management,
3. applying a ‘Living Labs’ approach in R&D regional consultation processes, and
4. supporting producer-driven ‘Farmer Action Groups’ as part of strategic partnerships.

Ultimately, the integration and embedding of the proposed activities into MLA’s adoption framework will expand the methods to reach producers and increase the demand for new and existing products.

Executive summary

Background

The project sought to identify a range of approaches used to engage producers, the impact of engagement and the critical factors in program design and delivery that either enable or hinder adoption. This project conducted a global review of innovative approaches to support adoption and practice change targeting red meat producers, advisors, service providers and Research and Development Corporations (e.g. MLA). The key project output was to provide recommendations for strengthening producer engagement adoption programs, to enable practice change on-farm, by proposing a set of activities that apply innovative project design concepts for MLA to pilot.

Objectives

The main objectives that were achieved in this project were to:

1. Establish a Stakeholder Reference Group, with key MLA and external stakeholders, to scope the priority review areas, discuss identified concepts, and finalise three for further development
2. Identify novel adoption/extension/practice change activities that can be adapted to address Australian Red Meat Industry issues and enhance uptake of innovation and best practice.
3. Develop a set of activities that could be implemented including Monitoring and Evaluation plans based on three design concepts from the global review.

Methodology

The methods used to achieve the objectives included:

- A rapid appraisal of Australian and international published literature targeting approaches in behavioural and practice change from the agricultural, business, environmental, educational, health and natural resource management sectors (245 articles reviewed)
- Conducting a series of telephone interviews with Australian and international adoption program/project informants (22 interviews)
- Facilitating a set of online interactive sessions with selected program informants to capture the innovative aspects of initiatives, critical success factors and recorded impacts (6 sessions)
- Co-designing activities with the project team, MLA and the Stakeholder Reference Group for implementation by MLA (4 activities)

Results/key findings

The global review of adoption approaches revealed that designing effective programs for behavioural and practice change relies on a comprehensive stakeholder analysis and engagement to get the ‘right people in the room’, skilled facilitators to support peer learning, leadership and group processes, building and maintaining social networks across supply chains and professions for knowledge generation and exchange, having a flexible approach to the adoption program so that it can adapt to changing

conditions and lesson learned, as well as appropriate resourcing (financial, people and time). Based on these insights, three design concepts were selected for development into activities.

1. Understanding target audiences and contextual factors in adoption (farmer segmentation and tailoring of approaches e.g. *Service Design Teams – UK, Young Farmer Business Program – AUS; Resource Consulting Services – AUS).*
2. Supporting producer peer-to-peer learning and producer leadership in adoption design (co-design/co-innovation/farmer action groups e.g. *Red Meat Profit Partnership – NZ*, *Extension 350 – NZ, AgriLink Living Labs – EU*).
3. Strengthening the capacity of the advisory sector (advisor mentoring, training e.g. *Dairy Australia national programs – AUS*).

The four activities proposed for implementation are:

1. engaging with southern rangeland producers,
2. designing a collaborative program to support wide adoption of pain relief in animal management,
3. applying a 'Living Labs' approach in R&D regional consultation processes, and
4. supporting producer driven 'Farmer Action Groups' as part of strategic partnerships.

These activities include the innovative ideas and critical success factors identified in the review, while providing a test-bed for continuous improvement in adoption approaches in the red meat sector.

Benefits to industry from implementing proposed activities

The expected benefits from efforts to:

- tailor adoption programs and products to better align with producer needs and motivations,
- create more opportunities for producers and advisers to be involved in leading and designing adoption projects,
- invest in building advisor capabilities in facilitation, and
- use behavioural insights for designing adoption activities

are:

- increased numbers of producers and advisors engaged,
- stronger performance of advisory networks in MLA adoption programs, and
- expansion of expertise of existing and new advisors.

Ultimately, the integration and embedding of the proposed activities into MLA's adoption framework will expand the methods to reach producers and increase the demand for new and existing products to generate more value from the investment to support change.

Recommendations and further research

It is important to plan and establish a strategic and operational governance model to progress the implementation of the four proposed activities for implementation as pilot projects. This could be achieved by setting up an implementation team involving MLA staff and selected Global Adoption Review SRG members as well as engaging MLA's Producer Adoption Reference Group (PARG) to provide advisory input to the implementation team.

This project has identified three topic areas for further research that would provide MLA with the opportunity to diversify and enhance their adoption products and services. Further research activity is recommended to learn how to better engage with Aboriginal and Torres Strait Islander producers and Indigenous Australian knowledge systems, increase practical knowledge about how to use hybrid models more effectively when delivering adoption programs and consider longitudinal monitoring and evaluation approaches for building quality evidence of the outcomes and impacts from adoption program design.

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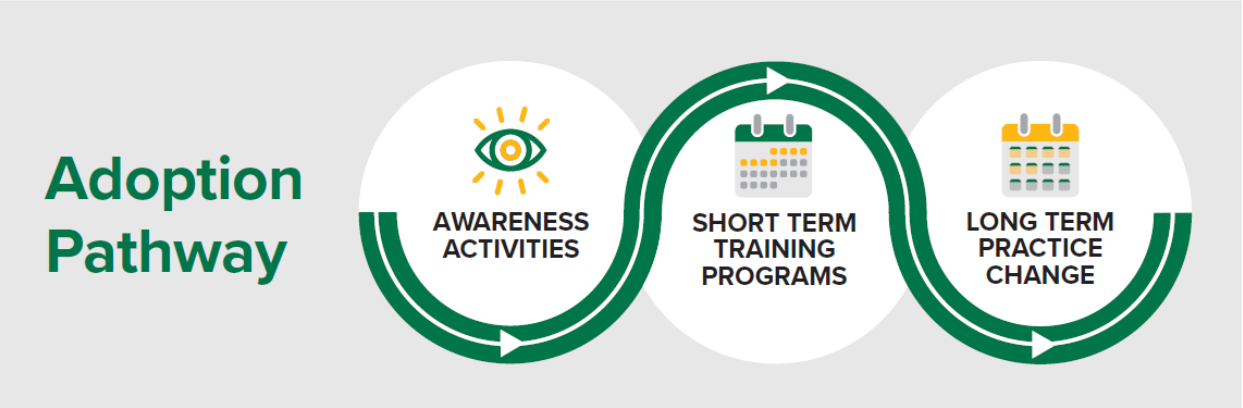
1. Background

1.1 Supporting the continuous improvement of MLA's adoption approach

Farmers, farm advisors and agricultural industry body representatives face increasingly complex decisions, considering emerging challenges and opportunities for agriculture such as climate change, drought, new or changing markets and new agricultural technologies. These decisions involve assessing the risks and benefits of adoption and change across a range of scales (e.g. property, regional, industry, community) with often uncertain outcomes. It is therefore important for the red meat sector to continually refine approaches to supporting change and adoption. There is a need to learn how others approach this challenge and what critical success factors can be drawn from other sectors, and internationally. There is significant dependency on the extension system and extension practitioners to deliver the programs of support that not only convert to on-farm change but also build producer capability to innovate and change.

According to MLA's Producer Adoption Outcomes Report 2020-2021 and MLA's Strategic Plan 2025, approaches to achieve on-farm improvements and change is based on an adoption pathway that focuses on awareness raising, short term training and long-term practice change (see Figure 1 below). Adoption products and services are delivered within a wider program approach to research, development, and adoption. This includes designing opportunities for capacity building of extension and advisory practitioners, as well as encouraging the participation of the extension and advisory network in MLA adoption programs (MLA, 2022; MLA 2020).

Figure 1 MLA's producer adoption pathway



The MLA Strategic Plan 2025 focuses on delivering 'fewer, bigger and bolder' programs of work to ensure that producers are getting value for their levy investments (MLA, 2020). This includes developing programs that are based on more than 12 months of support and learning for producers, focusing on change across the supply chain, being informed by data and finding new ways to capture value from a range of revenue raising opportunities in an evolving operating environment. The outcome of this strategic approach to adoption is to assist producers in gaining a global competitive advantage by

focusing on current challenges that include adapting to climate variability, delivering world-leading animal health and welfare outcomes and achieving carbon neutral red meat production by 2030 (MLA, 2020).

This project was developed to support the continuous improvement of approaches supporting change and adoption by the red meat sector. It was undertaken by reviewing national and international extension and adoption practices across industries, to identify successful novel strategies, programs, and practices that MLA can introduce or use to enhance those currently being implemented. The primary research questions to be answered were:

- How well are primary producers engaged with extension providers?
- What are the barriers (program design, delivery, promotion etc.) that may be causing low levels of adoption?
- What are the enablers (program design, delivery, promotion etc.) that may lead to higher levels of adoption?

The responses to these questions will inform how to improve MLA's current adoption strategy. Improvement means to trial, evaluate, and refine new approaches - while bringing red meat producers and other stakeholders along on the journey. Our unique approach was based on a framework of co-inquiry (consultation and engagement) with the key internal (MLA) and external stakeholders (members of the Producer Adoption Reference Group (PARG), Research Advisory Councils, producers, and public and private advisory and extension sectors that will make decisions about adoption approaches and investments alongside the completion of the project.

Complementing a rapid appraisal of the international literature on innovative global extension and adoption methods, the project approach is strongly participatory and connects key project stakeholders directly with practitioners of innovative models in Australia and overseas via an interactive on-line platform. This on-line platform was designed to facilitate learning and deliberation about best global adoption practices. This platform helped establish a Community of Practice for the project, to aid joint decision making and the selection of activities to implement. The continuous interaction between the SRG, MLA program deliverers and the project team in the form of online engagement facilitated effective participatory decision making throughout the project. Following an analysis, filtering process and consultative selection, three activities were identified for design concept scoping, ready for implementation. The direct engagement of the key stakeholders in interactions with international and national contributors provided an opportunity to learn together on global best adoption practices.

2. Objectives

The project objectives are as follows:

1. Establish Stakeholder Reference Group, with key MLA and external stakeholders, to scope the priority review areas, discuss identified concepts, and finalise three for further development
2. Identify novel adoption/extension/practice change activities that can be adapted to address Australian Red Meat Industry issues and enhance uptake of innovation and best practice.

3. For each activity (up to a maximum of 10 per industry), identify barriers to adoption in the red meat industry and in the regions the industry operates in.
4. For each activity (up to a maximum of 10 per industry), identify components that will drive success.
5. For each activity, (up to a maximum of 10 per industry), qualify the benefits to enhance adoption in the red meat industry.
6. Develop a design concept for three of the activities that could be implemented including Monitoring and Evaluation.

2.1 Achievement of objectives

The objectives of the project were fully achieved by establishing a functional Stakeholder Reference Group, completing a comprehensive literature review across agricultural and non-agricultural sectors, engaging with Australian and international program informants, shortlisting three design concepts that were developed into implementation activities including costings and a monitoring and evaluation plan.

3. Methodology

3.1 Project methods with descriptions of main components

3.1.1 Identify: Research questions

The main research questions, developed in consultation with the Stakeholder Reference Group, were:

1. **How well are producers engaged with extension providers?**

    a. What are the approaches used by extension providers to engage with different groups of producers/end-users?

- How are information dissemination channels decided?
- How are messages selected, targeted (value proposition) and marketed for different producer/end-user groups?
- What are segmentation approaches used to target diverse audiences?

    b. What are the extension methods service providers use and how are they assessed for effectiveness in meeting learning needs?

    c. How are programs involving multiple service providers administered and evaluated?

2. **What are the barriers (program design, delivery, promotion etc.) that may be causing low levels of adoption? What are the opportunities to increase levels of adoption?**

    a. What novel ideas are creating breakthroughs in areas (e.g., industries, sectors, geographies) of historically low adoption?

b. How are tools and resources utilised by extension deliverers and how effective is this in supporting adoption?

c. To what extent has remote location been addressed in extension approaches?

d. To what extent have participants' time restraints been addressed in extension approaches?

e. How are people incentivized and what are effective awareness raising activities that increase producers' interest in change/adopting practice change?

3.1.2 Establish: Scoping meeting: Identifying the Community of Practice

a. Meet with key MLA staff/PARG to confirm scope and methodology
b. Identify members of the project 'Community of Practice'* (CoP) and terms of reference for their role in the project (like a stakeholder reference group but with a more active involvement)
c. Invite members and establish CoP
d. Finalise preferences for international contacts, agricultural and non-agricultural sectors to approach

**A Community of Practice (CoP) is a group of people with a shared interest (in this case, 'adoption') who participate in joint activities which enables informal learning and improvement in the shared interest.*

3.1.3 Scout: Rapid appraisal of peer-reviewed academic literature and adoption approaches

a. Determine key search terms for the rapid appraisal of the international extension/adoption literature using subject headings, key words, truncation, and wild searches with numerous search engines.
b. Confirm criteria for best practice in extension and adoption with MLA/PARG/COP e.g. contribution to capacity building, evidence of impact, ongoing access to support, specific learning outcomes etc.
c. Determine key countries, key programs/projects and key informants; include other ag sectors in Australia: (Extension Managers network and APEN) and non-ag (e.g. Manufacturing; Health; Environment; Mining; Business ; Defence) to be decided short listed with the CoP and MLA.
d. Rapid appraisal/assessment of extension and innovation programs globally – peer reviewed and grey literature.
e. Key informant interviews to gather important details of the approach, practice, monitoring and evaluation and practitioner reflections of identified novel approaches.
f. Analyse and synthesise:' best bets' for regions, systems and topics.
g. Report on preliminary findings to the CoP

Literature Review

The rapid appraisal of the peer reviewed academic literature involved 245 articles in total. The literature was conducted in two distinct phases: Phase 1 focussed on literature from the agricultural and extension sectors. Phase 2 focussed on literature from the business/finance, educational, environmental, health and natural resource management sectors.

Both reviews followed a similar protocol for conducting the desktop search. The search parameters for the rapid appraisal of the peer-reviewed academic literature, and the interview questions for consultations with Australian and international practitioner networks, were developed based on the project's key research questions and following advice obtained in the Stakeholder Reference Group meeting in October 2021. Search terms and interview questions were finalised using a feedback process involving the stakeholder reference group and the project team.

Key search terms and keywords for the rapid appraisal of the literature on international extension, adoption and engagement approaches were determined by the project team in consultation with the stakeholder reference group. Peer-reviewed articles were identified using searches conducted in Web of Science and Scopus databases, both of which cover life sciences, social sciences, physical sciences and health sciences. These databases are complementary and so the research results did not overly duplicate each other.

Overarching search terms were:

Phase 1

1. Extension program design and delivery, using the search string 'agri* AND ('extension program*') AND (design OR delivery)', and
2. 'Engagement/engaging producers/farmers' and 'communication and marketing to producers/farmers', using the search string 'agri* AND engagement AND (producer OR farmer)'.

Phase 2

1. Overarching search terms were (program*) AND (design OR delivery).
2. To produce more targeted results, the search strategy was modified to increase the number of concept groups. The following concept groups were adopted: *program design and delivery*; *behaviour*; *promotion*; and *target population*. Through an iterative process the concept groups were combined with key words in search sets customised for each sector.

Sub-searches were then conducted, using additional keywords from the agreed upon search parameters Key words were truncated where required. (See Appendix 1 for a full description of methods)

Decisions to select articles for the rapid appraisal were based on a review of their abstract and relevance to the focus of the research questions. Articles were excluded if they:

- were general studies of adoption rather than with specific focus on methods
- did not have rigorous M+E / data sets
- were not considered sufficiently novel or relevant to the purpose of the review
- were books and book chapters

- were case studies from developing countries and were not deemed culturally relevant to the Australian livestock industry.
- publication date did not fall within the year parameter (2015–2021)
- were duplicates

Following further selection, articles were shortlisted for the rapid appraisal based on a high level of relevancy. Relevancy was based around key areas of interest as identified by the project team and Stakeholder Reference Group, and included:

- Innovative extension activities and approaches and how they are implemented
- Innovative tools and resources and how they are utilised
- Innovative engagement / marketing methods and how they are implemented
- The use of technology, social media, and other web-based approaches in extension to overcome barriers such as remote location
- Engaging Indigenous stakeholders and Indigenous knowledge
- Understanding target audiences and contextual factors
- Understanding the effectiveness of offering incentives to farmers

Key findings from the literature in Phase 1 were drawn from a final 154 articles. Key findings from the literature in Phase 2 were drawn from a final 91 articles. These findings are presented in the results section 4.1.

Consultations with Australian and international networks

In addition to the review of the academic literature, 32 individuals or organisations were contacted to request an interview, based on the feedback and priorities identified by the SRG. Of these 32 contacts 22 led to key informant interviews (See Appendix 1 for a detailed list of key informants interviewed). The purpose of these interviews was to gather in-depth accounts and important details of novel extension and engagement approaches, including observations from practice, knowledge and application of monitoring and evaluation methodologies, and reflections on these identified novel approaches.

As part of this process, key contacts for the consultations with international extension, adoption and engagement professionals were identified from a list of key countries, programs and projects, and informants. This list was based on existing networks of the project team and shortlisted in consultation with the SRG. Key Australian informants were similarly identified based on the project teams' and Stakeholder Reference Group's existing networks and included other agricultural sectors and non-agricultural sectors in Australia. The extension and engagement approaches mentioned during the interviews may or may not have been represented in the literature review.

A total of 22 international and Australian key informants were interviewed, using a catalogue of questions that can be found in Appendix 1. The analysis synthesised the main themes from across the interviews and short-listed programs, projects, or initiatives that appeared to be most successful and novel.

Key themes from the Australian and international consultations are presented in the results section 4.2.

Stakeholder Reference Group Workshop

As part of the 'scout' stage of the methods, a report on the preliminary findings from the literature review and interviews with program informants was presented to the stakeholder reference group as a synthesis of 'best bets' for MLA in terms of production regions, systems and topic areas. The report presented a summary of 17 successful programs and 14 design concepts. These reviewed programs were cross-referenced with MLA's current extension and adoption programs to highlight industry relevance and opportunities for application. The report was used as background reading material in preparation for a stakeholder reference group workshop that was held in February 2022 (online).

The aim of the workshop was to discuss the findings from the rapid appraisal and short list design concepts and programs for further investigation with program informants. The role of the stakeholder reference group (SRG) was to consider and put forward their priority concepts and programs through participating in small working groups, group discussions and voting in pre- and post-polling activities (see Table 1 for a full list of design concepts and programs presented in the workshop, with priority concepts and programs highlighted). A report of the workshop process and outcomes was circulated to all SRG members and uploaded to the online CoP platform.

Table 1: Results of the pre-survey and workshop poll results of the short-listed design concepts and program/projects

DESIGN CONCEPT (PRE-SURVEY)	DESIGN CONCEPT (LIVEPOLL)	PROGRAM/PROJECT (PRE-SURVEY)	PROGRAM/PROJECT (LIVEPOLL)
1.Understanding target audiences to tailor approaches	*1.Understanding target audiences to tailor approaches	1. Red Meat Profit Partnership (5)	*1. Red Meat Profit Partnership (10)
2.advisor training/capacity development	2. End-user targeted and co-design/participatory extension	2. Adviser to Adviser mentoring (3)	2. Service Design Teams (7)
3.networks and support	3.advisor training/capacity development	3. Extension 350: farmers learning from farmers (2)	3. Living Labs (6)
4.producer- led learning	4.producer- led learning	4. Farmer to Farmer mentoring (2)	4. Adviser to Adviser mentoring (4)
5.peer-to-peer learning.	5.peer-to-peer learning.	5. Living Labs (1)	5. Extension 350: farmers learning from farmers (4)
6. End-user targeted and co-design/participatory extension	6.networks and support	6. Circular Agriculture in the North Netherlands (1)	**6. Circular Agriculture in the North Netherlands (3)
7. Duration of program (>2 years)	7. Mentoring (peer-to-peer/advisor)	6. Young Farmers Business Program (1)	7. Young Farmers Business Program (3)
8. Hybrid engagement	8. Hybrid engagement	7. Dairy Campus (1)	8. Farmer to Farmer mentoring (2)
9. Access to support	9. Duration of program (>2 years)	8. I2 Connect (1)	9. Networked Demonstration Farms (2)
10. Mentoring (peer-to-peer/advisor)	10. Local Groups	9.Farm Business Development Groups (1)	10.Farm Business Development Groups (1)
11. Local Groups	11. Monitoring and Evaluation	10. Service Design Teams (1)	11. Dairy Campus (0)
12. Monitoring and Evaluation	12. Access to support	11. Networked Demonstration Farms (1)	12. I2 Connect (0)
13. Expanded project roles	13. Expanded project roles	12. Public short courses on rotation (1)	13. Public short courses on rotation (0)
		13. People in Dairy (0)	14. People in Dairy (0)

14. Engaging indigenous stakeholders and knowledge	14. Engaging indigenous stakeholders and knowledge	14. Lifetime Ewe Management (0)	15. Lifetime Ewe Management (0)
		15. Passion to Profit (0)	16. Passion to Profit (0)
		16. I4AG (0)	17. I4AG (0)

*Blue highlighting = top five concepts and programs that were nominated most frequently
**Grey highlighting = additional programs for consideration

3.1.4 Network (international; cross sector; outside sectors)

a. Invite a selection of key informants to interact with the CoP via on-line platform and interactive webinars.
b. Set up interactive e-platform for expert panels to consider and respond to key questions posed by CoP and responses visible to CoP). Transfer responses to a summary report – the e-platform established, managed and monitored by the project team.
c. Complete the process with a series of online interactive sessions between key program informants (international and local) and the SRG.

Online interactions with program informants

Continuing with our focus on a participatory and co-design approach, the project team coordinated, designed and facilitated six online interactive sessions to probe further into those adoption programs that were shortlisted and aligned with the three design concepts. The online interactive sessions were held between March 31- April 12, 2022 and were 1.5 hours long (see Table 2 for program and scheduling).

Table 2: Schedule of online interactions with key adoption program informants

Program	**Date and time**
Red Meat Profit Partnership and farmer action groups (NZ)	Thursday March 31, 12noon-1:30pm AEDT (2pm NZDT)
People in Dairy (AUS)	Thursday March 31, 2:30-4pm AEDT
NSW Young farmer business program (AUS)	Friday April 1, 2:00-3:30pm (AEDT)
Living Labs (EU)	Monday April 4, 4:00-5:30pm AEST (8am CET)
Extension 350 (NZ)	Tuesday April 5, 2:00 – 3:30pm AEST (4:00pm NZST)
Agriculture and Horticulture Board, (UK)	Tuesday April 12, 5.30-7:00pm AEST (8.30 am GMT)

The online interactive sessions involved selected program informants and practitioners, key MLA staff, the Stakeholder Reference Group and the project team. Each Zoom interactive session was based on a set structure that included a program/project update from the informant, Q&A between the SRG and program informant and summary reflections on what was considered important for implementing innovative adoption approaches in the red meat sector.

Each recorded online interactive session was written up as a case study, which included a snapshot of the overall approach, program features, program insights, critical success factors, outcomes and evaluation, and future developments (see Appendix 3 for a presentation of the case studies). An additional case study was added from an interview with Resource Consulting Services to complete the set of case studies.

3.1.5 Deliberate and decide

a) Develop short summary report for deliberation by CoP
b) With the CoP via webinar/zoom meeting, workshop the main findings and discuss recommendations for approaches to trial with target groups in the red meat sector.
c) Recommend and finalise proposals and implementation plan.
d) FINAL REPORT

Draft process of activity implementation plans

The four activity implementation plans for MLA to consider for funding and piloting were developed from three design concepts that were short listed. Insights gained from understanding how these concepts have been applied in Australian and international context through interactions with selected adoption program informants were also used in developing the implementation plans. The Global Adoption Review (GAR) project team proposed four activities in consultation with MLA and the SRG.

A first draft of the activity implementation plans was presented to the MLA Project Manager on April 26. The GAR project team invited written and verbal feedback on the activities. The draft activity plans were also circulated to the following MLA Managers and other relevant MLA staff, including those who are part of the Stakeholder Reference Group (Sharon Dundon, Margaret Jewell and Sarah Strachan – SRG members), Gus Rose (Manager – Consultation), Andrew Morelli, Harriet Bawden and Keely Kovacevic. The feedback from MLA staff was documented and integrated into activity implementation plans as much as possible.

The GAR project team presented summary versions of the four 'activity implementation plans' to the stakeholder reference group in an online consultation session on May 6. The process provided an opportunity to present the details of each activity to the SRG members, and receive verbal and written feedback on each activity by the SRG by asking two key questions:

- Do you see any 'red flags' with this activity?
- How could we add further value to this activity?

The SRG feedback was documented and integrated into the activity implementation plans. The activity plans were submitted and approved in the report L.ADP.2110 Milestone 4 on May 17.

4. Results

4.1 Rapid appraisal of Australian and international literature

The rapid appraisal of global extension and innovation programs in the peer reviewed academic literature focused on priority topics of interest identified in consultation with MLA and the SRG as well innovative tools and resources and how they are utilised. The summary of this rapid assessment presents key themes and principles of extension, adoption and engagement emerging from the review, including results from both Phase 1 and 2 of the literature review. This summary can be found in Table 3 (for a full presentation of the literature review including a discussion of the key themes and an annotated list of articles reviewed, please see Appendix 1).

The literature highlighted the important elements to consider when designing adoption and change activities:

- understanding target audiences and linking extension and engagement
- participatory approaches, co-design, and co-innovation
- catering to different learning styles
- e-extension, ICT, and hybrid delivery modes
- engaging Indigenous stakeholders and Indigenous knowledge
- formative and participatory monitoring and evaluation

Table 3: Key insights and practice examples from a global review of the literature

Principle / theme	Practice example	Benefits
Understand target audiences	Segmentation methods identifying 'personas' (farmer types and characteristics), using surveys, interviews, social media. Other methods include farmer focus groups or social network maps to gain understanding of social connections and identify gaps in networks/ communication. Pro-active networking activities are also an important engagement and trust-building mechanism (Fielke et al., 2018). Participatory approaches to extension and engagement improve understanding of target audiences (see below) Results from the second phase of the review revealed a range of methods for understanding target audiences being applied in sectors outside of agriculture. In some studies there was a focus on the influence of individual characteristics on decision making. For instance, the influence of age, gender, education and connection to nature with respect to participation in different nature-based activities (Woolley et al., 2021) and threat perceptions, attitudes, and social norms in relation to landholders' land clearing intentions (Simmons et al., 2021). Integrated behavioural models are commonly applied to identify motivational factors in change among target groups. Makenzie et al., (2021) use an integrated behavioural model for informing the co-production of interventions. The results support integration of social science methods to identify the influence of psychological factors on decision making and behaviour change. An alternative approach by Hoolohan and Browne (2018) considered how specific modes of intervention are prioritised within a social, political, semiotic and material landscape of professional practice in water demand management.	• Understand social-cultural characteristics and other contextual factors affecting farmer engagement, needs, learning styles, adoption, practice change and effective incentives • Understanding target audiences will drive successful engagement, program design and extension delivery

Principle / theme	Practice example	Benefits
Participatory approaches to program design and extension	Engaging with end-users/target audiences using surveys, interviews, social media, focus groups to gather information on their extension needs and learning preferences. Innovation platform: A forum to foster knowledge exchange among stakeholders with shared interests. Stakeholders have complementary roles in the development, adaptation, dissemination, and adoption of knowledge for improved program design https://simlesa.cimmyt.org/wp-content/uploads/AIP-RWANDA.pdf Co-innovation: The process of jointly developing new or different solutions to a complex problem through multi-stakeholder engaged research processes. (https://i2insights.org/2019/07/16/five-principles-of-co-innovation/) Participatory extension programs (PEPs): farmers, researchers, and rural experts collectively learn by sharing information and experiences (Knook et al., 2018). Management teams: A farmer-directed, team-based approach with demonstrated benefits for increased performance and profitability (Cordoba et al., 2018). For example, Repro-money: a farmer-led management team approach developed by the University of Wisconsin Madison: https://fyi.extension.wisc.edu/news/tag/repro-money/ Farm Business Development Groups (BDGs): Discussion groups/forum for peer-to-peer learning, sharing ideas and keeping up-to-date with new technology. Each BDG is managed by a facilitator and comprises around 20 like-minded farmers who will meet six times a year to focus on the topics agreed by the group. Activities include on-farm meetings, demonstrations, and skills training. (https://www.daera-ni.gov.uk/articles/rdp-business-development-groups	Proactive stakeholder engagement and interaction with target audiences are important to conducting effective engagement and networking. Participatory approaches to extension and engagement will: • improve understanding of target audiences, their needs, characteristics, other context (Knook and Turner, 2020) before rolling out fully developed programs (Simoes et al., 2019) • build relationships, trust and social capital between end-users, R,D&E professionals (Brown et al., 2021; Calliera et al., 2021). • allow farmers to contribute directly to extension program design • improve responsiveness to farmer diversity and learning needs (Sewell et al., 2017) • empower farmers to integrate new learning and existing knowledge • assist in integrating multiple types of knowledge (two-way learning from researcher-end-user and vice versa) • Generate learning and new knowledge from the interaction and cater for different learning styles. • Combine on-farm measurement and experimentation with researcher and adviser interactions

Principle / theme	Practice example	Benefits
Participatory approaches to program design and extension	Participatory/ co-design of digital agriculture technologies (Stitzlein et al., 2020) and decision-support tools (Harden et al., 2021), using focus group methodology, workshops, participatory training, demo-farms, BMPs Innovation platforms with producers (Brown et al., 2021); KTDA (Kenya Tea Development Agency) Peer-to-peer learning: farmer action groups , demo-farms, mentoring programs. The use of co-design is prevalent across business and finance, NRM and education. For instance: interventions to reduce sitting times at work were co-produced with employees (Mackenzie et al., 2021)and engaging young people as coresearchers was used as an approach to develop environmental indicators (Ungar et al., 2020). Learning labs or in-person innovation platforms have been applied in education and NRM. For instance in gathering school stakeholders to transform the discipline system (Ko et al., 2021); and promoting rural areas as attractive places to live (Zavratnik et al., 2019). Tantillo et al. (2020) described a remote innovation platform, using tele-mentoring to build a collaborative learning community, connecting eating disorder specialists with community-based practitioners in remote areas.	• Joint planning of activities contributes to improving agricultural production • Action learning cycles (Plan-Do-Observe-Reflect-Adapt) have in-built, participant driven monitoring and evaluation mechanisms Farmers benefits include: • benchmarking their business • identify areas for improvement. • develop business development plan to identify actions for improving technical efficiency and sustainability of the farm business. • Peer-to-peer learning and reduce social isolation Other benefits: • Obtaining farmer feedback/ input early on in product design/development phases promotes trust and increases relevance of the technology and scientific research. • Encourages knowledge diversity and generates buy-in from Indigenous landholders and producers • Indigenous engagement must be built with cultural sensitivity and expertise and on the same principles applying for all participatory approaches (inclusivity, reciprocity, collective ownership, equality, respect).

Principle / theme	Practice example	Benefits
Catering to different learning styles	Peer-to-peer learning: farmer action groups, demo-farms, mentoring programs; E-extension and hybrid models (media and F2F based, see below) Integrating digital tools to cater for different learning styles is prominent throughout the education, health and environment sectors. Notably, the use of digital gamification for improving awareness around NRM issues (Cheng et al., 2021; Leitao et al., 2022). A number of studies explored different ways of engaging audiences in face-to-face knowledge sharing, dramatizing data through ethnodrama, for communicating the outcomes of research (Taylor et al., 2017), escape room simulation for emergency healthcare procedures (Sarage et al., 2021) and using community games to simulate the consequences of crop choice on an aquifer to improve collective governance of groundwater (Meinzen-Dick et al., 2018).	Focus on peer-to-peer learning: • farmers value the opportunity to discuss farm performance and share knowledge with their peers. • Combines multiple forms of knowledge, including producer practice knowledge • Dialogical, two-way information • Builds capacity and skills beyond technical information, i.e., self-reliance, resilience, leadership, human capital, interpersonal skills, collaborative skills (Ndlela and Worth, 2021; Weaver et al. 2016) • Accessible learning outcomes peer-to-peer exchange and farmers empowered by new knowledge/practices drive adoption more than monetary incentives (Cordoba et al., 2018; Knook et al., 2018)
Multi-media e-extension and engagement	Instagram for extension programming (Stock, 2020) Use of Facebook, WhatsApp and twitter for engagement Timely Topics Web (TTW) tool: has four main components: a) general title and optional tagline, b) feature topic summary, c) central image relevant to the feature topic, and d) hotspot-linked images and associated text (https://uthorse.tennessee.edu/) (Ivey & Myer, 2019) The use of digital tools in business and finance, education, health and NRM extended from traditional digital tools such as videoconferencing for mentoring, coaching, counselling (Cliffe et al., 2021; Tantillo et al., 2020), and digital messaging (via SMS, webchat); (Burns et al., 2016; Chiang et al., 2018; Gilchrist et al., 2021). Application of behaviour change theory to further develop and apply the use of these tools was investigated (Chiang et al., 2018; Gilchrist et al., 2021), for instance in the use of a massive online open course (MOOC) as a tool to facilitate attitudinal change and engagement in activities around the topic of smart cities.	• Videos, websites and learning apps, social media channels are effective ways of disseminating information (Thorn et al., 2017) • Multi-media and e-extension approaches help address long distances, remote location, and time constraints as apps allow access to information on farm. • Producers interact with common social media apps that they use for social purposes as well (Ruggeri et al., 2018; Son et al., 2019) • Online-based approaches facilitate quantitative monitoring and evaluation based on website metrics • The use of digital tools enables the formation of "hubs" for linking up practitioners for example, in the health sector digital messaging tools have linked specialists with community-based healthcare providers (Tantillo et al., 2020).

Principle / theme	Practice example	Benefits
Hybrid (online/face-to-face) models	Remote engagement using social media with hands-on/ experiential learning material delivered to participants (Stokes et al., 2020) (US) Combining e-extension with call in service or local group meetings Weekly Webinar Series: "Ask the Ag Agent", Agriculture-Focused Response to the COVID-19 Pandemic – Rutgers State University of New Jersey https://sare.rutgers.edu/ask_the_ag_agent.html (Bamka et al.,2020) Extension blogs: combine peer-to peer learning and engagement with online extension via online blog sites. Two studies in health, one enabling greater integration of curriculum across education and professional development (Brannan et al., 2019) and the other examined workshops and the use of digital tools as supplements to standard care, providing greater reach at reduced cost (Budney et al., 2020). Results from NRM sector included an example of hybrid extension models in agriculture, enabling advisor and producer training among extensive livestock producers in western Queensland (Rolfe, 2017).	Face-to-face and peer-engaged learning as well as experiential learning modes (field tours/ workshops) are still preferred by producers and other learners and are still the most useful for practice change (Thorn et al., 2017) but research shows that this can be integrated with medial/ online based approaches. Hybrid (online/F2F) extension approaches blend traditional face-to-face teaching with online and/or multi-media-based instruction and can successfully combine the best of both approaches (Uribe& Santamaria, 2017) Extension blogs are a useful extension tool to disseminate science-based information as well as less technical, more applied information and provide an opportunity for peer-to-peer information exchange (Gardner et al., 2018)
Monitoring and Evaluation (M+E) methods	Common M+E methods include surveys or questionnaires, to collect both quantitative and qualitative M+E data. Quantitative methods also include website metrics (page views, unique page views, time on page, bounce rate (Angima & Carroll; 2019; Ivey & Myer, 2019). Qualitative methods include surveys, interviews and mind-mapping tools. The use of behavioural frameworks for evaluating interventions is prominent across the business and finance, education, healthcare and NRM sectors. A number of models are presented; the Delphi method for technological forecasting (Egfjord & Sund, 2020); the theory of planned behaviour (TPB) for linking pro-environmental identity and energy conservation behaviours (Hu et al., 2020), and for revealing the micro foundations of knowledge sharing and technology transfer (Scuotto et al., 2020); the behaviour change wheel to evaluate the delivery of webchat counselling (Gilchrist et al., 2021) and a digital health outreach platform (Chiang et al., 2018); The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) method (Johnson et al., 2020; Pullen et al., 2019).	Monitoring and evaluation activities, especially when they are participatory or built into an action learning cycle can aid understanding of target audiences and their changing practice. (Tuck et al., 2020)

4.2 Consultation with Australian and international networks

A total of 22 interviews with key informants in Australia and overseas were completed. The approaches and projects/programs identified as relevant or insightful examples as part of this consultation are summarised in Table 8. To determine key and repeating themes from the interview material, a basic thematic analysis was applied to all 22 interview transcripts. Four key themes emerged from these consultations:

- Understand your audience
- Support producers on the journey of learning and adoption
- Upskill advisors to teach and facilitate
- Create relationships across the supply chain.

A more detailed description of each theme with example programs that showcase each theme is presented in Table 4.

Table 4: Key insights and practice examples from the consultations with Australian and international program informants

Theme	Description of theme	Programs where theme is applied
Understand your audience: one size does not fit all.	The diversity of producers within the red meat industry is reflected in differences between the classes of livestock run and the management systems implemented on farm. Producers are not homogenous in their thinking, perspectives, and identity, and therefore their drivers. The interviews highlighted that extension and adoption programs aimed at red meat producers need to reflect this diversity and be able to meet the need for individualised approaches. The need to recognise the type of system and differences in practices and values between producers and align the delivery model and engagement was identified across numerous program informants, with one program informant identifying it as a critical success factor.	AHDB (UK) Targeting messages to different producer segments and levels of capacity in: 1. Genetics 2. Farm Business Management 3. Future farming landscapes Pork advisor, Australia • A range of delivery strategies in response to feedback / M&E • Not one size fits all – context, values, drivers across the whole supply chain Dairy NZ Target peer groups of young farmers with a focus on facilitated groups that work with associated industries to enact change. Training leaders to take information back to regions • Biz Start, Biz Grow
Support producers on a journey of learning and adoption	Facilitating change on-farm requires commitment and support from trusted advisors across the entire learning process. The importance of program facilitators providing a journey for producers was highlighted, moving from awareness and knowledge through to technical depth and support to adopt new practices. Support networks and coaching were a common theme throughout all the interviews, across wide ranging industries and countries, as a factor crucial to program success. The facilitated support can come in different forms including peer-to-peer relationships, mentoring from other producers or from advisors. The key is that the support network must be trusted.	Producer-driven learning supported by facilitators over a long period of time including regional discussion groups, short courses focusing on emotional intelligence, peer-to-peer learning. • Red Meat Profit Partnership, NZ • Pulse Check, GRDC • NB2 • Lifetime Ewe • South Australian Rural Women's Leadership Program • Ayr Peninsula EP Ag program • Dairy Australia focus groups • Extension 350, NZ Biz Start, NZ • Biz Grow, NZ • Mark & Measure, NZ • Emerging Leaders, NZ • Extension 350, NZ • Thriving Southland, NZ • Inside Dairy, NZ

		• Farm Tune, NZ Farmers decide what they want to learn about, and programs developed from that decision, so there is flexibility built into the program. • People in Dairy • Cups on, Cups off
Upskill advisors to teach and facilitate effectively	The need to understand extension properly and the principles of how people learn was considered by eight program informants to be essential to achieving adoption targets. Good facilitation and engagement were described as applying learnings to the producers' world and encouraging them to have a go in a supported way. While this process is more costly, it has been demonstrated to be more effective (Knook et al., 2020; Nettle et al. 2018; Teno & Cadilhon, 2016). To enable this process, advisors/extension practitioners require training and support themselves. Training in the red meat, dairy and pork industries has typically been focused on keeping advisors up to date on technical knowledge with limited focus on developing 'soft' skills.	Fast-Track peer mentoring with on-hand, rapid support and facilitation for farm and advisory business support and problem solving. • SOLINSA project http://www.solinsa.org/ • Living Labs • DESIRA (Italy) • Fairshare (Ireland) Cotton Info, Australia Highlighted the importance of peer-to-peer support and developing young consultants and advisors • Regional Young Farmer Network, NSW
Create relationships across the supply chain	Over half of all program informants explicitly mentioned that relationships across the supply chain need to be established. It was generally recognised that many people are not included in advisory efforts and advisors need to be more proactive in including roles such as farm employees and contractors as these are currently a blind spot in extension and advisory policy. Other roles, including stock agents, banks, seed companies, vets, accountants, and re-sellers were also identified as needing to be included in extension efforts.	Pork advisor, Australia • A range of delivery strategies in response to feedback / M&E • Not one size fits all – context, values, drivers across the whole supply chain Nefertiti (EU) • Linking Demonstration farms across the EU • Using demonstration farms to support farmer-adviser-researcher engagement in fragmented and privatised advisory systems and complex problems.

	Across all program informants who identified the entire supply chain as an area underutilised by extension providers, the need to develop trust and long-term relationships at a regional level was a key theme.	

In summary, across all interviews, the discussions highlighted that the novel approaches and strategies utilised were based on common participatory methods to target and focus efforts as well as in constructing tailored messages for targeted communities. While there were innovative strategies in place to utilise known extension practices, the processes described were older or well-established ideas. However, when these are applied in a new context, this drives producer engagement and adoption. New or innovative programs do not have to be pioneers. In addition, key insights for monitoring and evaluation identified that a static or point in time process of evaluation is a poor way of assessing programs as the data does not capture the entire learning process. Meaningful data can only be captured over extended programs. It was therefore also recognised, that funding bodies could think longer term into program development timeframes and include capacity and flexibility in expectations to design, develop, monitor, refine and review rather than the now more frequent short term/fixed program timeframes. Having greater depth and breadth in program development and delivery will benefit funding bodies in the long term.

4.3 Three design concepts for development

Consultation with stakeholder reference group members and MLA adoption program managers indicated the critical factors for successful extension and adoption programs were:

- design concepts that enabled an understanding of the target audience for tailored approaches
- opportunities for co-design of adoption projects and activities, with participants.
- delivering programs that incorporated advisor training, mentoring and professional development
- producer-led and peer-to-peer learning

Based on SRG and MLA feedback, three designs concepts emerged with associated adoption programs that warranted further exploration with program informants:

1. **Understanding targeted audiences and contextual factors in adoption** (farmer segmentation e.g. *Service Design Teams - UK, Young Farmer Business Program – AUS; Resource Consulting Services - AUS*)
2. **Producer peer-to-peer learning and leadership in adoption design** (co-design/co-innovation/farmer action groups e.g. *Red Meat Profit Partnership – NZ*, *Extension 350 – NZ, AgriLink Living Labs - EU*)
3. **Strengthening the capacity of the advisory sector** (advisor mentoring, training e.g. *Dairy Australia national programs - AUS*)

(See Appendix 3 for a case study presentation of these example programs that represent the design concepts)

4.4 Key concepts and their application in the red-meat sector

4.4.1 Tailored approaches that are based on a greater awareness of producer needs and the context for practice change.

It is apparent that supporting change and adoption in the red meat sector could benefit from taking a more targeted approach for engaging and recruiting producers in projects, based on an understanding of producer needs as the end-user or active participant in the process of change. Segmentation methods, social network mapping or participatory approaches can help identify producer characteristics, learning styles, aim/goals, interests, capacity for leadership and key challenges of the production system (e.g. Service Design Teams - UK, Farm Business Development Groups – EU). Improving understanding of the broader context the producer operates in terms of geographical remoteness, climatic zone, regional infrastructure and economy and local community interests is also important.

4.4.2 Strategies designed to strengthen producer knowledge networks and leadership.

In alignment with the targeted approach to change, there was a clear preference for programs that supported the exchange of knowledge between producers (e.g. *Red Meat Profit Partnership - NZ, Young Farmer Business Program - NSW, Extension 350: Farmers learning from farmers - NZ*). Producer-led learning provides opportunities for producers to control the direction of adoption programs, and co-design relevant activities for their peers with input from technical experts. The logic is that producer-led processes of change may increase the commitment to the program's outcomes.

If the approach used by the Red Meat Profit Partnership (RMPP) is compared to the MLA program (Profitable Grazing Systems - PGS), the key differences between the two are:

- PGS focus is on the technical topic and using a single method for training (coaching). There is one key deliverer (technical expert and coach).
- RMPP focus is on the group and bringing information and activities as required by the group. Multiple deliverers are used (facilitator, technical experts, mentors).
- RMPP has a longer timeframe (3-years compared to PGS 12-18 months).
- RMPP focuses on the group achieving their own goals, while PGS has a focus on achieving the program learning outcomes.
- RMPP had strong endorsement and involvement of processors.
- Training and support to RMPP facilitators was a priority.

4.4.3 Continued investment in the professional development of advisors/change practitioners

The specific skills and experience of the advisor were considered critical for the successful application of an end-user targeted approach and supporting producer-driven learning and leadership. The professional development of advisors and change practitioners should focus on improving their technical knowledge and people skills (e.g. communication, facilitation and relevant concepts from the social sciences to understand processes of change). Advisor-to-advisor mentoring was considered useful and could include pairing an advisor with a mentor outside the agriculture sector, but with expertise in managing people and change.

4.4.4 Some approaches would be best trialled in new projects/initiatives

The 'Living Labs' approach was of considerable interest to MLA and SRG. It accentuates the co-creation of innovative solutions to complex challenges between producer, advisers and researchers. Using this approach, there is active involvement and commitment from all stakeholders to experiment and build new knowledge or processes together as a long term collaboration. An example of this is the Circular Agriculture in North-Netherlands: Daring scenarios and Interlinked Transformation' project– which aims to co-create transformative pathways which connect future scenarios of 'circular agriculture' with preferred and practical stakeholder actions within technological and socio-economic conditions, thereby enabling governance (policy) interventions.

The 'service design' approach (e.g. Living Labs) that was applied by a number of informant programs, uses a better understanding of target audiences and engaging producers from different segments differently. While mainly focused on existing knowledge and the development of new products and services, the approach is also being used in considering new services in the carbon farming and contested knowledge areas. Drawing on social and behavioural sciences, the approach has an increased focus on knowledge exchange, additional to information and tool delivery. More effort is now put into deciding language and channels and piloting and testing different options, with greater emphasis on social and cultural dimensions to change. This provides a 'journey' experience of change, where producers can engage at different levels. It also identifies what the key influence relationship is to design and deliver services (e.g. farmer to farmer or farmer to adviser or farmer-community).

4.4.5 SRG advice for applying the design concepts to the MLA context

In terms of applying some of the priority design concepts and programs to the MLA context, there were three recurring themes that emerged from the final SRG workshop discussions:

1. Seek opportunities for adjusting current MLA programs, to incorporate a stronger focus on producer segmentation and advisor mentoring (e.g. PGS was considered a current successful program that could be enhanced by incorporating some of the identified design concepts)

2. Explore an opportunity to develop strategies for linking Producer Demonstration Sites (PDS) projects to create a coordinated whole industry knowledge network to extend producer learnings beyond the PDS participants
3. Adoption and change can be improved by involving a broader range of advisers, agricultural agents, service providers and value chain actors in MLA programs, and should be considered in any pilot activities.

It was advised that one-day events aimed at raising awareness should not be the focus, as too many of these events can lead to an incoherent adoption space, leaving producers disengaged. The focus should be on supporting long term practice change and ensuring adoption activities are linked to broader program outcomes to achieve a coordinated, collaborative and coherent delivery system of support.

4.5 Activity implementation plans for piloting

From the investigation of the design concepts within the chosen case study programs from the key informant interviews and interactions with the stakeholder reference group, four activities were developed for implementation by MLA (see Appendix 3 for a presentation of the selected programs as case studies). These activities reflect innovation through proactive approaches to support adoption, reaching farmers through unique or multiple approaches to service specific needs, involving investors/funders and service providers in partnerships for change beyond the 'usual suspects', and, providing the opportunity for producer-led design of a change agenda, alongside investment in the development of bespoke solutions for implementation.

The following section provides a summary of the four activity implementation plans. Each activity is presented with a corresponding monitoring, evaluation and reporting plan. To see the extended version of each activity for more detail about the process as well as costings, please see Appendix 2.

Activity 1: focuses on engaging with southern rangeland producers as a target for applying a service design approach. With the support of behavioural science, this activity aims to understand the needs, values and motivations for engagement, followed by the adaptation of the products, tools and services provided by MLA to more closely meet the needs of producers. (Table 5 and 6)

Activity 2: trials a program development team approach to mobilise collective effort of scientists, value chain actors, advisers and farmers to increase the use of pain relief as a routine practice for enhanced animal welfare in the sector, and report progress in the community. (Table 7 and 8)

Activity 3: trials a 'living lab' approach whereby groups of farmers, scientists, advisers and other stakeholders are supported by a facilitator in an iterative process to clearly identify problems and co-design the solutions for investment. (Table 9 and 10)

Activity 4: trials an open, producer-led approach to supporting change whereby producer groups are supported to form on the basis of a common interest or challenge, and are facilitated through adoption

by connection with the knowledge, expertise, tools and coaching to effect change alongside peer support. (Table 11 and 12)

These proposed activities could be integrated within existing MLA programs.

4.5.1 Activity 1 Implementation Plan: Engaging with southern rangeland producers

This activity trials a user-centred approach, with the support of behavioural science, to understand the needs and motivations for engagement followed by the adaptation of the products, tools and services from MLA to more closely meet the needs of producers. This activity will build the capacity of the red meat sector to design and target services to reflect the diversity of user needs. Insights from implementation of the approach in the southern rangelands could be replicated or scaled to other topics or settings.

Table 5: Activity 1 Implementation Plan: Engaging with southern rangeland producers

CONTEXT		**PROCESS**		**RESOURCES**	
Name of activity	Engaging with 'hard to reach' producers operating in the southern rangelands, to tailor adoption service delivery: the application of behavioural (user-centred) insights.	Key Methods	1)Behavioural insights (i.e., what engages people; why do they wish to be engaged) 2)Development of producer personas representing the diversity of needs of a range of producers 3)Tailoring the content of MLA programs to relevant needs 4)Developing engagement/adoption strategies based on these personas	Required role/skills internally for MLA	- Project management - Supporting local reference group - Capability in interpreting social research data - Trained in service design process (for example, RESET, EAST) - Evaluation
Problem definition or topic area	Almost 75 per cent of Australia is rangelands. Extensive livestock industries are the dominant agricultural users in the rangelands, however there are challenges in engaging with rangeland producers in adoption programs, projects and activities. There are often a wide range of assumptions made about 'hard to reach' producers. This activity examines the real needs and interests of producers to examine how MLA programs may be better targeted or adapted to meet rangeland producer needs. This activity is innovative as it: a) flips the focus to how industry needs to change and adapt , rather than expecting producers to 'fit' a mode of engagement and delivery. b) does not start with assumptions about why producers are less engaged but actively seeks to understand the producer perspective and interests to scope what producers do and do not need.	Steps	1) Conduct a desktop review of relevant reports on the social profile of Australia's rangeland producers /influences on engagement. 2) Stakeholder mapping (who is involved or influential in supporting rangelands producers, e.g., service providers, community organisations, producers, refer to Mitch's stakeholder mapping 3) Selecting 1-2 production regions/areas in the southern rangelands to focus the activity. Consider 2 states where the state-based resources, stakeholders and enterprise mix can be considered. 4) Form local reference groups /involve or contract key expertise (behavioural scientist, local interviewer) 5) Design interview process (behavioural insights) 6) Conduct interviews (local, trusted, trained interviewer who can gain access and confidence of local producers) 7)develop personas to which modifying an existing MLA program can be directed 8)select focus topic or program of MLA to modify to meet rangelands producer persona needs 9)plan, deliver and evaluate activity 10)develop recommendations for utilising behavioural insights in MLA service design	Required role/skills of the activity deliverer	- Training of MLA activity team or key stakeholders (advisors/service providers) to conduct persona interviews - Behavioural scientist consultant with ability to interpret social data and formulate behavioural insights for adoption support/practice change

Design concept	1) tailoring services to a targeted audience 3) strengthening the capacity of advisers/service providers	Who will lead	MLA Adoption Manager Work with /second a behavioural science consultant (e.g., young farmer business program/AHDB program lead)	Required prior information	Reports relating to the social and demographic profile of southern rangeland producers
Relevance to adoption context	The service design approach tailors programs by undertaking significant preliminary work to better understand end-users needs, interests in change.			Costs involved in pilot	Service fees if using third parties for social data collection/consultancy fees for behavioural scientist (Full costings in Appendix 2)
Fit with MLA	MLA has expressed an interest in targeting producers in the southern rangelands and has already begun mapping out key stakeholders involved in supporting adoption and production practice change	Governance model	MLA project team consisting of MLA Adoption Manager/MLA adoption project staff to coordinate activity and report to MLA Adoption Manager. Local reference group (producers; stakeholders; extension design expertise)	Proposed business model	Levy funded as a pilot program to determine the best E&A approach for southern rangelands producers.
Investment case i.e., value proposition/ROI	- Rangeland producers will have their specific needs understood and met by industry programs, leading to better engagement with future industry programs/services. - Greater value from current programs: e.g. PGS - A process that MLA can use for adapting existing programs to better match producer needs/ tailoring in other contexts. - Engaging advisors as part of local solutions could support the skills development and retention of advisers to deliver on producer needs.	Role of key stakeholders/ Partners	- Small set of advisers/service providers to be part of the MLA activity team during the stage of analysing the social data and matching/delivering current MLA offerings programs/projects/services based on producer needs - Evaluation design expertise	Time Frame	1st year – establish target areas, reference group, expertise and data collection (steps 1-7) 2nd year – develop personas/service design process for a focus program/topic and modify and pilot MLA offering with target groups (on-ground) 3rd year - widen implementation and monitor and evaluate strategies/replicate 4th year – Revisit personas /trial process in additional areas/programs.
Objective/ outcome	To increase the participation of southern rangeland producers in MLA activities	Reach to target producers	- Producers who operate in the southern rangelands who may be less engaged; engaged in other ways that are not widely offered; or disengaged - Baseline data collection: engagement and needs - Data collection on engagement metrics	Literature resources	See Appendix 2 for the extended version of activity implementation plans including a list of resources Key resources: AHDB, YFBP, Deer NZ
Monitoring, Evaluation and Learning plan/report	- Extent of engagement (pre-post) - Extent to which needs are met - Extent to which process can be replicated in other regions /for other programs				

4.5.2 Activity 1: Monitoring, Evaluation and Reporting Plan

Table 6: Activity 1: Monitoring, Evaluation and Reporting Plan

Goals	Outputs (products)	Outcomes (adoption)	Impacts (benefits)	How/Who/ When
OVERALL ADOPTION GOAL To increase the current adoption rate of new and best practices by southern rangeland producers by linking, tailoring and generating relevant MLA products and services for southern rangeland producers based on their identified needs and interests (behavioural insights). **KEY ASSUMPTIONS** Southern Rangelands includes NSW, South Australia, Western Australia and QLD MER based on 2 production areas being selected that are considered areas with low engagement e.g., Northern SA and the Goldfields region of WA. $925,000 investment over 3 years	Matching, linking and tailoring MLA products and services based on the needs, interests, goals, challenges and preferences of southern rangeland producers. MLA products that southern producers could be linked to or receive repackaged content: • EDGEnetwork® producer extension courses & workshops – Business Edge or develop southern pastoral zone equivalent products. • Genetics & breeding extension program (SBTS) • Making More from Sheep (MMfS) program. Limitation of feedbase relevance. • More Beef from Pastures Program (MBfP) program. Limitations of feedbase relevance. • Producer demonstration sites (PDS) • Producer research sites (participatory R&D) • Profitable Grazing Systems (PGS) • MeatUp forums	(Not knowing the baseline rate of adoption of MLA products and services by southern producers – the adoption outcomes are based on increases in adoption rates by %) **Producers:** Over 80% of southern rangeland producers in the targeted pilot regions are engaged with relevant MLA products (established and new) by the end of the third year of activity Southern rangeland producers in the targeted pilot regions implementing change on farm increases by > 15-250% by end of 3 year of activity based on MLA product adoption Match or increase the average satisfaction rate (*86.5 %) of pilot producers' level of satisfaction with their engagement with MLA products *86.5 % average satisfaction rate across MLA adoption programs (Producer Adoption Outcomes Report 2020-2021) **Per management unit (head livestock, hectares)** X number of livestock (sheep cattle or goats) included in practice change enabled through MLA products X number of hectares included in practice	Highly engaged producers operating in the southern rangelands with the skills and access to support services to turn complex issues into new revenue. **Positive cost: benefit** Internal rate of return of practice change implemented >10%. **Per management unit (head livestock, hectares)** X number of livestock (sheep, cattle or goats) benefited from practice change enabled through MLA products X number of hectares benefited from practice change programs enabled through MLA products	Main method to collect evidence of outcomes and impacts. 15–20-minute survey interviews with producers during regular farm visits or via telephone in the targeted production areas. 1) Pre-pilot producers indicate a baseline level of satisfaction (or not) with MLA's offerings of programs/products and adoption of current MLA products. Entry surveys also baseline, knowledge, skill, production and profitability relevant to the target practice change area. 2) Post-pilot producers indicate higher levels of satisfaction with MLAs repackaged/tailored offerings of programs/products including evidence of on-farm practice change related to product adoption. Exit surveys also assess, knowledge, skill, production and profitability relevant to the target practice change area. Who - Local agricultural advisers would collect data via farm visits/phone contact to clients who have been selected for pilot at the start and end of pilot.

	• Dieback management & extension program • Customised programs developed to meet the technical and delivery needs of the region.	change programs enabled through MLA products		3) General monitoring of participation rates in MLA programs/use of products – and noting any increases from regions in the southern rangelands Who - MLA Program Managers
Goals	**Outputs (products)**	**Outcomes (adoption)**	**Impacts (benefits)**	**How/Who/ When**
Specific project design goal - Southern rangeland producers accept the personas as a true representation.	Development of producer personas to match, adapt and tailor MLA programs/products with Include any updates from producers, which may include additional questions for follow up interviews/engagement.	Personas are developed in line with the producers' perceptions Personas are rated as a strong or very strong representation of southern rangeland producers.	Development of a trusted, validated producer segmentation resource (producer personas based on behavioural insights) that can be used by MLA staff when operating in the piloted regions.	After reviewing the personas producers rate them on accuracy and value through a survey. Throughout the development process, producers are given the opportunity to review the personas through a feedback loop. Who – Coordinated by Behavioural Scientist with the team of interviewers
Specific project design goal - Advisors working in the southern rangelands accept the personas as a true representation of southern rangeland producers.	Stakeholder mapping is conducted to determine who is involved and influential. Strong representation of advisors working in the southern rangelands is selected to participate in a review and survey/interview.	Advisors are involved in the entire process and more likely to use the personas. Most advisors rate the personas as a strong or very strong representation of southern rangeland producers.	Development of a trusted, validated producer segmentation resource (producer personas based on behavioural insights) that can be used by the wider extension and advisory network when operating in the piloted regions. (with permission from the rangeland producers)	After reviewing the personas advisors rate them on accuracy and value through a survey. Once the pilot producers have accepted the personas as a true representation, advisors are given the opportunity to review them. Who - The local reference groups form the basis for this review.
Specific project design goal - Increase the capacity of local advisers to deliver relevant extension activities to southern rangeland producers	Hold a webinar during the Livestock Advisor Update – present producer personas and behavioural insights, with their potential use - MLA/Behavioural scientist	Livestock advisers willing to use producer personas in the development and delivery of advisory services with their clients	X number of agricultural advisers who operate in the southern rangelands in the pilot regions base their engagement, extension and advisory activities on the producer personas. Those agricultural advisers who use the producer personas rate this producer segmentation resource as highly valuable	1) Have a register of advisers who expressed interest in using the producer persona 'toolkit' 2) Follow up phone calls with advisers who have received the producer persona toolkit and conduct semi-structured interviews to see if and how they are using the toolkit

			for providing insights into improving advisory practice.	Who - MLA Staff involved in the Pilot after producer personas have been developed and validated
Specific project design goal - MLA content is tailored to the needs of southern rangeland producers, based on the personas developed.	Tailor MLA products and services based on personal developed for southern rangeland producers.	Southern rangeland producers relate to the content delivered and there is an increase in uptake of MLA programs	- see above impacts in Overall Goal section	General monitoring of participation rates in MLA programs/use of products – and noting any increases from regions in the southern rangelands - pre-post pilot Who - MLA program managers
Specific project design goal - a bank of engagement strategies is developed	Develop a bank of engagement strategies that align with the personas developed	Southern rangeland advisors have access to engagement strategies that they can use within their roles Advisors are willing to use the tailored engagement strategies to work with producers.	X number of agricultural advisers who operate in the southern rangelands in the pilot regions base their engagement, extension and advisory activities on the producer personas. Those agricultural advisers who use the producer personas rate this producer segmentation resource as highly valuable for providing insights into improving their advisory practice.	Monitor the uptake of use of the strategies. Views and downloads from the MLA website are monitored by MLA program managers. Who - MLA program managers
Specific project design goal - Support southern rangeland advisors to use the developed personas and engagement strategies	Utilise current advisor networks to upskill and support advisors to implement tailored engagement strategies.	Increase in use and engagement of Livestock Advisor Update networks by southern rangeland advisors – programs, webinars, social media, events	Steady increase in the number of agricultural advisers who operate in the southern rangelands in the pilot regions and use the producer personas.	Monitor the engagement of southern rangeland advisors – attendance at events, engagement in forums including social media Livestock Advisor Updates M&E and social media Who - MLA program managers

4.5.3 Activity 2 Implementation Plan: Designing a Collaborative Program to Support Wide Adoption of Pain Relief

This activity trials a program development team approach to mobilise collective effort of scientists, value chain actors, advisers and farmers to increase the acceptability and use of pain relief as routine practices for enhanced animal welfare in the sector, and report progress in the community. The approach focuses on building commitment and agreement to the pathway to change and involving advisers, influencers and change agents to a collective effort to see change. This activity will build the capacity of the red meat sector to work together on an industry agreed extension approach to support adoption. If successful, the approach could be replicated in other programs.

Table 7: Activity 2 Implementation Plan: Designing a Collaborative Program to Support Wide Adoption of Pain Relief

CONTEXT		**PROCESS**		**RESOURCES**	
Name of activity	Designing a collaborative program to support wide adoption of pain relief products and procedures as part of routine sheep and cattle husbandry practices.	Methods	1.Establish a program team to develop the value proposition (social license/market access) and pathways of support to change for producers (including the role of advisers/supply chain). 2.Develop key messages and a delivery strategy 3.Train local advisers/service providers 4.Maintain adviser/service provider networks and track progress	Required role/skills internally for MLA	- Understanding of the technical issues related to pain relief management - Collaborative program design (e.g., mentor from other like programs in agriculture) - Managing stakeholder relationships
Problem definition or topic area	- Potential to improve the use of pain relief in both cattle and sheep industries: - According to a national survey - the majority (95%) of beef producers do not use pain relief for castration / dehorning / tipping / branding etc., - According to a national survey – only two out of five producers (39%) stated that they would be willing to use pain relief for marking of lambs	Preliminary steps	- Collate current industry information on pain relief practices and constraints to change - Stakeholder mapping to form working activity group of advisers/service providers in the pain relief area - Recruit a facilitator to manage the working activity group(s) - Develop relevant resources linked to producer needs e.g., case studies/guides around implementation for pain relief; current practices in pain relief; champions/influential farmers, trusted service providers; demonstration sites, etc. - mobilise advisers and stakeholder - Recognise farmers doing a good job / recognising best practice/going beyond best practice	Required role/skills of the activity deliverer	- Working activity groups of advisers/service providers are the deliverers of developing the key messages and possibly training local advisers/service providers in pain relief information and advice - Collaborative design of change pathway - Good communicator of technical information
Design concept	Design Concept 3: Strengthening the capacity of the advisory sector as a pathway to support practice change.	Who will lead/coordinate	MLA Animal Welfare Manager (national level) Two options for roll-out:	Required prior information	Understanding the current use of pain relief by livestock producers in Australia's red meat sector

			1)Set up one national working activity group with advisers/service providers from each state/territory or set up state-based working activity groups in each state/territory for national coverage 2)Set up state-based working activity groups for piloting (1-2 pilot groups)		Understanding why those who have adopted have and how they have fitted into their system for benefits
Relevance to adoption context	Activity is focused on building collaborative capacity within MLA and advisers/service providers to co-design adoption support initiatives and mobilise and coordinate effort to a common goal.			Costs involved in pilot	- Paid group facilitator for a working activity group(s) - Paid trainers if not using MLA staff/working activity group members - Sitting fees for working group - (Full costing in Appendix 2)
Fit with MLA	The use of pain relief products as part of routine sheep and cattle management/husbandry is currently not a common or widely adopted practice across the red meat industry.	Governance model	- Working activity groups would be facilitated by MLA activity manager/external industry facilitator - Working activity groups would be accountable to an MLA activity manager, MLA activity manager would report to the MLA Animal Welfare Manager	Proposed business model	- Levy paid pilot/part of an industry funded national program - User pays system for pain relief advice that is delivered by the state-based/national advisory teams
Investment case i.e., value proposition/ROI	Better animal productivity outcomes from managing pain during husbandry procedures.	Role of key stakeholders/ Partners	- Advisors/service providers form the core working activity group to review, design, deliver information products. - Agreed resources and tools by industry	Time Frame	Over 5 years to achieve 2027 targets
Objective/ outcome	Pain free red meat production: 1) National target for cattle e.g., 80% of Australia's beef producers routinely use pain relief by 2027 2) National target for sheep e.g., 90% of Australia's sheep producers routinely use pain relief by 2027	Reach to target producers	Initially per state reach, then national reach	Literature resources	- See Appendix 2 for the extended version of activity implementation plans including a list of resources - Key resources: CountDown Downunder, Evaluation design including evaluating the development process
Monitoring, Evaluation and Learning plan/report	- Level of collaboration/mutual goal amongst stakeholders - Information and resources for producers agreed and used by all stakeholders - Pain relief use metrics - Media reporting (+/-) - Market access information - Pricing signals - Base line metrics				

4.5.4 Activity2: Monitoring, Evaluation and Reporting Plan

Table 8: Activity2: Monitoring, Evaluation and Reporting Plan

Goals	Outputs (products)	Outcomes (adoption)	Impacts (benefits)	How/Who/ When
OVERALL ADOPTION GOAL 1- increased use of pain relief products in routine animal husbandry 2 - Manage and improve animal welfare outcomes in the red meat sector (use of pain relief for routine husbandry) **KEY ASSUMPTIONS:** These goals are applied at a national level and will be further determined by farm system, sector and region. $3,012,500 investment over 5 years	National targets set and accepted/supported by industry E.g. for cattle 80% of Australia's beef producers routinely use pain relief by 2027 and for sheep 90% of Australia's sheep producers routinely use pain relief by 2027 MLA products that could be linked to or have repackaged content: · Making More from Sheep (MMfS) program · More Beef from Pastures Program (MBfP) program · Producer demonstration sites (PDS) · Producer research sites (participatory R&D) · Profitable Grazing Systems (PGS) · Its Ewe Time forums · MeatUp forums · Livestock Advisor training and capacity building activities and programs BESTWOOL/BESTLAMB & BETTERBEEF extension program including facilitator training	(Not knowing the baseline rate of adoption of pain relief (latest figures are 2018) – the projected/ex post outcomes are based on estimated increases in adoption rates by %) Example estimates: **Producers:** Over 80% of all red meat producers are engaged in sustained practice change by the end of the third year of activity Match or increase the average satisfaction rate (*86.5 %) of pilot producers' level of satisfaction with their engagement with MLA products *86.5 % average satisfaction rate across MLA adoption programs (Producer Adoption Outcomes Report 2020-2021) **Per head (livestock)** X number of livestock (sheep cattle or goats) included in practice change enabled through MLA products	Highly engaged producers within advisory networks with the skills and access to services to turn contemporary welfare and ethics challenges into revenue opportunities through practice change. Highly engaged advisory networks with the skills and knowledge to support producers at a sector, regional and national level and regarded as experts in the field. International perception of Australian production for ethics and welfare increased. **ROI** **Option A) Market access** Export markets and opportunities maintained/increased market access estimate e.g., a market denial impacting 1% of the wool industry = $31Million, where the wool export value is $3Bn) **Option B) Identification of Production and Profit impacts** Any productivity and associated profitability outcomes of practice change attributed to adoption of pain relief practices identified. **Option C) Per head (livestock)** X number of livestock (sheep, cattle or goats) benefited from	MLA program managers at project inception, periodically throughout project (seasonally and annually based on production systems/sector and regions) Main method to collect evidence of outcomes and impacts. Collect current and then periodic/seasonal sales metrics/figures for pain relief products at a sector and regional level as possible Survey producers for qualitative and quantitative insights (what products, for how long, what procedures, drivers, economics etc.) 15–20-minute survey interviews with advisors during networking and meetings/events or via telephone. General monitoring of participation rates in MLA programs/use of products – and noting any increases from regions/sectors etc Pre and Post program surveys of producer participants to assess changes in knowledge, skills and practices regarding pain relief. Annual productivity measures implemented at project inception to track impact production levels. Desktop analysis of market access opportunities and potential premium/discount associated with animal welfare and pain mitigation practices.

			practice change enabled through MLA products	
Goals	**Outputs (products)**	**Outcomes (adoption)**	**Impacts (benefits)**	**How/Who/ When**
<u>Specific project design goals</u> Establish working activity group(s) of advisers/service providers Establish a program team to develop the value proposition (social license/market access) and pathways of support to change for producers (including the role of advisers/supply chain).	Stakeholder assessment, mapping and scoping of existing and potential service providers and existing and potential networks Collate current industry information on pain relief practices and constraints to change and have set of prioritized criteria for use against species, husbandry practice, production system, sector and region (Best Practice)	High level of understanding of needs and engagement with service providers at sector and regional levels Representative group of experts formed and are engaged	Engaged service provider network Industry wide engagement supporting engaged audience for MLA suite of products offering opportunity to increase program participation Agreement on the technical extension materials for communications - positions MLA as an industry leader in the field	Matrix developed for representation of SRG/stakeholders Stakeholder engagement and consultation/feedback Meets requirements for project timeframes Who - MLA/project lead and members program team and reference group
<u>Specific project design goals</u> - Develop route to change Develop of key messages and a delivery strategy Develop relevant resources linked to producer needs e.g., case studies/guides around implementation for pain relief; current practices in pain relief; champions/influential farmers, trusted service providers, demonstration sites, etc	Agreed industry metrics and targets on pain relief - sets industry benchmark Agreed delivery strategy Communications strategy including for media/broader industry engagement	Advisors are involved in the entire process and are engaged Advisors agree on metrics and benchmarks proposed for Australian Red Meat industry Impactful communication strategy delivering key messages leads to consistent industry approach	Messages widely taken up by media and industry and consistent messaging generated is being used	Identify key media outlets and industry bodies and seek feedback Offers incentive and is supported by and consistent with other industry programs (Sheep Sustainability/welfare Frameworks etc) Use program team and relevant expertise
<u>Specific project design goal</u> Provide appropriate support, mentoring, training and technical updates on R&D to service provider. Includes training	Series of training events and activities including via existing programs and products (see above)	Advisors are involved in the entire process and are engaged and aligned/in agreement on benchmarks and communications required to achieve program level goals	X% Increase in engagement by advisors with existing MLA programs including producer referral of Y%	Survey feedback from participants including for value proposition of being involved in the program/network Metrics/Number of participants attending

beyond technical capacity e.g., facilitation, communication, change management				MLA/project lead Periodically throughout project
Specific project design goal MLA maintains a network of highly engaged service providers who are engaged with red meat producers across all regions and sectors/farm systems	Established advisor network in Red Meat sector with high level of industry relevance and participants are representative of service providers identified in program goals	MLA has the means and support for sustained activity in an advisor/service provider network (updates/discussion/peer support opportunities etc)	Increase in use and engagement of Livestock Advisor Update networks by advisors – programs, webinars, social media, events Changes in knowledge, motivation, skills and attitude as a result of being art of the program and network	Numbers of participants in sustained engagement over X timeframe (time frame of project or beyond) Numbers of new participants over time Metrics/Number of participants engage with broader program and messaging/extension activities beyond training program Survey and interviews with participants
Specific project design goal - a bank of engagement strategies is developed	A bank of engagement strategies that align with the stakeholder assessment and producer needs analysis	advisors have access to engagement strategies that they can use within their roles Advisors are willing to use the tailored engagement strategies to work with producers.		Monitor the uptake of use of the strategies. Views and downloads from the MLA website are monitored by MLA program managers. Who - MLA program managers
Specific project design goal - Deliver innovative approaches with farmers/partly through regular service contacts of service providers e.g., vets/others	A suite of delivery strategies that align with the stakeholder assessment and producer needs analysis and are/can be integrated into existing MLA program frameworks e.g., PDS, PGS	Increased uptake of MLA programs supporting producer needs in this key area. High level engagement between producers and advisors including via MLA programs	Farm level RoI can be estimated via outcomes in programs (PDS PGS) RoI in increased uptake of e.g., PDS and PGs due to advisor engagement and content developed and integrated in this program. E.g. X% increase in participation in key programs	Monitor the engagement of producers and advisors – attendance at events, engagement in forums including social media Livestock Advisor Updates M&E and social media Who - MLA program managers

4.5.5 Activity 3 Implementation Plan: Pilot of a Living Lab Approach for Enhancing the R&D Regional Consultation Process

This activity trials a 'living lab' approach whereby groups of farmers, scientists, advisers and other stakeholders are supported by a facilitator in an iterative process to clearly identify problems and co-design the solutions for investment. The living lab approach is designed to provide a closer fit between priority setting and the on-ground projects to address the priorities by involving stakeholders more closely in the solutions-design stage. This activity will build the capacity of the red meat sector to design projects which more strongly reflect user needs.

Table 9: Activity 3 Implementation Plan: Pilot of a Living Lab Approach for Enhancing the R&D Regional Consultation Process

CONTEXT		**PROCESS**		**RESOURCES**	
Name of activity	Pilot a Living Labs approach for enhancing the R&D regional consultation by working towards solutions for regional priorities	Methods	1.Stakeholder mapping - Identification of Living Lab participants 2.Semi-structured interviews - to understand each stakeholder's ideas on the challenges/need for Living Lab 3.Series of facilitated workshop(s) - to unpack the challenge, co-define the problem and co-develop possible solutions with Living Lab members	Required role/skills internally for MLA	- MLA manager(s) will need to be familiar with the Living Lab concept and process - Recommend undertaking the short course - Establish and build relationship with AgriLink as a mentor
Problem definition or topic area	Regional Committees may often find it difficult to identify complex problems relevant to their region and work to work towards viable solutions	Preliminary steps	- Select regional consultation groups (2) interested in piloting a living labs process - Background training on living labs could perhaps have a northern and southern Living Lab although might struggle to get 15 members for a living lab in the north - Utilisation of assessment tool to work out if a Living Lab approach is appropriate to the MLA context/regional consultation process - Hermann or AgriLInk project member to be a mentor (with professional fees as part of the costing of this activity)	Required role/skills of the activity deliverer	- Two key roles: Living Lab facilitator and monitor and would need to undergo the Living Lab online course (10 hours) to understand the concept and process - Facilitation is needed to turn priorities into doable project ideas – there is where the LL could add value
Design concept	Design Concept 2: Producer peer-to-peer learning and leadership in program design – based on Living Lab application in AgriLink program	Who will lead/coordinate	MLA Program Manager – (Consultation) to coordinate and administer 2 Living Labs in different production regions	Required prior information	R&D priority areas that are considered challenging and have not received much traction

Relevance to adoption context	- Red meat sector needs to keeping building knowledge and adaptive practices in response to complex challenges such as climate change, transitions to digital agriculture. - It is important to ensure the R&D initiatives are developed with a clear line of sight from the priority setting process. - This activity aims to pilot a modified regional consultation process involving researchers, producers and advisers to multiply the value from priority setting to direct effort to solutions more quickly and in a more targeted way. Greater return on investment for producers and others in investing time of people in regional committee		Living Lab Initiator(s) - could be the NABRC, SALRC and WAMRC Regional Committee chairs?	Costs involved in pilot	- Living Lab members - sitting fees - Paid facilitator/monitor roles if not using MLA staff - Integrate Living Labs as part of MLA's regional consultation process paid for by RDC co-investment (Full costings in Appendix 2)
Fit with MLA	Desire to close the gap between producer-driven R&D priority setting and the adoption of new practices that have been developed through MLA's R&D projects	Governance model	Living Labs are likely to be accountable to NABRC, SALRC and WALRC and MLA Manager (Consultation)	Proposed business model	No additional costs to running the RACs once MLA staff/RACs trained in the process then do further additional investment over and above normal RACs running costs for Living Lab Facilitator/Monitor
Investment case i.e., value proposition/ROI	- Better functioning regional committees and more impact from the consultation process with improved connection between R&D priority setting, outcomes to market and quicker adoption - Could tap into other models as an output from the Living Lab process e.g., co-innovation/Drought Hub	Role of key stakeholders/ Partners	- The LL facilitator is a key role who runs the Living Lab activities (operational level) - Living Lab members would include the regional committee members and any additional stakeholders	Time Frame	- 1-1.5 years for setting up, defining problem and scoping possible solutions - 1-1.5 years to implement possible solutions (another separate activity for on ground delivery?) - AgriLink examples – which also included testing protypes/solutions in the field – however, we are proposing that this activity is focused mostly on everything up to testing the solutions in the field
Objective/ outcome	To apply a Living Labs process to MLA's current regional consultation for progressing solutions to complex industry challenges while building industry capacity for co-innovation	Reach to target producers	Engaging producers who are already active regional committee members for R&D priority setting and extending their capabilities and capacity in translating R&D priorities into designing high impact projects with researchers.	Literature resources	See Appendix 2 for the extended version of activity implementation plans including a list of resources
Monitoring, Evaluation and Learning plan	- Does it short track the time it takes to get projects through NABRC, SALRC and WAMRC - Align with Fewer, Bigger, Bolder approach to R&D - Need to be clear what the value is for using levies to fund this –is it a better process does it get to problems/solutions quicker or provide more targeted and strategic ideas?				

4.5.6 Activity 3: Monitoring, Evaluation and Reporting Plan

Table 10: Activity 3: Monitoring, Evaluation and Reporting Plan

Goals	Outputs (products)	Outcomes (adoption)	Impacts (benefits)	How/Who/ When
OVERALL ADOPTION GOAL Overall goals: To apply a Living Labs process to MLA's current regional consultation for: • progressing solutions to complex industry challenges • closing the gap for producers between R&D priority setting and MLA products for adoption • increasing industry capacity for co-design/innovation **KEY ASSUMPTIONS:** Establish to Living Labs by selecting 2 regional committees with the following characteristics: • have diverse stakeholders within the committee • have clear objectives about what they want to achieve as a group • have strong leadership and good facilitation • have a complex challenge that is suitable for a Living Lab MER is just for the project design part of the activity, not the delivery $599,000 investment over 3 years	Living Labs produce a set of designed project proposals that offer solutions or possible options to trial to address R&D priority areas that are considered challenging and have not received much traction. Living Lab project proposals and designs are successful in receiving MLA funding for implementation Relevant designed project proposals could be used to progress or add value to current MLA products on offer, particularly: • Producer demonstration sites (PDS) • Profitable Grazing Systems (PGS) • Producer research sites (participatory R&D)	(Not knowing the baseline rate of adoption of MLA products and services by MLA levy paying producers – the adoption outcomes are based on increases in adoption rates by %) **Producer Adoption Reference Group** PARG endorses the Living Lab project proposals and designs **Producers:** Adoption rate of Living Lab project solutions via the enhanced RAC process is accelerated by 1—2 years compared to average adoption rate of MLA products. X number of producers operating in the regions with an established Living Lab are involved in trialling/engaging with the solutions/options proposed in the Living Lab projects Producers involved in trialling/engaging with the Living Lab project indicate the level of satisfaction with MLA products match or increase the average satisfaction rate (*86.5 %) *86.5 % average satisfaction rate across MLA adoption programs (Producer Adoption Outcomes Report 2020-2021) **Management unit (livestock, hectares)**	Better functioning regional committees and more impact from the consultation process with improved connection between R&D priority setting and getting outcomes to market/adopted quicker or by more producers/stakeholders **ROI** **$/ha net benefit based on PDS figure as a guide** Extra producers involved in trialling solutions/options based on Living Lab projects that would not have been possible without the initiative (so x* the value assumed of these products) Long term practice change –Producers participating in the PDS program can expect an additional net benefit of *$6/ha annually as a result of their participation in the program. (Producer Adoption Outcomes Report 2020-2021) **Management Unit (livestock, hectares)** X number of livestock benefited from practice change enabled through Living Lab projects	Main method to collect evidence of outcomes and impacts. Living Lab Monitor to document who is involved in trialling/engaging with Living Lab projects based on a developed Engagement Excel Spread Sheet that is used to record producers involved in any trials/project workshops/events used to communicate the Living Lab projects Short phone/face to face interviews with producers who are involved in trialling/implementing the solutions/options proposed in the Living Labs projects capturing information about any practice changes that may have occurred, and intention to promote the Living Lab projects to other producers. Who - Living Lab Monitor under the management of the MLA Manager (Consultation)

		X number of livestock (sheep, cattle, goats) included in practice change enabled through Living Lab projects X number of hectares included in practice change programs enabled through Living Lab projects	X number of hectares benefited from practice change programs enabled through Living Lab projects	
Goals	**Outputs (products)**	**Outcomes (adoption)**	**Impacts (benefits)**	**How/Who/ When**
Specific project design goal – to track the progress of the Living Lab process and capture the value of being involved by the Living Lab participants	Living Lab documentation, the process/outputs from stakeholder mapping, stakeholder interviews and workshops Evaluation reports that capture the individual level and group level experiences/expectations/value from participating in the Living Lab process Living Lab milestone reports	Based on each Living Lab monitoring and evaluation findings, the value of the Living Lab concept is demonstrated to enhance the national and regionally relevant research, development and adoption priority setting process by delivering optimum value back to grass-fed beef and sheep meat businesses and the red meat industry. The Living Lab concept/process is rolled-out across the MLA regional consultation process and become embedded in the Consultation Framework.	- see economic Impacts above Living Lab participants skilled in co-designing strategic project proposals Producers and researchers develop stronger links and professional networks	• Document workshop ideas, activities and outputs • Use pre-during-post interviews or survey to evaluate Living Lab participant's expectations, experiences, and perceptions of the value of the process • Evaluation can be at the individual level (per Living Lab member – interview or questionnaire) as well as at the group level (whole Living Lab – focus group) Who - Living Lab Monitor
Specific project design goal – Living Lab Facilitators/Monitors are well supported to conduct their specialise roles	Living Lab Facilitators/Monitors are provided with training and offered peer mentoring	Living Lab Facilitators/Monitors skilled in leading, guiding and monitoring the Living Lab process	Living Lab Facilitators/Monitors have the capability and capacity to facilitate producers and researchers in turning priorities into doable project ideas	• Online training • AgriLInk mentor • Peer support group process
Specific project design goal – to receive the endorsement from the Producer Adoption Reference Group on the Living Lab project proposals/designs that will be considered for delivery/implementation	Living Labs generates a set of designed project proposals for MLA funding	Producer Adoption Reference Group endorses some/all of the Living Lab designed project proposals.	PARG endorsed Living Lab projects may be better received by the producers in the pilot regions.	• Consultation with PARG at meeting Who - MLA Manager Consultation
Specific project design goal – to gauge the success of the Living Lab activity as a whole including Living Lab facilitator, monitor, members, MLA staff and	Independent evaluation report to demonstrate the success/challenges/limitations with the Living Lab pilot	Independent evaluation provides recommendations on how to improve the process for roll-out across MLA's regional consultation process	A well proven process to enhance MLA's regional consultation process in R&D priority setting to deliver high value	• Phone/Zoom interviews • Develop a case study of each Living Lab

producers who may be involved in the delivery/implementation phase of the Living Lab			projects that may be integrated into MLA products for adoption.	• Hold a forum with both Living Labs to showcase successes, challenges etc. Who – independent evaluator

4.5.7 Activity 4 Implementation Plan: Producer-Driven Farmer Action Groups with Strategic Partnerships

This activity trials an open, producer-led approach to supporting change whereby producer groups are supported to form based on a common interest or challenge and are facilitated in change through connection to the knowledge, expertise, tools and coaching to effect change, alongside peer support. Closely modelled on the Red Meat Profit Partnership (RMPP) and the Extension 350 model in New Zealand, the approach links producer-led interests with regional and/or value chain stakeholder investment to provide strategic and collective support to change. Whether a triple-bottom line interest in productivity, environment and well-being or more value and less waste from carcasses, this trial builds on the MLA PGS model to attract co-investment and a broader range of topics. The farmer action group approach is designed to increase engagement and support change in a wider diversity of producers than might be engaged in the current service offerings of MLA. The activity will provide farmers with the resources to effect change in their farm business as well as build the capacity of advisers to facilitate change and build the capacity of stakeholders to collaborate to support change at a local/regional level.

Table 11: Activity 4 Implementation Plan: Producer-Driven Farmer Action Groups with Strategic Partnerships

CONTEXT		**PROCESS**		**RESOURCES**	
Name of activity	Producer-driven farmer action groups with strategic partnerships	Methods Preliminary steps	1. Establish the strategic partnerships 2. Establish Producer Action Groups 3.Hold Producer Action Group meetings/learning activities/action plans 4.Trial new ideas on farm that have come from learning activities 5. Compulsory KPI benchmarking of action taken on individual action plans	Required role/skills internally for MLA	- Good understanding of how the RMPP program worked - Administering strategic partnerships through co-investments
Problem definition or topic area	There is an opportunity to improve producer performance in meeting the market specifications/carcase compliance by working closer with the processing sector/value chain stakeholders. - Enhancing the PGS model/approach by building in the RMPP model and other concepts from the review and work within current initiatives e.g. JBS, WAMMCO, GMP, already looking at MDC projects linked to producers Options: - Extension 350 approach: focus on TBL - list 10 different topic areas that a produce action group could tackle – and they need to select 1-3 topics to pursue as a way of putting some context/boundary to the topic area – rather than a blank page			Required role/skills of the activity deliverer	- Group facilitators – need to be highly skilled in running group processes for peer learning, managing group dynamics, and working with strategic partners - Be prepared to undergo some training

	- Livestock Data Link has been updated/reincarnated so would need to refer to latest version - Reducing waste in the supply chain is becoming a focus – Fight Food Waste CRC – might be interested in being involved/investor				
Design concept	- Design Concept 2: Producer peer-to-peer learning and leadership in program design - farmer action groups based on RMPP/Extension 350 - Design Concept 3: Strengthening the capacity of the advisory sector as a pathway to support practice change	Who will lead/coordinate	- Small Steering Group to include MLA Adoption Manager/staff and partner processors/value chain actors - Each Producer Action Group is facilitated by a Group Leader	Required prior information	- Any industry reporting that indicates the level of producer performance for meeting market specifications - Knowledge of potential group facilitators through current MLA advisory/service provider networks - Knowledge of processing companies willing to invest in activity
Relevance to adoption context/Fit with MLA Fit with MLA	- MLA Strategic Plan 2025 - developing new, high value products that allow us to maximise the whole carcase. - Currently 20% of the carcase delivers 80% of the value and we need to shift this balance, including by transforming what is currently considered waste attracting little or no value into high value products.			Costs involved in pilot	(Full costing in Appendix 2)
		Governance model	- Formation of Pilot Steering Group - MLA Adoption Manager to manage the 2 projects/report to Steering Group - Facilitators of producer action groups to report to MLA Project Manager	Proposed business model	MDC model – co-investment with strategic partner (processing companies/food distributors and/or retailers)
Investment case i.e., value proposition/ROI	- MLA Strategic Plan 2025 – helps to achieve the goal of engaging producers in project design to help ensure that investments have a pathway to adoption identified from inception as well as taking a supply chain approach to practice change. - RMPP ROI - $18.70 for every $1 invested	Role of key stakeholders/ Partners	- Processor companies as investment partners and also potentially Subject Matter Experts or connectors - Group leader – facilitate and report on producer action group plans and progress - Producers to lead their peer action group - Could consider involving livestock buyers/stock agents in the activity as connectors to the processing sector or supporting on-farm change as an 'adviser'	Time Frame	3 years
Objective/ outcome	Meeting market specifications" - producers working with processors/stakeholders working to improve access to R&D outputs to for meeting market specifications and improve supply chain performance	Reach to target producers	Establish 2-3 producer action groups in (sheep and/or beef) in local areas where the target processors operate	Literature resources	See Appendix 2 for a list of resources
Monitoring, evaluation and learning	- Productivity improvement - Data use - Market value				

4.5.8 Activity 4: Monitoring, Evaluation and Reporting Plan

Table 12: Activity 4: Monitoring, Evaluation and Reporting Plan

Goals	Outputs (products)	Outcomes (adoption)	Impacts (benefits)	How/Who/ When
OVERALL ADOPTION GOAL: Meeting market specifications - producers working with processors/stakeholders to improve access to R&D outputs for meeting market specifications and improving supply chain performance. **KEY ASSUMPTIONS:** 2x supply chains and then 2-3 Producer Action Groups for each supply chain, depending on the size of supply chain. The Producer Action Groups life span is 2 years (not the whole activity time) $590,000 investment over 3 years (This includes $100,000 in-kind contributions)	Producer Action Groups are driving the agenda of this activity. Farmer action groups will work with key supply chain stakeholders including partnering with a meat processor on various topic areas of their choice that are related to improving supply chain performance. MLA products that Producer Action Group could be linked to are MLA R&D reports from investment in supply chain sustainability, innovation, profitability, traceability etc. For example: • Driving Value through Supply Chain Innovation • Beef Supply chain for the 21st Century in Australia • Supply Chain sustainability R&D projects Producer Action Groups could also be linked to the suite of MLA products that are listed in previous activities – however, the main context is working more strategically with supply chain actors for better performance across the supply chain.	(Not knowing the baseline rate of adoption of MLA products and services by southern producers – the adoption outcomes are based on increases in adoption rates by %) **Producers:** 90% or more of producers in each Producer Action Group have implemented their Farm Action Plans **Per production unit (livestock, hectares)** X number of livestock included in practice change enabled through Producer Action Groups X number of hectares included in practice change programs enabled through Producer Action Groups	Producer action groups (PAGs) established, resulting in increased delivery of product to market specifications and receiving subsequent premiums or avoided discounts. **To note: RMPP ROI** $18.70 for every $1 invested **ROI Option A) Positive cost:benefit** Break even example: if 30 producers involved in the pilot of PAG, then need to see benefit of at least $17K/farm (not including other benefits in the chain, etc.) which is $8.5/sheep (if av. 2000 head of sheep per farm) or $42.50/cow (if av. 400 head beef farm) (or calculate on an av. hectare basis) **ROI Option B) calculating the extra benefit from PAG vs. business as usual** e.g., compare the cost of this activity 4 and subtract the normal cost of a PDS or PGS group and then that is the extra benefit needed from the PAG approach vs the PDS/PGS approach. **Per production unit (livestock)** X number of livestock benefited from practice change enabled through PAGs	Main method to collect evidence of outcomes and impacts. MLA to conduct interviews/surveys with participants at the start of the project and again at the end. This ensures evaluation is done by an independent person not group leaders, and also save costs from using an external evaluator. Who - MLA Program Managers Development of a case study of each Producer Action Group involved in the pilot. Who - Group Leader to coordinate this Pre and Post program surveys of producer participants to assess changes in knowledge, skills and practices regarding meeting market specifications. Product compliance reported by processors at project initiation and completion to identify change from project participants. To be quantified as a rate and economic terms.

			X number of (ha) benefited from practice change programs enabled through PAGS	
Specific project design goal to increase the amount of red meat hitting higher quality targets and therefore increasing the value of product along the supply chain.	Establishment of producer action groups with strong processor/supply chain engagement. As part of group inception PAGs select group leaders and identify goals/focus areas (and topics). Groups hold workshops or other activities to explore topics and increase skills and knowledge skills to achieve group goals.	Status of communication, relationships amongst supply chain stakeholders (project participants) improves over life of project. There is an improvement in at least one of the following variables at the end of the project: profitability, reliability of supply and/or quality of product. There is a measurable improvement in the knowledge, skills and confidence of project participants	Supply chain working collaboratively towards the same goal Improved profitability, reliability of supply and/or quality of product. Method Pre-project vs post-project survey/interview with all participants.	MLA to conduct interviews/surveys with participants at the start of the project and again at the end. This ensures evaluation is done by an independent person not group leaders.
Specific project design goal to incentivise the completion and implementation of Farm Action Plans	Completed Farm Action Plans that reflect the new knowledge, skills, services, information acquired through the inquiries made in the Producer Action Group with supply chain partners	Implementation of the Farm Action Plans that bring about new or improved practices on farm that lead to productivity and profitability benefits.	Streamlined approaches for producers and supply chain partners to work together for mutual benefit.	Group Leaders to ensure Farm Action Plans are completed and implemented MLA Project Manager to review completed Farm Action Plans as a benchmarking requirement for release of next round of funds to support the Producer Action Groups.
Specific project design goal: to improve communications and collaboration along the red meat supply chain .	• Group leaders are trained to facilitate and lead groups. • Group activities are well attended by both producers and supply chain reps.	• Status of communication, relationships amongst supply chain stakeholders (project participants) improves over life of project. • Strong, committed engagement by all participants (producer and processor) during life of project.	Improved supply chain relationships Improved profitability, reliability of supply and/or quality of product Method • Attendance records/engagement throughout project. • Pre-project vs post-project survey/interview with all participants.	• Group leaders to keep detailed attendance records for all group activities. • MLA to conduct interviews/surveys with participants at the start of the project and again at the end. This ensures evaluation is done by an independent person not group leaders.
Specific project design goal: to increase the capacity within the red meat industry to support producers and the supply chain to improve what they're doing	• Group leaders are trained to facilitate and lead groups. • Ongoing support and training/networking for group leaders	• Group leaders improve their leadership and communication skills. • Group leaders are effective in their roles at coordinating and supporting groups to achieve goals	Increased capacity for leadership and facilitation within supply chains Method • Pre-project vs post-project survey/interview with group leaders. • Post project survey with participants.	• MLA to conduct interviews/surveys with group leaders at the start of the project and again at the end. • MLA to conduct interviews/surveys with participants at the end of the project

5. Conclusion

The operating environment of red meat producers is constantly evolving, and new and more complex challenges are emerging in adapting to climate change and achieving sustainable food systems. Through this project, we have identified 4 ways in which value could be added to MLA's current adoption approaches, products and services as strategies to engage and support red meat producers in responding to these challenges.

The rapid appraisal of 245 published articles from the agricultural, business, educational, environmental, health and natural resource management sectors showcased a diversity of concepts used in designing, influencing and facilitating desired behavioural and practice change in various contexts. The literature highlighted the important elements to consider when designing adoption and change activities:

- understanding target audiences and linking extension and engagement
- participatory approaches, co-design, and co-innovation
- catering to different learning styles
- engaging Indigenous stakeholders and Indigenous knowledge
- e-extension, ICT, and hybrid delivery modes
- Formative and participatory monitoring and evaluation

While 'new to the world' innovative approaches were not obvious in the literature, innovative approaches that are new to agriculture or involving new combinations of known approaches in agriculture were revealed in both the literature and key informant interviews. For instance, in the agricultural sector, approaches to support change which emphasised the importance of values in farming and applying behavioural psychology principles to the design and implementation of interventions to meet the needs of different farmer typologies, or personas, were found. These reflected interpersonal approaches and aligning interventions with cultural and institutional norms. From the natural resource management and environmental change field –the use of community games to simulate the consequences of farm decisions in groundwater management and engage producers in determining options for their farm was found.

Across the different sectors reviewed, the importance of building trust amongst end-users in the process of change and empowering end-users to actively participate in the design and delivery of change programs were common themes.

The interviews with 22 program informants from Oceania, Europe, South America, and Africa emphasized the importance of:

- understanding your audience where one size does not fit all,
- supporting producers on their own journey as a dynamic experience in learning and adoption
- upskilling advisors to teach and facilitate change effectively
- creating relationships and partnerships across the supply chain to support change

5.1 Key findings and insights

Four new adoption activities with detailed implementation and monitoring and evaluation plans have been developed for MLA to review and trial.

Four activities that have been proposed for implementation:

1. Engaging with southern rangeland producers
2. designing a collaborative program to support wide adoption of pain relief in animal management
3. applying a 'Living Labs' approach in R&D regional consultation processes
4. supporting producer driven 'Farmer Action Groups' as part of strategic partnerships

In addition to the proposed pilot activities, there are opportunities to refine or modify current MLA extension programs, using the lesson learned from the literature review and interviews. Following a series of online interactions between the Stakeholder Reference Group and the key informants and practitioners involved in these programs, several tenets emerged for the design of effective programs and activities for behavioural and practice change:

- Undertake a comprehensive stakeholder analysis and engagement to ensure the 'right people are in the room' when planning and deciding on the target audience and supporters of the pathways to change
- Involve skilled facilitators to support ongoing experiences in learning and adoption of producers
- provide opportunities for peer to peer learning within producer groups
- build and maintain social networks across supply chains and professions for knowledge generation and exchange
- allow flexibility within the program/activity so it can adapt to changing conditions which might mean a change in topic area, process or timing of activities
- appropriately resource the change process (financial, people and time)

5.2 Benefits to industry

All four activities involve a reconfiguration of the RD & E process to target farmers and include advisers in the scope and design of research outputs and the type of extension approaches. Each activity recasts the role of regional groups or committees to extend beyond priority setting to design of the route or pathway to change. Each activity focuses on understanding and then addressing diversity through co-design and tailoring of products and services.

Overall, the likely benefits from implementation of these activities are:

- increased engagement of producers and increased adoption, thereby creating more value from the investment to support change.
- greater engagement of advisory networks in MLA adoption programs and increased capability of existing and new advisors - this includes expanding the engagement and role of value chain actors in extension programs

- an increase in demand for new and existing products targeted to meet producer and industry needs - this will increase the uptake of outputs from existing R&D projects and focus the development of outputs from new or ongoing R&D investments
- greater application of the MLA segmentation report to tailor and target adoption support to producers

6. Recommendations and further research

6.1 Recommendations

6.1.1 Implementation of proposed adoption activities as pilot projects

It is important to plan and establish a strategic and operational governance model to progress the implementation of the four proposed activities. It is recommended that:

- MLA form an implementation team to initiate the activities, including representatives from the SRG
- MLA socialise the findings of the review and engage key stakeholders and investors in considering involvement/co-investment in implementation
- The PARG to oversee the operation of the activities as an advisory group
- MLA to consider input and advice from the key informants from the programs reviewed in implementing the activities (e.g. as part of the advisory group).

6.1.2 Integration of proposed adoption activities as an extension of current programs

The Global Adoption Review has captured numerous ideas of interest that could be integrated into existing initiatives without having to be stand alone or new projects/initiatives. Some of these recommendations have been conceived to generate 'small wins' to demonstrate value early during the process of initiating change.

These include:

- **Producer ownership:** Consider mechanisms for increasing producer ownership of extension and adoption efforts (e.g. extending farmer reach in the R&D priority setting process to include research project design, allowing more flexibility for producers to select the program components of PDS activities, greater resourcing of formal peer to peer mentoring (producer-to-producer) through current programs such as Profitable Grazing Systems and Producer Demonstration Sites.
- **Supporting adoption practitioners (advisers/service providers):** Increase efforts to train and upskill practitioners in group facilitation, and in applying behavioural change concepts and tools. Consider supporting more direct interactions between advisers and service providers with field research sites as well as with producer education programs linked to emerging research to strengthen the red meat industry's knowledge networks. Consider building a community of practice for facilitating change in the red meat sector involving private, public and not for profit advisory/service providers. Consider linking adoption practitioners to

expertise and mentors within and outside the agricultural sector. This could be included in programs such as PGS, EDGE and PDS.

- **Triple Bottom Line:** Greater consideration of the economic, social and environmental elements in program goal-setting to achieve whole-farm benefits for producers. This could include collaborating with regional initiatives such as the Future Drought Fund (FDF) through their regional nodes to integrate MLA's focus on carbon farming/drought resilience. Develop messaging and value proposition to appeal to a range of values (social, cultural, environmental etc.) not only productivity and profitability. This concept could be integrated to any of MLA's existing extension and adoption programs.
- **Local action networks:** Use of 'Farmer Action group' principles in designing local activities for producers to achieve their own goals and respond to challenges prioritized by the producers themselves. This could be applied to engagement with stakeholders such as agtech developers, finance providers, natural resource managers, veterinarians, food retailers, etc in a flexible process of learning and implementation.
- **Informed delivery:** Incorporation of behavioural insights into all MLA programs by establishing methods for collecting appropriate social data to inform the development, packaging and delivery of adoption products and services. The key application of behavioural insights is to tailor adoption products based on a clear understanding of producer values and motivations for change, as opposed to delivering existing knowledge according to the producer's learning style. Understanding the range of needs and capabilities of a producer population at a regional level provides different entry points for producer engagement to cater to different interests and capacities.

6.2 Further research

This project has identified several topic areas for further research that would provide MLA with the opportunity to diversify and enhance their adoption products and services.

6.2.1 Engagement with Aboriginal and Torres Strait Islander producers and Indigenous Australian knowledge systems

The Stakeholder Reference Group highlighted the importance for the red meat industry to engage with Aboriginal and Torres Strait Islander producers and Indigenous Australian knowledge systems to learn new land management practices relevant to agricultural production and to acknowledge the diversity of producers in Australia's production regions.

Consider developing a research context for engagement with Aboriginal and Torres Strait Islander producers potentially using a Living Labs approach to co-design a learning and implementation agenda. This agenda could include, for instance, an emphasis on the revegetation of agricultural landscapes, water management based on local water cycles and fire management. This approach recognises high value programs that have previously involved collaborations between Aboriginal and Torres Strait Islander communities and the natural resource management sector for social-ecological outcomes.

6.2.2 Hybrid delivery models of adoption programs and products

There is scope to better understand what the best way is to combine multiple delivery modes such as digital/face to face, group/individual, participatory/theoretical) to serve multiple purposes, for instance awareness raising; training; producer-led adoption, for greater engagement and impact. It is not clear from this global review how to link different delivery modes for specific outcomes, and if combining multiple delivery modes may assist in amplifying learning, consolidating knowledge and socialising applications for on-farm adoption (practice change).

Consider investing in empirical research with adoption practitioners to understand how to incorporate different modes of adoption program delivery with what effect on producer engagement, and adoption decision making.

6.2.3 Investigation into monitoring and evaluation of different approaches for building evidence of effective program design

More studies are needed with a focus on what monitoring and evaluation (M&E) has been done across various adoption programs and products to identify useful and innovative monitoring and evaluation approaches. This work would aim to make M&E more engaging and mutually valuable for the participant, deliverer and funding partner, as currently all three stakeholders find it a challenge to do well.

Consider a comprehensive study of the range of M&E approaches and methods for measuring the success (or not) of adoption programs, the quality of the evidence these approaches generate, as well as the findings about what change and adoption occurred, at what scale and for whom. Other aspects to include should be the range of M&E practices that are applied pre-during-post the adoption process (formative, summative and participatory methods), as well as using contextual analysis for comparison of adoption performance between different locations.

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8. Appendix

8.1 Appendix 1. Rapid appraisal of the literature and interviews with adoption program informants (Australian and international)

The search parameters for the rapid appraisal off the peer-reviewed academic literature, and the interview questions for consultations with Australian and international practitioner networks, were developed based on the project's key research questions and following advice obtained in the Stakeholder Reference Group meeting in October 2021. Search terms and interview questions were finalised using a feedback process involving the Stakeholder Reference Group and the Project Team.

Research questions

The main research questions were:

How well are producers engaged with extension providers?

3. What are the approaches used by extension providers to engage with different groups of producers/end-users?
    a. How are information dissemination channels decided?
    b. How are messages selected, targeted (value proposition) and marketed for different producer/end-user groups?
    c. What are segmentation approaches used to target diverse audiences?
4. What are the extension methods service providers use and how are they assessed for effectiveness in meeting learning needs?
5. How are programs involving multiple service providers administered and evaluated?

What are the barriers (program design, delivery, promotion etc.) that may be causing low levels of adoption?

f. What novel ideas are creating breakthroughs in areas (e.g., industries, sectors, geographies) of historically low adoption?
g. How are tools and resources utilised by extension deliverers and how effective is this in supporting adoption?
h. To what extent has remote location been addressed in extension approaches?
i. To what extent have participants' time restraints been addressed in extension approaches?
j. How are people incentivized and what are effective awareness raising activities that increase producers' interest in change/adopting practice change?

Rapid appraisal of peer-reviewed academic literature

Key search terms and keywords for the rapid appraisal of the literature on international extension, adoption and engagement approaches were determined by the project team in consultation with the Stakeholder Reference group. Overarching search terms were:

3. Extension program design and delivery, using the search string 'agri* AND ('extension program*') AND (design OR delivery)', and
4. 'Engagement/engaging producers/farmers' and 'communication and marketing to producers/farmers', using the search string 'agri* AND engagement AND (producer OR farmer)'.

Sub-searches were then conducted, using additional keywords from the agreed upon search parameters. Some searches revealed considerable overlap, while other searches failed to return any results. These searches were broadened or modified, using truncation and wild searches where required. For example, search strings containing 'agri* AND marketing' did not return any producer-focused results. 'Marketing' and 'communication' were therefore covered through the combined keyword search.

An initial search of journal articles was conducted in the Web of Science database using 'topic' level search (including title, author, keyword). A broad search ('first cut') using the search string agri* AND ('extension program*') AND (design OR delivery), with the publication date delimited to 2015–2021, returned 179 results.

An initial search using the search string 'agri* AND engagement AND (producer OR farmer)' returned 190 results. Additional searches were performed on the Scopus database but as these returned significant overlap and duplication, the search was limited to a keyword search across agriculture and extension specific journals, including: *Agricultural Systems*, *Agriculture and Human Values*, *Journal of Agricultural Education and Extension* (JAEE), *Journal of Extension* (JoE) and *Journal of Rural Studies* for the years 2015–2021.

First phase of literature review

Selection of papers for rapid appraisal from the agricultural sector.

There were 369+ overall results from these searches. A number of papers were excluded because they were duplicates or considered not relevant to the rapid appraisal. This resulted in an initial reference list of 243 articles to be considered. Of these, 147 results were deemed *most relevant*, and 96 articles deemed *somewhat relevant* to the research questions and taken into the next selection step.

Decisions to select articles for the rapid appraisal were based on a review of their abstract and relevance to the focus of the research questions. Articles were excluded if they:

- were general studies of adoption rather than with specific focus on methods,
- did not have rigorous M+E / data sets,
- were not considered sufficiently novel or relevant to the purpose of the review,
- were books and book chapters, or
- were case studies from developing countries and were not deemed culturally relevant to the Australian livestock industry.

Following further selection, **154** articles were shortlisted for the rapid appraisal. This selection was based around key areas of interest as identified by the project team and Stakeholder Reference Group, and included:

- Innovative extension activities and approaches and how they are implemented
- Innovative tools and resources and how they are utilised
- Innovative engagement / marketing methods and how they are implemented
- The use of technology, social media, and other web-based approaches in extension to overcome barriers such as remote location
- Engaging Indigenous stakeholders and Indigenous knowledge
- Understanding target audiences and contextual factors
- Understanding the effectiveness of offering incentives to farmers

Key findings from the **final 154** papers selected for review are discussed in the results section.

Second phase of literature review

Selection of papers for rapid appraisal from the health, finance, environment, education, natural resource management sectors.

Search strategy

In consultation with the Stakeholder Reference group the review of academic literature for the rapid appraisal was extended beyond the agricultural sector. The search strategy was informed by the project team's aims to identify successful and innovative approaches to engagement and adoption in the sectors of business and finance, health, education and environmental management. Peer-reviewed articles were identified using searches conducted in Web of Science and Scopus databases, both of which cover life sciences, social sciences, physical sciences and health sciences. These databases are complementary and so the research results did not overly duplicate each other.

Overarching search terms were (program*) AND (design OR delivery). Sub-searches were conducted using additional keywords from the agreed upon search parameters. Initial searches were not productive because the broad overarching search terms were overly broad and returned unmanageably large number of results whereas many of the key word sub-searches were too narrow and failed to return any results. To produce more targeted results, the search strategy was modified to increase the number of concept groups. The following concept groups were adopted: *program design and delivery*; *behaviour*; *promotion*; and *target population*.

Through an iterative process the concept groups were combined with key words in search sets customised for each sector. Key words, truncated where required, included: *adoption strategy, innovation, impacts; behaviour change, social change, practice change, behavioural psychology, environmental psychology; technology, communication, social marketing, social media, campaign, advocacy; consumer, client, patient, student, learner, community, landholder, service provider*. These combinations were tested iteratively, and search sets refined based on the number and relevance of search records and the project team's knowledge of the literature. Exclusion criteria were derived based on filters such as document type, categories, language (English only) and publication date (past 5 years).

Screening strategy

There were **521+** overall results from these searches. A number of papers were excluded because they were duplicates or considered not relevant to the rapid appraisal. This resulted in an initial reference list of **487** articles to be considered. Of these, **96** results were deemed most relevant, and **97** articles deemed somewhat relevant to the research questions and taken into the next selection step. Table 1 provides a summary of results from the screening process.

Table 13: Search string results

Search string	*Total*	*Most relevant*	*Somewhat relevant*	*Least relevant*
Web of Science – Business and finance	58	4	6	48
Web of Science – Education	34	4	8	22
Web of Science – Health	36	7	6	23
Web of Science – Environment and NRM	90	14	10	66
Scopus – Business and Finance	50	11	10	29
Scopus – Education	92	25	21	46
Scopus – Health	92	18	23	51
Scopus – Environment and NRM	69	13	13	43
Total	521	96	97	328

Decisions to select articles for the rapid appraisal were based on a review of their abstract and relevance to the focus of the research questions. Articles were excluded if they:

- were general studies of adoption rather than with specific focus on methods
- did not have rigorous M+E / data sets
- were not considered sufficiently novel or relevant to the purpose of the review
- were books and book chapters
- were case studies from developing countries and were not deemed culturally relevant to the Australian livestock industry.

Following further selection, 96 articles were shortlisted for the rapid appraisal. This selection was based around key areas of interest as identified by the project team and Stakeholder Reference Group, and included:

How well are the different groups of people engaged in change?

1. What are the approaches used to engage with different groups (patients, clients, students, landholders, residents, end-users, etc.)?
    a. How are information dissemination channels decided?
    b. How are messages selected, targeted (value proposition) and marketed for different groups (patients, clients, students, landholders, residents, end-users, etc.)?
    c. What are segmentation approaches used to target diverse audiences?
2. What are the methods providers use to engage groups (patients, clients, students, landholders, residents, end-users, etc.) and how are they assessed for effectiveness in meeting skills, awareness, knowledge and learning needs?
3. How are programs involving multiple service providers managed and evaluated?

What are the successful approaches (program design, delivery, promotion, etc.) which increase levels of adoption/implementation of changed behaviour or practices?

1. What novel ideas are creating breakthroughs in areas (industries, sectors, geographies, etc.) of historically low adoption/minimal implementation?
2. How are tools and resources utilised by sector service deliverers and how effective is this in supporting adoption?
3. To what extent has remote location been addressed in approaches?
4. To what extent have participants' time restraints been addressed in social change/behaviour change/practice change approaches?
5. How are people incentivised and what effective awareness raising activities are used to increase interest in change among groups (patients, clients, students, landholders, residents, end-users, etc.)?

Rapid appraisal

Key findings from the final **91** new papers selected for review are discussed.

The results were categorised according to the list of relevant themes identified in Global Adoption Review - Report A - Literature review (L.ADP.2110):

T1: Understand target audiences
T2: Participatory approaches to program design and extension
T3: Catering to different learning styles
T4: Multimedia, e-extension, and engagement
T5: Hybrid (online/face-to-face) models
T6: Monitoring and Evaluation (M+E) methods

Table 2 shows the application of relevant principles across the search strings.

Table 14: Categorization of relevant principles, across individual search strings

Search string (number of papers)	***T1***	***T2***	***T3***	***T4***	***T5***	***T6***
Web of Science – Business and finance (4)	3	0	0	2	0	0
Web of Science – Education (4)	0	1	1	3	0	1
Web of Science – Health (7)	1	0	4	1	1	2
Web of Science – Environment and NRM (14)	2	3	3	4	1	2
Scopus – Business and Finance (11)	4	2	1	3	0	3
Scopus – Education (25)	2	5	8	7	0	4
Scopus – Health (18)	10	2	2	5	0	7
Scopus – Environment and NRM (13)	8	3	1	3	0	5
Total	**31**	**16**	**20**	**28**	**2**	**24**

NB. More than one principle was applied to individual results.

Key findings from the rapid appraisal of Australian and international literature

The rapid appraisal of global extension and innovation programs in the peer reviewed academic literature focused on priority topics of interest identified in consultation with MLA and the SRG as well innovative tools and resources and how they are utilised. A key insight emerging from the rapid appraisal of the international extension and adoption literature is the centrality of engagement to the understanding of target audiences and to the development of end-user targeted extension and adoption programs and services. Both engagement and end-user relevance are also closely linked in the theme of participatory approaches as both prerequisite to and resulting from participatory extension approaches. Table 3 provides a summary of key insights (principles or themes) matched with applied practical examples and the benefits derived from these approaches.

Most of the examples and methodologies described in the literature do not appear particularly innovative or novel in and of themselves. For example, farmer-led, peer-to-peer learning groups and workshops, participatory and co-design methodologies, and market segmentation are well-known and widely utilised extension and adoption approaches. However, in some cases, innovation happens with new combinations of well-known approaches. This is particularly true for the emerging 'hybrid' engagement and extension methods that rely on a combination of online, long-distance education or social media and face-to-face interactions. Similarly, the literature on participatory and co-design methodologies advances understanding of the key principles required for effective participatory extension design and delivery. This review has therefore been organised around key themes that are useful in aiding the design of extension and adoption concepts. These themes are discussed in more detail below.

Discussion of key findings from the rapid appraisal of the literature

Phase 1: Literature from the agricultural and extension sectors

The following themes have been generated from Phase 1 of the rapid appraisal of literature from the agricultural extension and adoption sector.

Theme 1: Understanding target audiences and linking extension and engagement

The importance of understanding target audiences and responding to their dynamic needs and contexts when developing extension programs and throughout delivery is emphasised throughout the international extension and adoption literature. This includes the necessity to understand farmers' diverse socio-cultural, economic, and geographical contexts, their needs and learning styles, and motivations for change and adoption. Better understanding of these target audiences in turn aids understanding of what influences, drives, or hinders farmers' adoption decisions, and can inform the design, development, marketing, and delivery of end-user targeted and site-specific extension services that are tailored to farmer needs (Conway et al., 2021; Dill et al., 2015; Gardner et al., 2018; Ofori et al., 2020; Oyinbo et al., 2019). Producer segmentation methods, for example categorising producers as either strong or weak adopters, risk averse or less sensitive to risk, or typifying them along social value and age lines, are a common tool used for understanding target audiences (Oyinbo et al., 2019).

Much of the literature highlights the importance of proactive engagement activities and transparent communication with farmer target audiences to improve understanding and help build trustful relationships and emphasise the link between such activities and improved extension/ adoption outcomes (Brown et al., 2021; Calliera et al., 2021; Campling et al., 2021). Building and nurturing relationships and networks with producers and extension professionals is central to effective extension and adoption of practice change for two central reasons: first, ongoing engagement with producers and other end-users improves their awareness of and willingness to engage with extension program offerings (Ataei et al., 2021; Cobon et al., 2021; Fielke, 2018; D. Gupta et al., 2021; Harden et al., 2021). Second, ongoing end-user engagement enables extension professionals and program designers to gain a better understanding of their target audiences, and design programs and content based on this understanding (Cobon et al., 2021; Spiegal et al., 2020; Thorn et al., 2017). In strategic health communication, Gupta et al. (2021) found that fostering adoption required more than awareness raising but instead involved sustained investments in communication and engagement for social and behavioural change processes.

Methods to engaging and understanding target audiences. There are several different approaches and methods to engaging and understanding target audiences, with a range of benefits to the design, development, and delivery of extension, and adoption outcomes. **Surveys, interviews, and focus-group discussions** are frequently applied to collect needs-based information to inform product development and program design and determine common themes and factors affecting learning and adoption of practice change (Cobon et al., 2021; Dill et al., 2015; Gardner et al., 2018; Sewell et al., 2017). In the health sector, Rider et al. (2020) describe frequent surveys of target audiences as a useful tool for planning interventions. Information gathered in this way has also been found useful for informing engagement and marketing strategies (Mueller et al., 2020). In an extension programming context in the US, Narine et al. (2020) used a three-phase needs assessment to identify and investigate their target audience's perception of priority issue areas for extension programming.

Networks. Mapping extension networks, for example using social network analysis, provides a comprehensive overview of connections and disconnects between individuals and groups in the target audience to identify barriers in communication (gaps in networks) that can be pro-actively addressed by targeted networking activities (Nourani et al., 2019). Pro-active networking activities are also an important engagement and trust-building mechanism (Fielke, 2018).

Interactive, dialogue based, and participatory approaches to both engagement and extension emerged as an important common theme from across the literature (Knook et al., 2018; Knook & Turner, 2020; Sewell et al., 2017; Spiegal et al., 2020). Here, it is noted that interactive, dialogue based, and participatory approaches provide valuable methodologies for engaging and understanding target audiences, and informing communication, marketing, and extension program design. Participatory methods, and associated plan-act-observe-reflect-(adapt) action learning cycles can also aid monitoring and evaluation of extension activities in real time, as participants can be actively involved in the reflection on and adjustment of activities, both during their program participation and ex post (Knook et al., 2018).

Incentives. Participatory approaches have shown to empower farmers to gain better understanding and this drives adoption more than monetary incentives (Salvia et al., 2018). 'Intrinsic rewards', such as an increased sense of self-efficacy, achievement and learning, have been described as significant individual predictors of motivation to act and change, on par with 'extrinsic rewards' (Mankad et al., 2019). These can include both financial incentives (i.e. business stability), and non-monetary, value driven and common good incentives, for example, agri-environmental benefits (Coyne et al., 2021; Cross & Ampt, 2017; Quella et al., 2021). The quality of programs and level of personal and business benefit are additional important incentives for engaging end-users, especially youth (Akrong et al., 2020). Piñeiro et al. (2020), in their review of nearly 18,000 papers on whether incentive-based programmes lead to the adoption of sustainable practices found that adoption rates are higher when programmes offer short-term economic benefits.

Theme 2: Participatory approaches, co-design, and co-innovation

Participatory approaches, including co-design and co-innovation models, were another key theme across the literature. A strength of participatory research and extension is that the approach can span the boundaries between science and scientists on the one hand and farmers and farmer decision-making on the other (Spiegal et al., 2020). The interactive, end-user driven principles of participatory approaches assist in the collection of current, targeted, needs-based information. This enables products and programs to be tailored to various end-user characteristics, regional differences, and seasonal variations to meet end-user needs and ensure relevance to their changing contexts (Cobon et al., 2021). It is important to maintain continuous engagement with participants and obtain feedback early when designing products or programs (Stitzlein et al., 2020). As participatory extension involves active listening, two-way information exchange and farmers' involvement in the planning, implementing and evaluation of extension programmes (participatory design or co-design); (Mbeche et al., 2021), it also provides the basis for a sociocultural extension approach that considers personal, interpersonal and institutional factors that characterise the target audience and their context (Sewell et al., 2017). This can assist in informing future engagement and marketing strategies (Mueller et al., 2020). Importantly, to be effective, participatory approaches need to be strongly committed to the principles of diverse, inclusive, and equitable participation, and be highly flexible and responsive to the participant community they are addressed to. Participatory approaches can therefore be very time-intensive and expensive. However,

studies have shown that participatory extension programmes (such as innovation platforms) **lead to higher adoption** (Knook & Turner, 2020). For example, participatory extension programs contribute to changing farmer perspectives and enable extension program designers and service providers to better understand practice change in their target audience (Brown et al., 2021). Some examples of participatory approaches that stood out from the literature are discussed here.

Co-design is a design approach to developing programs or products that actively involves end-users and stakeholders from the very beginning of the process or project, from the collective definition of the issues, challenge, or opportunity to be addressed, through to the roll-out of the final product or service. (https://defrafarming.blog.gov.uk/2020/12/11/what-we-mean-by-co-design/). For example, **co-design of digital technologies or decision support tools** involves participatory processes to obtain farmer end-user input and feedback early in the product design/development phases. Co-design approaches promote trust in the process, and the product or service, and increases the relevance of the technology and scientific research to farmer end-users.

Innovation platforms are forums that are established to foster interaction and knowledge exchange among relevant stakeholders around a shared interest. Innovation Platforms involve co-design processes as stakeholders perform complementary roles in the development and adaptation of program design but in addition are also involved in the dissemination and adoption of knowledge for improved program design and/or biophysical and socioeconomic benefits.

Co-innovation refers to the process of jointly developing new or different solutions to a complex problem through multi-stakeholder engaged research processes. Similar to other participatory and action-based extension design and delivery approaches, co-innovation employs an action learning cycle of 'plan-act-observe-reflect (adapt)', as represented in Fig 1.

Figure 2– The action learning cycle

Key principles of co-innovation include:

1. Identify and involve partners and stakeholders benefitting from the research to understand the problem from their perspective from the beginning and develop solutions together.

2. Put the problem at the centre: co-innovation is not about the farmer's need to change, but about researchers, farmers, policy makers, industry etc addressing shared problem together.

3. Assemble and nurture the right team with the technical and collaborative skills to strengthen the team's ability to co-innovate, and act as translators between the partners and stakeholders.

4. Share results early as they emerge, rather than waiting until the end of the research. This keeps the partners and stakeholders engaged in the research process and assist in the action learning cycle

5. Structure an action learning cycle of Plan-Do-Observe (monitor)-Reflect-(Adapt) to maintain a focus on action, adapt to changing circumstances and quickly seizing new opportunities for success. One good way to do this is to build in monitoring and evaluation activities from the beginning, using participatory processes (https://i2insights.org/2019/07/16/five-principles-of-co-innovation/).

Additional principles of stakeholder/end-user driven co-innovation observed by Pinxterhuis et. al. (2019) include: inclusivity, diversity, and contextual awareness, and involving stakeholders in reflexive Monitoring and Evaluation for the continuous development and improvement of both process and outcomes of the co-innovation.

Participatory extension programmes (PEPs) are advisory programmes based on voluntary participation, where farmers, researchers, and rural experts collectively learn by sharing information and experiences (Knook & Turner, 2020).

Management teams: A highlight from the literature was the interdisciplinary, collaborative management team model for farmer-directed, participatory extension design described by Cordoba et al. (2018). Cordoba et al. (2018), in their study 'Repro Money', a collaborative, management team-based extension program to improve dairy farm reproductive performance in the United States, demonstrate the benefits of participatory and farmer-directed extension design to increasing reproductive performance and profitability: Farms that enrolled in the program formed reproductive performance teams, assigned specific responsibilities to farmer members, set team goals, developed action plans, and determined evaluation strategies. This team-based extension program demonstrated benefit to increasing performance and profitability (Cordoba et al., 2018). Individual steps in this participatory program included:

1. farmer-directed, initial assessment of the change context,
2. identification of areas for improvement,
3. goal setting,
4. implementation of an action plan,
5. final evaluation.

Other key participatory methods include on-farm demonstrations, farmer action groups, field tours and other in-person events (i.e., workshops) but also podcasts, blogs, and surveys (Cordoba et al., 2018; Spiegal et al., 2020). Participatory approaches such as those described here explicitly empower farmer as active participants and contributors to the design and development of programs and services rather than just a source of information (Menconi et al., 2017). In a study from the US American wine industry, Garner et al. (2018) present the use of 'extension blogs' as a useful extension tool that help to disseminate science-based information as well as less technical, more applied information and provided an opportunity for peer-to-peer information exchange.

Engagement. A clear benefit of participatory approaches is that they require direct engagement, transparent communication and a partnership approach when engaging with target audiences. These are all elements of trust- and relationship-building. Participatory extension, when conducted on commercial farms with direct involvement of managers and producers, is therefore a powerful engagement approach. The importance of transparency, building trust and empowering end-users to actively participate in the design and delivery of extension programs has been shown to support adoption in target audiences (Brown et al., 2021; Calliera et al., 2021; Knook & Turner, 2020).

Theme 3: Catering to different learning styles

Additional benefits of participatory approaches include that they can improve participant understanding and learning outcomes, for example as part of learning-by-doing and by integrating peer-to-peer and producer practice knowledge with other, interdisciplinary, and non-specialist knowledge (D. Gupta et al.,

2021). Participatory approaches contribute to farmer knowledge and capacity building, and this has been identified as a crucial driver of adoption (Cordoba et al., 2018). Non-specialist, inclusive language and communication are the key tenets of participatory, end-user targeted learning (Jenkins et al., 2020). Additionally, Sewell et al. (2017) identify several conducive conditions and environmental qualities for learning, and social and psychological drivers for practice change. These include for example, the farmer participant developing an identity of a learner and a sense of belonging to a learning community, including the direct engagement with scientists. Reinforcement and validation of learning, developing an enhanced sense of self-efficacy, and seeing relative advantage in practice change based on the individual learning experience further drive adoption (Sewell et al., 2017). Salvia et al. (2018) have similarly identified a positive link between the rate of adoption and the degree of stakeholder participation via increased understanding of complex interactions (Salvia et al., 2018). Peer-to-peer learning approaches, while not in and of themselves novel, continue to take on a dominant role in international extension approaches described in the literature. Farmers continue to value opportunities to discuss farm performance and share knowledge with their peers (Jack et al., 2020).

The importance of understanding the target audience's diverse learning preferences and learning styles was another key insight derived from the literature review that is closely linked to the requirement of pro-actively engaging with target audiences. To this end, Nettle et al. (2018) suggest that extension professionals are an important conduit to understanding target audiences that can be further enhanced and utilised through the provision of relevant teaching and learning training to advisors. Catering for difference learning preferences includes for example the provision of multi-sensorial, audio, visual and tactical-based learning experiences as well as more traditional delivery modes such written and media publications, electronic dissemination, and face-to face meetings (Sewell et al., 2017). Considering personal values and psychological factors, interpersonal, cultural and institutional factors, including social capital (i.e. farmers standing in the community) for example via the application of farmer typologies or segmentation, has also been shown to be of critical importance when developing programs, content, and topic-dependent messaging (i.e. climate change (Thorn et al., 2017).

Principles of participatory learning, co-design, and co-innovation, include the development of respectful relationships, diversity, inclusivity, using relevant and inclusive content and resources, recapitulating key concepts, power-sharing, empowerment for decision-making, and equity (Harden et al., 2021; Sewell et al., 2017). Peer-to-peer learning and participatory extension facilitate social learning (Jack et al., 2020) but it is noted that participatory advisory services with a focus on 'peer-to-peer' learning require facilitation and knowing target audiences (Dooley, 2020; Jack et al., 2020). Importantly, Ndlela and Worth (2021) note that building farmer capacity goes beyond improving technical knowledge and skills. Genuine and inclusive participation in farmer development programmes, especially inclusion in decision-making, builds personal, human capital and leadership capacity, including self-reliance, resilience, leadership, interpersonal, collective decision-making skills (Ndlela & Worth, 2021; Weaver, 2016).

Nocco et al. (2020) highlight the need to better prepare extension scientists for engaging in agribusiness spaces, and offer the following practical methods and recommendations for designing social learning processes:

1. Training participants and extension scientists in participatory learning: Seek out alternatives to the deficit model of science communication (e.g., via the co-production of knowledge).

2. Training extension scientists. When agricultural stakeholders have very different identities or world views, it is important for scientists to conduct identity-based assessments prior to engagement.

Scientists should develop coping strategies (e.g., trigger identification, response planning, mindfulness, strong practitioner networks) to deploy during and after engagement.

3. Study design. Physical, social, and extension scientists should collaborate from project proposal to completion to help establish biases, expectations, and share conditional outcomes.

4. Study design. Scientists should start all collaborative projects with agricultural stakeholders by critically acknowledging their own positionality, advocacy/stakeholder role, and biases.

5. Organization of meetings: Choose grower-controlled spaces to hold meetings that facilitate knowledge exchange and co-production. These may be spaces that are either associated with agricultural trade associations or regularly used by agricultural trade associations.

6. Organization of meetings: Keep an agenda, but relax schedule enforcement and promote questions, interruptions, and dialogue during scientific presentations. Ideally, a participant member is responsible for agenda enforcement.

Theme 4: Engaging Indigenous stakeholders and Indigenous knowledge

The core principles of participatory engagement and extension, and co-design, are applicable when engaging Indigenous people and knowledge. Additionally, cultural knowledge and skills, respect, and cultural sensitivity are of the essence. Key factors include the collaborative creation of new knowledge, and practical workshops with the aim of recording integrating indigenous knowledge and science. Issues of Indigenous IP must be considered in this approach (Radcliffe et al., 2021).

Theme 5: E-extension, ICT, and hybrid delivery modes

There is an increasing use of information and communications technology (ICT), social media, and other web-based approaches in extension to overcome barriers such as end-users' time constraints and remote location (Kenny & Regan, 2021). ICT- based approaches can deliver effective learning tools that producers can use flexibly, at their own time and in the field, and that empowers them to independently deal with data (Kenny & Regan, 2021). This convenience of remote learning opportunities has been noted as positive (Patillo et al., 2021). However, while a study from China shows increases in agricultural productivity resulting from the delivery of distance education using ICT (Guo et al., 2018), the convenience of accessing on-demand information was reported as only one of many information sources in the Indian Direct2Farm study (Kansiime et al., 2019). Social media, including Facebook, WhatsApp and Twitter, are increasingly being used to understand target audiences. Using mobile apps that are already being utilised by farmers in their personal time and outside extension content (i.e. WhatsApp, Facebook) have been shown to be the most effective (Petril'ák et al., 2020; Son et al., 2019). Stock (2020) studied the use of Instagram for extension programming and found that it creates connections and expands programming opportunities. ICT-based extension approaches additionally facilitate quantitative Monitoring and Evaluation via page views and other metrics (Stock, 2020).

The use of ICT for extension and engagement has been brought into further focus in the global response to the Covid 19 pandemic. Thron et al. (2017), in their study of mixed delivery methods, found that a combination of medial (videos, websites) and experiential (field tours, workshops) delivery modes was considered useful for information dissemination. However, they also stress the importance of face-to face interactions as they found that participants considered face-to-face engagement and experiential learning (including on-farm demonstrations, field tours, and workshops) as most useful for practice change.

Observation-based learning strategies, such as farmer field schools and other participatory approaches can be further enriched using information and communication technologies (ICT); (Wyckhuys et al., 2018). Such hybrid learning and extension approaches integrate face-to-face teaching with online instruction (Uribe & Santamaria, 2017). For example, Patillo et al. (2021) describe alternative educational opportunities that emerged in the response to Covid-19 related restrictions on more traditional, face-to-face extension approaches in Missouri's cropping sector. In this example, a blended, or hybrid, approach that combined video conferencing, online teaching, digital recordings, video repositories, and social media communications with more hands-on, experiential learning opportunities provided through the drop off of learning material to participants, proved effective. Another study from the US by Stokes et al (2020) similarly used remote engagement via social media in combination with the delivery of hands-on learning materials to participants. Another e-extension/ face-to-face hybrid model is described by Bhaskara and Bawa (2021) in a study of an extension approach combining an online, digital information platform with local farmer group meetings to increase engagement and peer interaction. A third e-extension hybrid variation offered a call-in- support, real-time needs assessment and advice that was provided by the 'Ask the Ag Agent' web platform was developed to share timely information with the agricultural community (Bamka et al., 2020)

The literature further describes examples of using digital technology for participatory design (Stitzlein et al., 2020). However, it is important to recognise and incorporate farmers' values and beliefs systems into the design and usage of digital tools to increase the perceived relevance of research, development and extension to their everyday life-worlds. ICT tools are just tools that facilitate engagement and extension but need to acknowledge that psychological factors and personal values apply with this mode of engagement as well (Stitzlein et al., 2020). Limitations associated with telecommunication access and network coverage need to be considered when using ICT-based engagement and extension methods in regions with low or unreliable coverage.

Theme 6: Monitoring and Evaluation methods

In their systematic review of qualitative, quantitative, and mixed method evaluation of participatory extension programs, Knook et al. (2018) observe that quantitative and qualitative data need to be integrated for a better understanding of social context and for gaining insight into participants' perceptions and motivations. In the specific case of evaluation of participatory extension programs, Knook et al (2018) further recommend consideration of reflexive ex-post evaluation. Similarly, Moravek et al. (2017) incorporate quantitative and qualitative data, including participant reactions, capacity gains and practice change (measured in water quality improvement in this case). Outcome measures need to be considered from an end-user perspective. A benefit of participatory approaches is their often iterative, or cyclical nature of 'planning-acting-observing-reflecting-adjusting action/planning', and wherein monitoring and evaluation is undertaken by participants as part of progressing through the collaborative design process or delivery of extension programs. In this way, monitoring and evaluation activities can be integrated into the ongoing processes of action and adjustment of action.

The most common Monitoring and Evaluation (M+E) methods described in the literature include surveys or questionnaires, i.e. to collect quantitative and qualitative data on the perceived usefulness of specific delivery methods for disseminating information (Thorn et al., 2017; Uribe & Santamaria, 2017). Quantitative methods include website metrics (page views, unique page views, time on page, bounce rate (Angima & Carroll, 2019; Ivey & Myer, 2019). Tuck et al. (2020) utilised both surveys and mind-

mapping tools for both monitoring and evaluation activities and understanding their target audience and their changing practice.

Phase 2: Literature from the non-agricultural sectors

The literature from business, finance, education, health, and natural resource management (NRM) sectors supported findings of, and provided additional insights to, the review of agriculture sector literature.

Theme 1: Understanding target audiences and linking extension and engagement

Results from the second review revealed a range of methods for understanding target audiences being applied in sectors outside of agriculture. Qualitative, quantitative, and mixed methods research was applied to understanding target audiences in a range of studies.

In some studies there was a focus on the **influence of individual characteristics on decision making.** For instance, the influence of age, gender, education and connection to nature with respect to participation in different nature-based activities (Woolley et al., 2021) and threat perceptions, attitudes, and social norms in relation to landholders' land clearing intentions (Simmons et al., 2021). Health-directed behaviour change interventions such as 'sit less at work' examined intrapersonal, interpersonal, organisational and environmental determinants of behaviour change (Mackenzie et al., 2021); and in examining change agents in the legal profession Nahmias (2018) examined common attributes among 'changemaker' lawyers. An 'adoptability framework' was developed by Higgins et al. (2021) to assist regional farming groups and other extension personnel to better target soil management resources and communications to farmers. The framework is based around the following steps:

Step 1: Identify the soil management challenge/priority.
Step 2: Identify how the soil management challenge/priority should be addressed.
Step 3: Identify drivers of adoptability influencing local capacity to address the challenge/priority.
Step 4: Identify interventions for addressing adoptability challenges.

Integrated **behavioural models** are commonly applied to identify motivational factors in change among target groups. Simmons et al. (2021) compared traditional econometric models with two popular behavioural models (Theory of Planned Behaviour and Protection Motivation Theory) and a fourth, integrated model to consider land clearing intentions. Similarly, Makenzie et al., (2021) use an integrated behavioural model for **informing the co-production** of interventions. The results support integration of social science methods to identify the influence of psychological factors on decision making and behaviour change. An alternative approach by Hoolohan and Browne (2018) considered how specific **modes of intervention are prioritised** within a social, political, semiotic and material landscape of professional practice in water demand management.

Web-based analytics are increasingly being applied to target customer engagement in the business sector (Potdar et al., 2018; Yusuf et al., 2018). In the health sector, web-based recruitment portals are being developed to expedite the recruitment process for medical research (Musker et al., 2020) and in evaluating online mass media campaigns such as the efficacy of a 'Tobacco-Free Living' (Rudov et al., 2017).

Further in studies related to understanding target audiences, several results considered innovative ways of **engagement**. Seeking to facilitate participant reflection and analysis among online adult education graduates den Heyer et al. (2021) combined stories-based techniques with aspects of the Most Significant Change and the SenseMaker frameworks into Learning from Stories of Change.

Similarly, Epanchin-Niell et al. (2022) propose a conceptual model of private land conservation decision making, designed to facilitate communication, collaboration, and integration across disciplines and points to methodological innovations that can expand understanding of private land decision-making by structuring the contextual factors, enabling consideration of relevant factors, improving policy targeting and design through innovative data collection, see Figure 1 below.

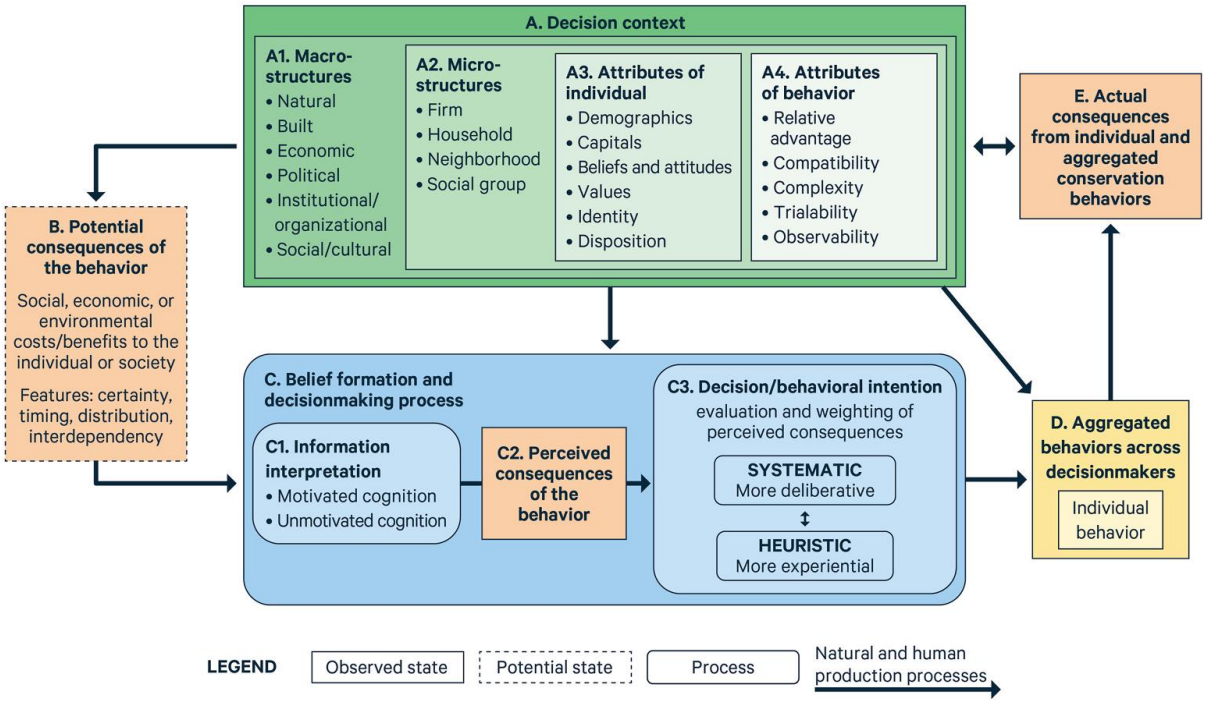

Figure 1: Conceptual model of individual conservation decision making on private lands.

Also, Hu et al. (2020) tested an innovative behavioural intervention strategy for limiting energy use in organizational settings under an expanded theory of planned behaviour model. These examples demonstrate the **increased use of behavioural models** in understanding and engaging target groups, which provide frameworks for considering individual and social influences on decision making and change challenges.

The use of **incentives** as a mechanism for engaging groups is considered by Coyne et al. (2021) who compared private agri-environmental schemes with public schemes, which are perceived as more restrictive, providing insufficient reward for the 'red tape' involved. Ryan et al. (2019) found seed grants addressed an unmet need of smaller employers by supporting them to adopt health promotion initiatives.

Theme 2: Participatory approaches to program design and extension

The use of **co-design** is prevalent across business and finance, NRM and education. For instance: interventions to reduce sitting times at work were co-produced with employees (Mackenzie et al.,

2021); engaging young people as coresearchers was used as an approach to develop environmental indicators (Ungar et al., 2020); in secondary education, self-learning, self-discipline, self- and peer-assessment was promoted via interactive tools (Nguyen et al., 2020) and in universities, co-design supported collaboration between researchers and academic planners (Zinoski, 2020). Learning labs or **in-person innovation platforms** have been applied in education and NRM. For instance in gathering school stakeholders to transform the discipline system (Ko et al., 2021); and promoting rural areas as attractive places to live (Zavratnik et al., 2019). Tantillo et al. (2020) described a **remote innovation platform**, using tele-mentoring to build a collaborative learning community, connecting eating disorder specialists with community-based practitioners in remote areas. Also, Cassaniti et al. (2021) used a digital platform (Net-Map) to explore digital-based, community-driven partnerships with the private sector for health promotion outcomes. A notable study from the business and finance sector investigates how a museum can enable social and cultural innovation towards sustainable development by bringing together different stakeholders to participate in system change (Ernst et al., 2016).

Peer-to-peer engagement and learning is commonly applied in education settings (Saez et al., 2018; Smith & Petosa, 2016). Saez et al. (2018) investigated the selection of peers by matching peer facilitators according to socioeconomic status to promote physical activity behaviour (Saez et al., 2018). Social learning was applied to examine the impact of single- and double-loop learning not only on behaviours, but also on pro-environmental values and intentions (Noguera-Méndez et al., 2016) . .

Co-development through social innovation involves community members in the design and delivery of interventions in health; engaging non-experts in innovation contests to develop awareness campaigns (Zhang et al., 2017), and for designing dengue control interventions (Echaubard et al., 2020). **Social marketing** applies concepts used in marketing of goods and services, to social challenges. The approach has been adapted for use in marketing awareness and behaviour change in health (Anibaldi et al., 2020; Schillinger et al., 2017).

Theme 3: Catering to different learning styles

Exploring approaches to **delivering opportunistic behaviour change** is prominent in the health sector, encouraging medical professionals to deliver opportunistic health behaviour change interventions to patients during routine medical consultations (Harrison et al., 2022; Keyworth et al., 2018, 2019). Harrison et al. (2022) also explored the impact of such programs on knowledge, confidence and behaviour of medical professionals and staff.

Integrating **digital tools to cater for different learning styles** is prominent throughout the education, health and environment sectors. Notably, the use of **digital gamification** for improving awareness around NRM issues (Cheng et al., 2021; Leitao et al., 2022). Research in this area is moving beyond testing of the principle to what aspects of the game are most appropriate for learning outcomes in the relevant audience (Leitao et al., 2022). Additionally, the use of **digital therapeutics** for health behaviour change (Budney et al., 2020), and the use of **visual media** (carbon mapping, thermal imaging) for providing consumer feedback on energy use (R. Gupta et al., 2018).

A number of studies explored different ways of engaging audiences in face-to-face knowledge sharing, dramatizing data through **ethnodrama**, for communicating the outcomes of research (Taylor et al., 2017), **escape room simulation** for emergency healthcare procedures (Sarage et al., 2021), using **community games** to simulate the consequences of crop choice on an aquifer to improve collective governance of groundwater (Meinzen-Dick et al., 2018), and to inform the suitability/trustworthiness of

actors when delivering conservation interventions (Baynham-Herd et al., 2020), also Harvey et al. (2020) engaged participants in **actor-based health and safety induction**. Also, Ernst et al. (2016) consideration of 'art as tool – museum as lab' (outlined in Theme 2) is a notable for catering to different learning styles. While these types of interventions are useful for engaging different audiences, it is noted that they are not suitable for all audiences and deciding when and where these approaches are suitable is key to their success. Williams, et al. (2022) describes the use of **motivational interviewing** for professional development among animal welfare officers. The Log Cabin Project, a demonstration facility in Napier, New Zealand displaying sustainable building and living practices proved to be a catalyst for behavioural change, providing an comparable example of MLA producer demonstration sites, which enable demonstration or even concept proofing of innovative agricultural practices, in the NRM sector (Bahho & Vale, 2020).

Theme 4: Multimedia, e-extension, and engagement

The use of digital tools in business and finance, education, health and NRM extended from traditional digital tools such as **videoconferencing** for mentoring, coaching, counselling (Cliffe et al., 2021; Tantillo et al., 2020), and **digital messaging** (via SMS, webchat); (Burns et al., 2016; Chiang et al., 2018; Gilchrist et al., 2021). The use of such tools also enabled the formation of a "hub" which linked specialists and community-based healthcare providers (Tantillo et al., 2020). Application of behaviour change theory to further develop and apply the use of these tools was investigated (Chiang et al., 2018; Gilchrist et al., 2021), for instance in the use of a massive online open course (MOOC) as a tool to facilitate attitudinal change and engagement in activities around the topic of smart cities.

In addition to videoconferencing and MOOC, **desktop platforms** are enabling interactive interventions for psychotherapy (Meyer et al., 2015), and self-paced online curriculum that utilises virtual simulation (Shah et al., 2018). Also, Cassaniti et al. (2021) explored frameworks for establishing community-driven partnerships between social enterprise and the private sector in health.

Social media platforms are an increasingly important part of society, such platforms enable the collection of large amounts of context specific data (Ali et al., 2020; Yusuf et al., 2021).

The use of digital tools also included more specialised applications developed for **mobile and tablet devices**; in NRM to enable **reporting of environmental concerns** by citizen scientists (Hayik, 2021), **visualisation of data** around energy use and carbon footprint (R. Gupta et al., 2018; Lopez-Carreiro et al., 2020; Petersen et al., 2020); and in health, to promote health-related learning and self-assessment, and **structure conversations** between health care providers and patients (Johnson et al., 2020).

Digital **gamification** is used in the NRM sector, to address a range of environmental challenges that are seen as less interesting, including studies testing the use of gamification generally (Cheng et al., 2021), analysing the relationship between different aspects of games and learning outcomes (Leitao et al., 2022) and the processes of social change that are occurring through gamification (Ouariachi et al., 2020; Sharma & Siu, 2018). Results suggest gamification provides an effective media for engaging groups, especially among youth. Additionally, the design of reward systems (e.g., points, badges, leaderboards); (Leitao et al., 2022) and gaming attributes (e.g., achievability, challenge, and credibility); (Ouariachi et al., 2020) impacted the success of gamification platforms as learning tools.

Finally, **network monitoring equipment** among schools in Denver, USA, were integrated to build real-time air quality data, enabling greater awareness by participating schools and increased opportunities for identifying citywide data patterns (Ogletree & Thomas, 2019).

Theme 5: E-extension, ICT, and hybrid delivery modes

While studies examining the integration of online and face-to-face interventions were rare, two studies in health, one enabling greater integration of curriculum across education and professional development (Brannan et al., 2019) and the other examined workshops and the use of digital tools as supplements to standard care, providing greater reach at reduced cost (Budney et al., 2020). Results from NRM sector included an example of hybrid extension models in agriculture, enabling advisor and producer training among extensive livestock producers in western Queensland (Rolfe, 2017). Digital approaches outlined in Theme 4 provide options for researchers and practitioners to be used in combination with traditional face-to-face approaches.

Theme 6: Monitoring and Evaluation methods

The use of **behavioural frameworks** for evaluating interventions is prominent across the business and finance, education, healthcare and NRM sectors. A number of models are presented; the Delphi method for technological forecasting (Egfjord & Sund, 2020); the theory of planned behaviour (TPB) for linking pro-environmental identity and energy conservation behaviours (Hu et al., 2020), and for revealing the microfoundations of knowledge sharing and technology transfer (Scuotto et al., 2020); the behaviour change wheel to evaluate the delivery of webchat counselling (Gilchrist et al., 2021) and a digital health outreach platform (Chiang et al., 2018); The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) method (Johnson et al., 2020; Pullen et al., 2019). Frameworks arising from behavioural change theory offer adaptable approaches to M&E, enabling consideration of the relationship between factors that influence decision making, and measuring the expected and resultant impacts of interventions.

Rapid assessment procedures are a pragmatic option for producing timely, contextually rich evaluative information about complex interventions implemented into dynamic clinical settings. Holdsworth et al. (2020) introduced a rapid team-based analysis to an evaluation of an intensive care unit redesign initiative.

The prominence of **digital tools** has led to greater consideration of the processes of change that occur through that media (Johnson et al., 2020; Lopez-Carreiro et al., 2020; Ouariachi et al., 2020; Robinson, 2021; Sharma & Siu, 2018). Results suggest behavioural frameworks are an important way of evaluating these tools. Additionally, the use of search engine analytics by Rudov et al. (2017) enabled identification of innovators in support of smoke-free policy change; and **data analytics** to gain insight into the behaviour changes that occurred as a result of a technology-enabled educational program (Galy et al., 2019).

A **contextual analysis** was performed by Djian et al. (2019) to determine differences between two countries regarding smoking prevalence, health services and culture, analysing the specific national contexts of two anti-smoking social marketing campaigns.

Consultation with Australian and international networks

In addition to the review of the academic literature, 32 individuals or organisations were contacted to request an interview, based on the feedback and priorities identified by the SRG. Of these 32 contacts 22 led to key informant interviews (see Table 4 for detailed listing of key informants). The purpose of these interviews was to gather in-depth accounts and important details of novel extension and engagement approaches, including observations from practice, knowledge and application of monitoring and evaluation methodologies, and reflections on these identified novel approaches.

As part of this process, key contacts for the consultations with international extension, adoption and engagement professionals were identified from the list of key countries, programs and projects, and informants as introduced in the first milestone report. This list was based on existing networks of the project team and shortlisted in consultation with the SRG. Key Australian informants were similarly identified on the basis of the project teams' and Stakeholder Reference Group's existing networks and include other agricultural sectors and non-agricultural sectors in Australia.

A total of 22 international and Australian key informants were interviewed, using a catalogue of questions that can be found on pp – 31-32.

The analysis synthesised the main themes from across the interviews and short-listed programs, projects, or initiatives that appeared to be most successful and novel as well as presenting 'best bets' for regions, systems and topics of interest to MLA. Four key themes emerged from these consultations and are discussed in detail below.

1. Understand your audience: one size does not fit all.

The diversity of producers within the red meat industry is reflected in differences between the classes of livestock run and the management systems implemented on farm. Producers are not homogenous in their thinking, perspectives, and identity, and therefore their drivers. The interviews highlighted that extension and adoption programs aimed at red meat producers need to reflect this diversity and be able to meet the need for individualised approaches. The need to recognise the type of system and differences in practices and values between producers and align the delivery model and engagement was identified across numerous respondents, with one respondent identifying it as a critical success factor.

Taking a farmer-centric approach to program development and implementation was identified by 100% of the interview respondents as a constructive method of producer engagement. Respondent 7 recognised the top-down approach of advisors determining producers' obligations within the agriculture industry as a cause of conflict. This was supported by respondent 8, who found that discussion groups that were focused on the motivation of the facilitator rather than the outcomes sought by the group resulted in producers feeling the process was forced upon them, and the groups ultimately failed.

One risk identified by respondent 17 was that of central thinking losing relevance at a regional level. While national programs are accepted as the engine room, the eyes, ears, and feet on the ground at a regional level drive the success of programs. Regional iterations of national programs provide the depth and breadth of understanding required to engage producers. When developing regional programs, flexibility is crucial. Respondent 15 highlighted the need for flexibility, including differentiated success criteria, at the engagement, preparation, and implementation stages to ensure program success. Flexibility allows deliverers to be responsive to the needs and demands of producers.

Numerous respondents acknowledged a targeted approach as a critical component of successful programs. This involves developing differentiated approaches to engage producers at different levels of knowledge and skills and developing different iterations of the same program. Respondent 10 observed that organisations often pitch their programs at the highest level and therefore overlook many producers, leading to a large number unengaged. Audience understanding needs to be put first. M&E can be utilised to determine understanding and what needs to occur next. Organisations should not be nervous about a chaos phase when determining what people want - it is essential to developing an outcomes-focused program. Elements of successful programs included developing a community of practice, peer-to-peer learning, and mentoring.

In response to diversity within the sector, the need to use a range of engagement strategies was identified by the majority of respondents. Online engagement is becoming a large component of many programs; however, the preferred method of contact is shown to be face-to-face events, with the importance of taking events to producers and not relying on them travelling vast distances highlighted by respondent 15. Four respondents stated that the overuse of platforms such as Zoom is leading to online fatigue, with a further 6 respondents identifying that they are cautious with the use of Zoom due to the potential of fatigue. Respondent one went on to express that when used well and utilised with effective facilitation techniques, Zoom can work well to engage producers.

A common theme among respondents was that effective programs include numerous engagement methods (e.g. case studies, magazines, farmer profiles, webinars, and roadshows) to appeal to a wider range of producers. Print and paper resources are still an entry point for many producers and should not be disregarded. Social media has shown to have a high success rate across a diversity of age groups but a mix of all channels, including newspaper and radio to engage with producers was the most beneficial. Social media is most useful when used to drum up interest and anticipation in the lead up to an event.

Respondent 12 recognised that producers are outgrowing the technical space and moving to topics such as governance, human capital, labour management, emotional capital, and politics. This was mirrored in the responses of 3 other respondents, with producers showing an increased concern for family: work balance and social and cultural dimensions of farming, not just economics and finances. The topic/season driven programs are now being overlooked for programs that offer skills and training in managing the business, team, and self. These comments came from respondents from the red meat, pork, and dairy industries both in Australia and overseas.

2. Support producers on a journey of learning and adoption

Facilitating change on-farm requires commitment and support from trusted advisors across the entire learning process. Respondent 10 highlighted the importance of program facilitators providing a journey for producers, moving from awareness and knowledge through to technical depth and support to adopt new practices. Support networks and coaching were a common theme throughout all the interviews, across wide ranging industries and countries, as a factor crucial to program success. The facilitated support can come in different forms including peer-to-peer relationships, mentoring from other producers or from advisors. The key is that the support network must be trusted.

The time and effort required to build trust is a substantial commitment. Respondent 14's method to building trust between program facilitators and producers involved a de-centralised approach targeting local issues. Over 3 years consultants worked with producers in groups and one-on-one to set goals and implement and embed new practices. Monthly meetings between the consultant and producer ensured

everything stayed on track. Discussion groups also formed an integral component of this program, with groups meeting on-farm to work through and solve in-depth issues on the host farm. Target farmers were matched with more experienced producers in the region to provide a mentor and additional person within the support network.

Feedback from three interviews, indicated that producers respond well to programs when a feeling of connection is created. Respondent 16 identified the need for facilitators to always be available to provide connection and support. Face-to-face events and interactions and follow up calls form the core of the producers' support network, however when this is not possible, for example out of hours, YouTube channels, recordings and resources fill the gap. Creating a sense of community and the feeling of being a part of a movement engages and enthuses producers. As well as coaches to provide guidance for producers, utilising champions within the industry to convey a message has shown to be successful. The champion producer must be a respected leader within the community for others to take notice of what they say.

The co-creation of innovation and solutions between farmers, advisors and researchers appears to encourage active involvement and foster ownership of the process. Respondent 9 found success with this approach, with the co-creation of new knowledge, ideas and processes involving multi-stakeholder participation in real-life settings. They found it was effective when the issue was of high complexity and urgency, participants were willing to learn and collaborate and there was time for trust building, flexibility and openness in outcomes expected. High quality facilitation is crucial for success of programs such as these.

Three respondents from across the red meat and pork industries specified that larger producers are easier to engage with as they already have established networks and generally understand industry expectations. Across all industries, smaller producers need to be catered for in program promotion and delivery to ensure all stakeholders are reached. It is important that the training and coaching provided to farm managers and owners filters through to other family involved in the business and employees. Respondent 18 includes all stakeholders within a business from the top down in the training process to prevent disinformation and (unintentionally) working against the goals of the business. Benchmarking groups using an approach based on fundamental principles were identified by numerous respondents as a successful engagement tool.

3. Upskill advisors to teach and facilitate effectively

The need to understand extension properly and the principles of how people learn was considered by eight respondents to be essential to achieving adoption targets. Respondent 1 described good facilitation and engagement as applying learnings to the producers' world and encouraging them to have a go in a supported way. While this process is more costly, it has been demonstrated to be more effective (Knook et al., 2020; Nettle et al. 2018; Teno & Cadilhon, 2016). To enable this process, advisors/extension practitioners require training and support themselves. Training in the red meat, dairy and pork industries has typically been focused on keeping advisors up to date on technical knowledge with limited focus on developing 'soft' skills.

Respondent 8 credited the continuous training and support of facilitators as one of the many success factors of their key program. They found that moving away from knowledge transfer or delivery of research outputs as an exchange of information and tools, to training staff in key frameworks and service design was integral to engaging producers. Respondent 10 placed value in facilitators

understanding the target audience and engaging producers at different levels (understanding the different methods of learning and differentiating their program outputs to facilitate the learning process). Respondent 11 believed that consultants should utilise networks around them to support coordination of facilitation activities as a means of professional development to continuously upskill in teaching techniques.

The interviews indicated a belief that facilitators and advisors need to be trained to deliver their activities at the starting point of the producers in the room. Rather than simply start by delivering information, start by asking producers where they are currently at, what their problem is and what information do they have. Engagement and adoption follow once rapport, trust and respect is gained. Respondent 2 identified the need for advisors and facilitators to become skilled in the process of teaching so that producers do not realise that the process is structured and facilitated. This includes logistics such as room set up, as well as how the information is delivered. Each producer has a different issue to fix, and effective facilitators will incorporate this into their activity.

Successful programs have been identified as those with structures in place to ensure facilitators are trained and kept up to date with the latest in social sciences. This is a continuous process that filters down to regional advisors and facilitators. Respondent 17 notes that advisors and facilitators need the opportunity to review and refine the programs they deliver and take on board what worked and what didn't work to ensure future programs are developed in context of past ones. Advisors and facilitators need to be trained to take producers through the learning cycle and support them to implement practices on farm. This is a long-term process that offers the opportunity to include farmers and advisors in the co-development of programs.

4. Create relationships across the supply chain

Respondent 4 identified that in South Africa they have seen a shift of mindset in the industry from an individual and competitive approach to collaboration across the supply chain. They surmised that this was largely due to the next generation of advisors entering the workforce, as much of the older generation were resistant to collaborating. The 'get on with it' attitude of South African consultants, as shown by respondent 4 and 3 has resulted in roles across the supply chain simply recognising the need and successfully working together for the benefit of producers.

Over half of all respondents explicitly mentioned that relationships across the supply chain need to be established. Respondent 9 recognised that many people are not included in advisory efforts and advisors need to be more proactive in including roles such as farm employees and contractors as these are currently a blind spot in extension and advisory policy. Other roles, including stock agents, banks, seed companies, vets, accountants, and re-sellers were also identified as needing to be included in extension efforts. Respondent 13 attributed success within their programs to understanding the linkages with research priorities across organisations and ensuring that conflicting information across different organisations was minimised.

The end user's relationship with extension providers was identified by respondent 19 as being one of the most important determinants of why producers value being involved in programs. They avoid conflicts of interest by focusing on topics that are not covered by consultants and take a partnership approach to projects. At a regional level, it comes down to strengths of relationships. Respondent 8 identified that one of the success factors of their project is the ability to connect with a local, trusted presence to engage with the under-engaged parts of the community. Respondent 10 tackles this by

defining key relationships within the community, for example farmer-farmer or advisor-farmer and creating a community of practice around these relationships. Different approaches for different roles were used when building on the relationships. Online programs were identified as an option by respondent 13 to bring people across areas together.

Across all respondents who identified the entire supply chain as an area underutilised by extension providers, the need to develop trust and long-term relationships at a regional level was a key theme.

In summary, across all interviews, the discussions highlighted that the novel approaches and strategies utilised were based on common participatory methods to target and focus efforts as well as in constructing tailored messages for targeted communities. While there were innovative strategies in place to utilise known extension practices, the processes described were older or well-established ideas. However, when these are applied in a new context, this drives producer engagement and adoption. New or innovative programs do not have to be pioneers. In addition, key insights for monitoring and evaluation identified that a static or point in time process of evaluation is a poor way of assessing programs as the data does not capture the entire learning process. Meaningful data can only be captured over extended programs. It was therefore also recognised, that funding bodies could think longer term into program development timeframes and include capacity and flexibility in expectations to design, develop, monitor, refine and review rather than the now more frequent short term/fixed program timeframes. Having greater depth and breadth in program development and delivery will benefit funding bodies in the long term.

As a final part of this consultative process, interviewees were also asked to identify key programs or projects that offered practical examples of program approaches they deemed as successful, innovative or generating high levels of engagement and/or adoption. Six of these programs are presented as case studies in the next phase of consultation with the Stakeholder Reference Group.

Table 4: Summary of approaches and projects/programs from the consultation process

Respondent/Organisation(country)	Approach	Focus	Project(s) to note
1. Advisor, Australia	Producer-driven learning supported by facilitators over a long period of time	Training the extension providers on facilitation skills to enable the full learning cycle to occur.	Red Meat Profit Partnership, NZ Pulse Check, GRDC NB2 Lifetime Ewe South Australian Rural Women's Leadership Program
2. Advisor, Australia	Producer-driven learning supported by facilitators over a long period of time	Training the extension providers on facilitation skills to enable the full learning cycle to occur. Cooperative approach across industries.	Ayr Peninsula EP Ag program Red Meat Profit Partnership, NZ Dairy Australia focus groups Lifetime Ewe Extension 350, NZ
3. Advisor, South Africa	Involve everyone in the business in the process	Using accurate data to benchmark producers, with all people in the business having access to and understanding the information	
4. Intelact, South Africa	Promoting science as the hook	Developing support networks for producers to engage with along the whole adoption process	
5. Intelact, South Africa	Benchmarking	Business conference for farm owners, technical conference for farm managers and farm walks for everyone to look and learn	
6. NZ deer association (NZ)	Advance party groups	Motivation of producers to change practices to develop new markets.	Passion to Profit (P2P), Deer NZ
7. University outreach (Brazil)	Milk Family	Small family Farm diversification support	
8. Beef and Lamb NZ	Farmer Action Groups (1)	Increase % of farmers engaged in business improvement.	Red Meat Profit Partnership, NZ
9. AgriLink (EU)	Fast-Track peer mentoring	On-hand, rapid support and facilitation for Farm and advisory	SOLINSA project http://www.solinsa.org/ Living Labs

Respondent/Organisation(country)	Approach	Focus	Project(s) to note
	Living Laboratories	business support and problem solving. Policy changes- implications for new farm practices	DESIRA (Italy) Fairshare (Ireland) JAEE Special Issue (TBC)
10. AHDB (UK)	Behavioural science	Targeting messages to different producer segments and levels of capacity in: 4. Genetics 5. Farm Business Management 6. Future farming landscapes	
11. ACS, South Africa	Using a consultant network to coordinate activities	Benchmarking and study groups to engage with producers and increase adoption	
12. Large Herds Committee, South Africa	Train the trainers	Use high quality speakers for conferences, study groups and farmers days to draw producers in	
13. Cotton Info, Australia	Peer-to-peer support	Supporting and developing young consultants and advisors	Regional Young Farmer Network, NSW
14. Dairy New Zealand	De-centralised approach	Regional discussion groups over 12-months, short courses focusing on emotional intelligence, peer-to-peer learning	Biz Start, NZ Biz Grow, NZ Mark & Measure, NZ Emerging Leaders, NZ Extension 350, NZ Thriving Southland, NZ Inside Dairy, NZ Farm Tune, NZ
15-16. Young Farmers Business Program, NSW	Creating a sense of community	Activities based on what the participants want or need, supporting producers to feel like they are part of a movement	

Respondent/Organisation(country)	Approach	Focus	Project(s) to note
17.Dairy advisor, Australia	Flexibility in program design	Farmers decide what they want to learn about, and programs developed from that decision	People in Dairy Cups on, Cups off
18. Pork advisor, Australia	A range of delivery strategies in response to feedback / M&E	Not one size fits all – context, values, drivers across the whole supply chain	
19. Dairy NZ	Peer groups of young farmers	Facilitated groups that work with associated industries to enact change. Training leaders to take information back to regions	Biz Start, Biz Grow
20. i4Ag (UK)	Farmer Action Groups (2)	Microbial stewardship on livestock farms	
21. The National Agricultural Extension Service, Uruguay	3 areas of innovative activity	Ongoing short course training, Living Labs, farmer to farmer mentoring	
22. Nefertiti (EU)	Linking Demonstration farms across the EU	Using demonstration farms to support farmer-adviser-researcher engagement in fragmented and privatised advisory systems and complex problems.	

Interview consultations

Interview questions

1. Who/what programs are engaging young people well? How do they do it (channels, language, etc)?
    a. What are 3 critical success factors of this program/initiative?
    b. Are you able to provide any impact data (percentages of target markets reached) for these programs/initiatives?
    c. Are you able to suggest where we could find more information about these programs (i.e. grey literature)?
2. What considerations are given to M+E in these programs? What the M+E activities are/were conducted?
    a. (How) is M+E in-built into the program design and delivery?
3. Has this program/ initiative won awards or been recognized for a novel approach or impact by others?
    a. If so, what was the award and what did it recognise specifically?
4. Do your or does your organization use social media or other platforms to encourage producer-led discussion/conversations?
5. (How) does your organization coordinate extension activities across industries / silos? If so, how do you identify:
    a. program overlap / alignment
    b. different deliverers/ organisations
    c. how delivery is synergistic (i.e. all parties have their needs met)
6. How does your organization motivate producers and encourage appetite for change, learning and skill development before extending technical information?
    a. information on 'value proposition' for change for producers
    b. What incentives are provided or how are people incentivized to participate (including what is done to raise awareness and increase interest in change/adopting practice change)
    c. Do you/ did you use or apply insights from social science in your approach to turning curiosity into motivation and moving unwilling to willing (the mindsets for change)
7. What experience does your organization have with remote/extensive pastoral regions - how to manage distance in engagement and delivery?
8. Thinking about the last 18 months – what innovative approaches/strategies/changes has your organisation applied to continue engagement and delivery under COVID-19 restrictions?
    a. How effective have these approaches been to achieve practice change?
9. How does your organization engage with producers?

a. marketing and language - market segmentation and then motivation – targeting the motivation by their interests and characteristics

b. incentive-based adoption approaches compared to education and supported learning-based approaches (e.g. cows for Cambodia)

c. social licence

d. how is your messaging cognisant of external factors (drought, fires, financial changes on farm)?

10. Do you work with or involve commercial providers and/ or supply chain stakeholders in your extension programs?

    a. Why, how, what works, how to address conflicts?

11. In your industry/region what is the role of commercial providers and sales/products in extension and engagement?

    a. Do you have any evidence of effective involvement by them in adoption programs?

12. In your industry/region what is the role of the supply chain in extension and engagement, do you have any evidence of effective involvement in adoption program?

Table 5. Literature review Phase 1 – Summary table of articles, findings and consideration for implementation

Author (Year) Title (Country in Focus)	Extension program design	Engagement or marketing	Key idea or findings
Abell et al. (2015) A Framework for Identifying Implementation Issues Affecting Extension Human Sciences Programming (United States)	Y		We developed the multilevel Implementation Issues Framework (IIF) to guide the identification and analysis of factors contributing to the ability of a program model to achieve its intended outcomes. The four implementation spheres of influence (program participant, program staff, organisational climate, and community) orbit around the conceptual design-in-action, illustrating the idea that factors found within each sphere may impact and be impacted by issues in one or more of the other spheres. The IIF can be used to complement logic models, inform process evaluation efforts for new and multisite programs, and support the implementation of evidence-based programming. Check relevance. Model untested.
Akrong, et. al. (2020). Youth agripreneurship in the horticultural value-chain: The case of small-scale mango farmers in Southern Ghana (Ghana)	Y	Y	A multistage sampling technique was used. Data were analysed using descriptive statistics and the binary logit econometric model. Findings revealed that age, education, and access to credit and extension services motivate youth participation in agriculture. They recommended that development partners provide credit facilities and capacity development through agricultural training and extension services to enhance youth participation in high value markets.
Alomar R. (2017) Drawing Together: Using sketchbooks to gain insight on a program's effectiveness (United States)	Y		Discusses the use of sketchbooks and drawing together as part of a healthy garden healthy living program especially good for working with children. But in this case was used with homeless clients of a soup kitchen Participants are asked as a group to sit and draw what they did today and discuss. New Insights on the programs utility and effectiveness were captured that would not be captured by usual evaluation processes.
Anderson, et. al. (2019). Genetically Engineered Crops: Importance of Diversified Integrated Pest Management for Agricultural Sustainability (Global)	Y	Y	The sustainability and versatility of pest management plans (IPM) can improve by incorporating technologies like integrated pest management (IPM), genetically engineered (GE) crops, insect resistance management (IRM), integrated weed management (IWM), and genetically modified (GM). The benefits of a successful IPM strategy, including reduced application of broad spectrum chemical pesticides, more durable pest management in ecologically balanced crop production systems, and reduced risks to human health and the environment, are clear. For this, GE crops represented a valuable tool.

Angima & Carroll (2019) Recruitment and Onboarding Resources for Extension in the West (United States)	Y	Y	Extension program leaders in the West have developed an online resource to support recruiting and onboarding of new Extension professionals. Components of the resource include summaries and short videos featuring Extension professionals discussing Extension work, Extension's history, community relationships, professional expectations, and program assessment. These elements are intended to support each state's recruiting and mentoring programs and to foster a more cohesive approach across Extension for recruitment, onboarding, retention, and program assessment. Assessment is based on website metrics: pageviews, unique pageviews, page entrances, average time of page.
Anjola-Oluwa & Benjamin (2019) Listenership of Latoju Oja Radio Extension Programme among Farmers in Oyo State, Nigeria (Nigeria)	Y	Y	This study assessed the listenership of Latoju Oja radio programme among farmers in Oyo state, Nigeria. Ninety farmers from three local government areas were randomly interviewed and data was analysed using descriptive and inferential statistics. The Latoju Oja radio extension programme is aimed at making relevant market information available to market participants, ensuring awareness of several prices of agricultural commodities across the five agro-ecological zones. A significant relationship existed between level of education, benefits derived and listenership of Latoju Oja radio programme.
Arnall (2021). Walking with farmers: Floods, agriculture and the social practice of everyday mobility (Mozambique)		Y	The focus was understanding the role of human agency by illuminating the role of perception, action and decision- making in the everyday when undertaking environmental migration using an innovative walking methodology. This research presents an empirical case study of regularised farmers' movements in and out of a floodplain during the rainy season in central Mozambique to show how people's day-to-day routes are continuously reproduced through meaningful encounters and engagements with physical obstacles and other people.
Arnold et al. (2017) The Impact of a Campus-Based 4-H Summer Conference Program on Youth Thriving (United States)	Y		This paper tests the fit of a new program model, the 4-H Summer Conference program, beyond the context in which it was developed. The model is based on youth development research, to describe and evaluate the impact of 4-H on youths. Survey data was collected on 'thriving indicators'; a) openness to challenge and discovery, b) hopefulness for the future through college aspiration and motivation, c) prosocial development, d) positive emotionality, and e) intentional self-regulation. The study demonstrates how research can be translated into a program model that can be tested and used for program planning, evaluation, and improvement. Check relevance.
Ataei et al. (2021) Discriminant analysis of the participated farmers' characteristics in the conservation agriculture project based on the learning transfer system (Iran)	Y		The learning transfer system (LTS) is defined as the 'individual, educational and organizational components that affect learning outcomes on work performance'. The components are organised into four categories; trainee characteristics, motivation factors, environmental elements, and ability; each measured by a set of variables. The findings illustrated nine variables of LTS had significant effects on the level of farmers' learning transfer. It can be concluded that the learning transfer system is an applicable tool to investigate farmers' learning transfer in the agriculture sector.

Bamka et al. (2020) Ask the Ag Agent Weekly Webinar Series: Agriculture-Focused Response to the COVID-19 Pandemic (United States)	Y	Y	A weekly webinar series titled 'Ask the Ag Agent' was developed to share timely information with the agricultural community. The use of web-based platforms facilitated significant networking opportunities between farmers, agencies, and not-for-profit organizations. The format provided us the opportunity for real-time needs assessment and provision of resources and programs much faster than traditional activities. The program demonstrated that Extension programming can be adapted using web-based options to provide timely, science-based information
Barnes & Coatney (2016) Maximising the Economic Value from Facebook Marketing in the Agri-food system: Boosting Consumer engagement Through Contests (United States)		Y	B2C program, used a boosted post to promote cop-op and a competition to grow views
Bayala, et. al. (2021). Multi-Actors' Co-Implementation of Climate-Smart Village Approach in West Africa: Achievements and Lessons Learnt (West Africa)	Y		Development strategies focusing simultaneously on adaptive farming, productivity, and reducing greenhouse gas (GHG) emissions-known as climate-smart agriculture (CSA) strategies-are key to responding to climate change and variability challenges. This paper discusses the Participatory Action Research (PAR)- CSA methodology. Findings proved that this methodology deliver tangible outputs at the technical level by linking new techniques to their appropriate uses. Context-specific agricultural technologies and practices were tested and proven adaptable to both climatic and socioecological circumstances. There are several favourable parameters for CSA expansion, including, but not limited to, engaging youth, experienced stakeholders, and CSA alliances in the region. These factors could help accelerate large-scale promotion and adoption of CSA practices for both West Africa's dry and humid areas.
Beecher & Hayungs (2017) Getting your message across: Mobile phone text messaging (United States)		Y	Introduces SMS marketing tools and mass text messaging in extension programming- phones are more accessed than social media. Twitter was more effective than SMS to increase readership of a blog. Specific texts supporting a class activity that the participant was already involved in were more effective at generating action
Berger et al (2019) Financial Impact of Penn State Extensions Know your numbers Dairy Program (United States)	Y		Using before and after financial data from producers who participated in a dairy financial planning extension program, they were able to estimate the financial impact of the program in terms of state economy and jobs using https://implan.com/
Berven et al. (2020) Investing in extension's workforce: Assessing and developing critical competencies of new agents (United States)		Y	Identifies soft skill competencies required in Extension professional. Technical skills are a given. Used expert panel to identify competencies, developed assessment for competencies, and developed a range of e-course resources on the competencies e.g., business writing, presentation skills, conflict resolution etc
Bhaskara, et. al. (2021). Societal Digital Platforms for Sustainability: Agriculture (India)		Y	Describes an interactive information system in real time to provide agricultural information to farmers to increase yields, reduce or optimize farm inputs, inform farmers about markets and government policies, and enable digital literacy among farmers, which would eventually

			enhance rural incomes. Farmer clubs were created at the village level to increase engagement in the program and to access information. A call-in help centre enabled farmers to get information in real time. In addition, a digital platform named eKisaan delivered relevant and contextual information in the local language, mostly in the video format via mobile and cloud technologies. The combined incremental savings and incremental earnings resulted in increased income after 18 months. Over time, costs can decrease by spreading fixed costs over several years, with benefits reaching more farmers. Thus, the digital systems focused on information alone can be cost-effective, reduce inputs, increase productivity and income, and foster sustainability.
Bowen, et. al. (2019). The digital divide: Implications for agribusiness and entrepreneurship. (Wales)		Y	This paper investigates the impact of broadband access on agribusiness in rural Wales and the resulting implications on entrepreneurial activity. Survey results highlighted issues of technology adoption, with 19% of farmers in the survey having no access to broadband internet, with others reporting the speed of connection being a limiting factor. The consequences of poor connectivity point to limited computer skills and low levels of soft technology adoption, a lack of engagement with social media, limited scope for innovation and restricted business growth, with 55.1% of food respondents identifying poor broadband access as a barrier to internationalisation.
Bradford, et. al. (2020). Incorporating social dimensions in hydrological and water quality modelling to evaluate the effectiveness of agricultural beneficial management practices in a Prairie River Basin (Canada)		Y	Explores the value of combining both qualitative and quantitative methods and social science data to enhance salience and legitimacy of watershed models so that end-users are more engaged. Mixed-method workshops with agricultural producers gathered feedback on the developing model and the incorporation of social determinants affecting decision-making. Farmers' engagement was explored with models testing Beneficial Management Practices (BMPs) and the potential of incorporating their decision processes within the model itself. Recommendations from this research that support adaptive decision-making on farms, and across watersheds and basins: "1. Simulations models for BMPs in agricultural contexts need to consider the scale at which they will be applied. It is the desire of the participants from the QRB to be able to look at their own landholdings and waterways as well as at the watershed scale. 2. Simulation models can incorporate human dimensions through the use of Q methodology studies which help to establish perspectives and important drivers not otherwise included in physical science–based modelling. 3. Simulation models benefit from users working on them in workshops with modelers present so they can learn from each other face-to-face. 4. Participants are interested in including economic information such as benefits, or costs related to full or partial implementation of individual or a combination of certain BMPs to help realistically plan for the future and recognize when to change the dynamics of their implementation plans."

Brown et. al. (2021). Application of innovation platforms to catalyse adoption of conservation agriculture practices in South Asia (Australia)		Y	Conservation agriculture-based sustainable intensification (CASI) is a package of practices that could improve the sustainability of smallholder farm productivity and profitability. This paper examines the utility of 'Innovation Platforms' (IPs) as a tool to catalyse adoption of CASI for smallholder farmers in South Asia and generate opportunities for rural micro-entrepreneurship in areas with high rates of poverty, small farm sizes and complex labour markets. IPs were effective in developing trust in communities, among stakeholders, empowering rural youth and women through direct engagement.
Calliera, et. al. (2021). Multi-actor approach and engagement strategy to promote the adoption of best management practices and a sustainable use of pesticides for groundwater quality improvement in hilly vineyards (India)		Y	A multi-actor approach and engagement strategy using participatory training, Demo farm and monitoring to prevent groundwater contamination by Plant Protection Products (PPPs) was developed. This strategy was successful in improving attitudes to more sustainable practices. This is supported also by the monitoring data that show in 2019 a decrease by 44% of pesticides occurrences and a fall by 68% of values above EQSgw if compared with the period 2017–2018. All actors with a role in water governance and use were involved. Surveys campaigns were developed for the evaluation of BMPs and MMs adoption by farmers. Farmers are not completely aware of the water benefits given by adoption of Best Management Practices (BMPs) and Mitigation Measures (MMs.) Proactive information about challenges in water quality are essential for BMPs adoption.
Campling, et. al. (2021). A multi-actor, participatory approach to identify policy and technical barriers to better farming practices that protect our drinking water sources (Europe)		Y	Protection of drinking water from nutrients and pesticides requires a good uptake of Best Management Practices (BMPs). The uptake of BMPs was assessed by a participatory approach across Europe. Barriers preventing the uptake of obligatory and voluntary BMPs were identified. Barriers were related to policy tools at the national and European scale. Social acceptance among all actors and communication was required right from the start.
Chazdon et al. (2016) From Knowledge to Action: Tips for Encouraging and Measuring Program-Related Behavior Change (United States)	Y		Outlines behaviour change evaluation using the 'action items method', which requires program participants to define their own action plans as part of a program and asks about completing these goals. The components of the method include program delivery enhancements, program evaluation enhancements, post-program enhancements, and a feedback loop. Check relevance. Model is untested.
Ciacca et. al. (2021). Organic Agroforestry Long-Term Field Experiment Designing Trough Actors' Knowledge towards Food System Sustainability (Italy)		Y	This study reports the experience of co-designing a new Long-Term Experiments (LTEs) in Southern Italy by local actors and scientists. Through a participatory action research methodology, an LTE was considered as a biophysical component of an agroecological living lab, a public–private environment aimed to design a local food system. The setup of parallel field trials in satellite farms stands for the other biophysical component, whereas the stakeholder platform represents the social one. The implementation of research topics in parallel field trials of the satellite farms (AP network) allows us to move from the field to farm scale and maximize the impact of the activities to a territorial/local one. Findings revealed that three major domains for the agroecological transition take place, namely (i) adaptation

			of agricultural practices, (ii) conservation of biodiversity (including traditional cultivar valorization) and natural resources, and (iii) development of embedded food systems, so defining the ALL as an Agroecological Territory.
Cobon et al. (2021) Northern Australia Climate Program: supporting adaptation in rangeland grazing systems through more targeted climate forecasts, improved drought information and an innovative extension program (Australia)	Y	Y	Engagement involved information provision through quick presentations, newsletters, websites, and tools. Extension involved dialogue-based activities involved interactive workshops and targeted discussions and between farmers and advisors. NACP focussed on the climate information needs of industry stakeholders is communicated, through the NACP extension team, to the NACP research and development teams to inform more targeted product development. Content delivered by NACP extension is tailored by region and season to meet the needs of user
Conway et. al. (2021). Going against the grain: Unravelling the habitus of older farmers to help facilitate generational renewal in agriculture (Ireland)		Y	Limited uptake of financial incentives, designed to confront global trends of an ageing farming population and low levels of land mobility, reveal resistance or at best ambivalence, amongst farmers towards altering existing farm management and ownership structures in later life. A multi-method triangulation methodology was employed to obtain in-depth understandings of the senior generation's deeply embedded views, and the changes they perceive will occur upon their engagement in the process. Findings reveal that the attitudes and behaviour required to 'step aside' and retire from farming not only 'go against the grain' of the older farmers' habitus, appearing to be instinctively 'wrong', they also appear incompatible with what is necessary to earn recognition as a 'good farmer'. The article concludes by recommending that a shift in thinking towards succession and retirement must be confronted at an earlier life stage in order to inculcate a new farming habitus.
Cordoba et al. (2018) Repro Money: An Extension Program to Improve Dairy Farm Reproductive Performance (United States)	Y		A collaborative team of scientists and extensionists applied the management team model to Repro Money, a farmer-directed, team-based Extension program. Farms that enrolled in the program formed reproductive performance teams, assigned specific responsibilities, set team goals, developed action plans, and determined evaluation strategies. Survey data was collected at the first team meeting; on farm production characteristics, reproductive management, and health assessment; and last meeting on reproductive performance and accomplishment of goals. Herd performance and economic outcomes were measured for each team. The design of the Repro Money Extension program was based on a farmer-directed, team-based approach that consisted of an initial assessment, identification of areas for improvement, goal setting, implementation of an action plan, and a final evaluation. Results from Repro Money demonstrate the benefits of a team-based approach to increasing reproductive performance and profitability. Participant evaluation of program not reported.
Coyne et. al. (2021). Identifying economic and societal drivers of engagement in agri-environmental schemes for English dairy producers (England)	Y		Focuses on a small number of commercial dairy producers located in the North West of England who were all suppliers of a global food producer and members of the producer's own private agri-environmental schemes (AES). The study explored the economic and

			societal drivers of adoption of agri-environmental behaviours and perceptions of the private processor AES. Overall, farmers felt that income from the private AES provided stability and resilience to their businesses, permitting them to have greater confidence in business planning and budgeting for the upcoming year. The majority of the farmers were not part of a public AES but were already undertaking some agri-environmental behaviours and were motivated to join the private scheme primarily by financial incentives and by a desire to maintain the natural environment. Decisions over which agri-environmental behaviours to adopt were driven by the existing animal management practices, geography and landscape of the farm.
Crayton (2018) The Event Horizon for the Horizon report: Inclusivity in Extension Programs (United States)	Y		Discusses the issue of white male biases for STEM and extension professionals in reference to the Horizon report (NMC Technology Outlook for Cooperative Extension 2016–2021) an emerging technology foresight report) Adoption of emergent technology is hindered by inequality in STEM. Discusses avoiding mixed gender classes, recruiting culturally diverse extension professionals addressing the fact extension professionals can be culturally diverse etc
Criessen, et. al. (2021). Identifying the drivers and constraints to adoption of IPM among arable farmers in the UK and Ireland (United Kingdom)		Y	This study used an extensive farmer survey to address both these issues. Adoption levels of various Integrated pest management (IPM) practices varied across the sample depending on a range of factors relating to both farm and farmer characteristics. Positive relationships were observed between IPM adoption and farmed area, and familiarity with IPM. Choice of pest control information sources was also found to be influential on farmer familiarity with IPM, with those who were proactive in seeking information from impartial sources being more engaged and reporting higher levels of adoption. Policies that encourage farmers to greater levels of engagement with their pest management issues and more proactive information seeking, such as through advisory professionals, more experienced peers through crop walks, open days and discussion groups should be strongly encouraged.
Cross, et. al. (2017). Exploring Agroecological Sustainability: Unearthing Innovators and Documenting a Community of Practice in Southeast Australia (Australia)	Y		Describes a movement to regenerate and sustainably use native grasslands using innovative grazing and cropping strategies. We find that this movement has the essential characteristics of a “community of practice” (COP) and is a strong example of a bottom-up transition toward a sustainable agroecological farming system. This COP was identified and described using participatory rural appraisals followed by biophysical and sociocultural studies with active COP members. Using these multiple mixed-method approaches helped characterize the COP’s many layers, revealing how and why it is driven and fashioned by innovators who collaborate via joint enterprise, mutual engagement, and shared repertoire. Holistic Management, Grazing for Profit, and Stipa Native Grasses Association were the key enabling programs/associations for the COP, which, like other agroecological movements, exists on

			the margins of conventional agri-innovation systems and endures with little public acknowledgment or support.
Das, et. al. (2021). Usability and effectiveness of new media in agricultural learning and development: a case study on the southern states of India (India)		Y	Aims to socially transform and bring behavioural change among the farmers of southern India through the usage of new media to prevent suicides. The research has gauged the factors that affect new media accessibility and usability, hindrances in the process and change of farmer's behaviour through online social marketing bringing social transformation. The study is action participatory in nature, and the data is triangulated by conducting a survey at the first level using the Delphi technique among 184 rural south Indian farmers who are smartphone users use new media, and at the next level, the farmers were requested to use WhatsApp for agricultural new sharing, and in the last stage, personal interview with entrepreneurs and farmers has been conducted to understand their new media adoption, e-learning and online social marketing. New media is the best way to transform agricultural practices socially. It is a forum where all the farmers of the country can get together and address the issue of the agrarian crisis. Online social marketing (OSM) through WhatsApp is one of the best methods of behavioural change because different farmers can share their experiences and emotion for the crisis and give an appropriate solution to a problem. And, one of the most important features of OSM is it removes third parties from miscellaneous issues be it selling, buying or seeking and sharing information.
Davis et al. (2020) Using Virtual Reality Equipment to Enhance Learning in Extension Youth Programming (United States)		Y	This article provides information on how to use virtual reality equipment to increase participant engagement as well as suggestions for incorporating virtual reality activities into Extension youth programming. Check relevance. No M&E.
Diaz et al. (2020) Evaluation competencies and challenges faced by early career extension professionals: developing a competency model through consensus building. (United States)	Y		To examine the evaluation competencies extension professionals, need to develop and the challenges faced by early career extension professionals when they evaluate their extension education programs. Not relevant.
Dill et al. (2015) Factors affecting adoption of economic management practices in beef cattle production in Rio Grande do Sul state, Brazil (Brazil)	Y		To understand the factors affecting the adoption of economic management practices, 73 farmers were interviewed in the Rio Grande do Sul State, Brazil. A probit model was estimated to identify farmers' characteristics, access to information, and production and economic characteristics that affect the adoption of economic management practices. Farmers with large landholdings and diversified production are less likely to adopt such practices. Internet access, participation in farmer associations, receiving technical assistance, number of cows bred annually, weaning rate and utilization of the birth to slaughter system, positively affect the probability of adoption. Few workshops and training programs on farm management are offered to farmers, therefore information presented might be useful to motivate the development of extension programs which consider farmers' characteristics.

			Snowball sampling was used to identify farmers who were potential adopters, then any other farmer. Data collection involved survey and interview methods.
Doll et al. (2018) Using dialogue to engage agricultural audiences in cooperative learning about climate change: A strategy with broad implications (United States)		Y	Dialogue based extension Michigan University used an interdisciplinary group (extension professionals and educators) to develop the Carbon, Energy and Climate series of facilitated discussions, Stakeholder shared their thoughts on climate change and the changes they have made in management practice as a result then extension and educator staff shared new research of climate impacts on agriculture. Discuss both sides of any differences in opinion Also used these forums as a way to identify new research opportunities. Each event was audio recorded transcribed analysed with NVivo to highlight themes and followed up with pos session surveys
Dooley, (2020). An Ethnographic Look into Farmer Discussion Groups through the Lens of Social Learning Theory (England)		Y	Participants cite numerous benefits from Farmer discussion groups (FDGs), e.g., economic, social, etc., but how learning happens in these contexts from an adult cognitive learning theory perspective is not well understood. Thus, Bandura's social learning theory was used to study seven FDGs in the South West of England. The results from 12 months attending FDG meetings demonstrated that behaviour modelling and role modelling were present in all FDGs. Self-reflexivity, however, was not evidenced as being promoted by all groups' interactions, which (facilitated) critical discourse amongst the FDG participants was found to foster. Thus, evidence of social learning was not found to be occurring as a result of all the FDGs' interactions.
Downey et al. (2015) The Systematic Screening and Assessment Method: An Introduction and Application (United States)	Y		The study promotes Systematic Screening and Assessment Method (SSA) as a cost and time efficient method for identifying extension programs. SSA is an approach that scans and assesses the professional landscape for programs using pre-determined criteria. The steps involved in SSA include topic selection, scan for programs, screen programs, conduct assessment of evaluability, review rate of interventions, use information to inform program evaluation. SSA was used to identify and assess the merit of health living programs in the areas of nutrition; physical activity; alcohol, tobacco and other drugs. The resulting identification and assessment of healthy living programs not reported.
Ellis et al. (2019) Method for Monitoring Quality of Extension Programs: A Dashboard Construction Process (United States)	Y		This article outlines the 'dashboard construction process'. for monitoring the quality of in-person nonformal education programs. The dashboard process selecting performance measures, choosing data collection strategies, designing the content and layout of the dashboard, collecting data, and populating the dashboard with performance metrics. The process was developed a 4-H special interest club dashboard. Check relevance. No M&E.
Ezeh et al. (2021) Extension Agents' Use of Mobile Phone Applications for Agricultural Extension Service Delivery in Ebonyi State Agricultural Development Programme, Nigeria (Nigeria)	Y	Y	This study assessed extension agents' use of mobile applications (apps) for extension service delivery. The results of the analysis showed that the most utilized mobile apps for extension service delivery were WhatsApp (76%) and Facebook (53%). However, the use of mobile apps for extension service delivery were limited as a result of unavailability of network coverage in

			rural area (84%), lack of institutional policy for application of mobile apps in extension service (75%), low ownership of smartphones among farmers (73%), poor farmers' knowledge on the use of mobile apps (67%), and poor internet connectivity (66%). Check relevance. Context, limited M&E.
Febria, et. al. (2020). Partnerships Generate Co-Benefits in Agricultural Stream Restoration (New Zealand)		Y	Shows how an initial progress by a sole farming family at the Silverstream in the Canterbury region, South Island, New Zealand, was used as a catalyst for change by the Canterbury Waterway Rehabilitation Experiment, a university-led restoration research project. Partners included farmers, researchers, government, industry, treaty partners (Indigenous rights-holders) and practitioners. co-benefits included lowered costs involved with large-scale actions (e.g., earth moving), reduced pressure on individual farmers to undertake large-scale change (e.g., increased participation and engagement), while also legitimising the social contracts for farmers, scientists, government and industry to engage in farming and freshwater management. These actions were scaled from a single farm to multiple catchments nationally.
Fielke et al. (2018) Lessons for co-innovation in agricultural innovation systems: a multiple case study analysis and a conceptual model (New Zealand)	Y		Three cases are examined to understand the components that shape the performance of innovation projects and identify the key elements of successful co-innovation. A conceptual model is developed to better align projects within the broader system strategies and designs for innovation. The model incorporates structural (actors, interactions, institutions, and infrastructure) and functional elements (entrepreneurialism, guidance, and markets; sources and diffusion of knowledge; balanced expectations and resource mobilisation) that contribute to co-innovation. The findings suggest that when key functional elements were present, a greater likelihood that co-innovation project outcomes could be achieved.
Friedl S.E., Ober H.K., Stein T.V., Andreu M.G. Modernising Training Options for Natural areas managers (United States)	Y		Discusses the conversion of traditional face to face workshop delivery of extension to hybrid sessions 24 hour instruction formats delivered initially as 3 day face to face then as 2 day online I day in person and 1 day online 2 day in person. Used Blackboard a free online app for delivery of training. Hybrid course delivery was rated as better than 100% face to face particularly relevant because of COVID travel restrictions. Also attractive to participants as they could absorb online content at their own pace and then engage in the fact to face sessions more prepared
Gardner et al. (2018) Assessing the Educational Needs of the Pennsylvania Wine Industry (United States)	Y		The study collected online survey data on skill level, varieties, and styles of wine, wine-making production challenges, and best practices for addressing extension program needs. The survey was disseminated via email to wine industry members. To meet the needs of hobbyists, a blog created to improve exposure to reputable, science-based information and present important principles in an applied and less technical way. Blogs offer opportunities for extension to be successful in delivering information. Check relevance.

Gates, et. al. (2021). Factors influencing the performance of voluntary farmer disease reporting in passive surveillance systems: A scoping review (Global)		Y	Farmer engagement with voluntary disease reporting can increase with a robust animal health surveillance system in place and farmer´s prompt awareness of clinical signs and taking more active role. Some measures that can be implemented from a proactive biosecurity culture point of view for disease-agnostic can be reducing the volume and frequency of animal movements, installing double-fencing on shared field boundaries, and thoroughly cleaning any vehicles, equipment, or clothing that have been in contact with animals are routinely implemented by farmers to prevent pathogens from spreading through common transmission pathways.
Gbangou, et. al. (2020). Coproducing Weather Forecast Information with and for Smallholder Farmers in Ghana: Evaluation and Design Principles (Netherlands)		Y	Developing more useful and accessible weather and climate information services (WCIS) can help small-scale farmers improve their adaptive capacity. The literature suggests that such WCIS can be achieved if forecast information is produced jointly by farmers and scientists. This research tests this hypothesis by evaluating the outcomes of an experimental coproduction of weather forecasts in Ada, Ghana. The experiment involved a user-driven design and testing of information and communications technology (ICT)-based digital (smartphones and apps) and rainfall monitoring tools by 22 farmers. Results showed a positive evaluation of the intervention, expressed by the level of engagement, the increase in usability of the tools and understanding of forecast uncertainty, outreach capacity with other farmers, and improved daily farming decisions. The success of the intervention was attributed to the iterative design process, as well as the training, monitoring, and technical support provided.
Gebremariam et al. (2021) Determinants of Farmers' Level of Interaction with Agricultural Extension Agencies in Northwest Ethiopia (Ethiopia)	Y		This research identifies critical determinants for interactions between farmers and extension agencies. Cross-sectional farm household-level data from three hundred household heads were collected between September 2019 and March 2020 and triangulated with data from workshops with farmers and extension agents. Farmers' socio-economic characteristics significantly affect their degree of interaction with extension agencies. Although personal and demographic characteristics are important, farmers' interaction levels require conducive institutional and household assets, groups/social capital and access to extension agents' contexts. Check relevance. Context.
Grand et al. (2019) How the woodland stick benefits Oregon family forestland owners and extension volunteers (United States)		Y	The Woodland Stick is a simple and cost-effective tool that forest landowners can easily use to obtain rough estimates of average tree size and wood volume on their properties. The Woodland Stick was originally developed in 1966 by the Soil Conservation Service to combine the Biltmore Stick, which can be used to measure tree height and diameter (Jackson, 1911), with soil and tree productivity information (U.S. Department of Agriculture Soil Conservation Service, 1966). Simple tool with good adoption rates according to post workshop training surveys

Guo et al. (2018) Impacts of Distance Education on Agricultural Performance and Household Income: Micro-Evidence from Peri-Urban Districts in Beijing (China)	Y		This paper assesses the impact of a distance education program on agricultural productivity, using information communication technology (ICT). The ICT-based extension service is associated with increases in agricultural productivity via distance education. The study considers the effect of crop type, district and household characteristics, when measuring the impact of the program. Differences between these factors highlights the importance of implementing inclusive ICT-based services.
Gupta et al. (2020) Designing better input support programs: Lessons from zinc subsidies in Andhra Pradesh, India (India)	Y		This paper evaluates the performance of an input support subsidy, the micronutrient subsidy program in Andhra Pradesh and presents a case for providing this support in the form of direct cash transfers. Check relevance. Context.
Gupta et al. (2021) Strategic Communication in Health and Development: Concepts, Applications and Programming (International)	Y		Experience and research studies demonstrated that mere 'awareness' was not adequate for fostering adoption of 'new' practices; instead, it required sustained investments in communication for social and behavioural change processes. For this, bottom-up communication design, participatory communication with community involvement, evidence-based advocacy and preparedness for risk communication are required for effective communication and health and development. The article attempts to analyse the approaches and shed light on the role of communication in health and development, especially in the context of health crisis.
Haider et al. (2015) Growing Green Energy: A Review of Extension's role in the Development of Advanced Biofuels (United States)		Y	Very targeted comm to extension professionals about tackling grower and community barriers for growing biofuel crops. In general, there is low understanding of biofuel production and benefits, and extension professionals can be the reliable source of information Extension educators at the University of Wisconsin-Madison developed computer software that allows users to estimate community impacts based on expected benefits resulting from the siting of a local biorefining plant. This program allows users to evaluate community impacts based on plant employment opportunities, plant sales, and the income earned by plant employees.
Hamilton, et. al. (2019). I don't go to Meetings: understanding farmer perspectives on bovine TB and biosecurity training (England)		Y	Farmers were interviewed at agricultural shows, their comments analysed and the frequency of words in use were measured to produce a set of common themes. This thematic analysis provides an illustrative rather than representative picture of farmer opinions yet holds significant explanatory value for understanding the apparent lack of engagement with biosecurity training. Broad-ranging farmer perspectives can be understood through a 'typology' of feelings about bovine tuberculosis (bTB), particularly expressions of blame, loss, confusion, ignorance, resignation and fear. The cumulative effect amounts to one of overwhelming negativity, explaining why so many farmers disengaged from training provision; a finding with relevance and value for the way training providers plan future communication methods in relation to biosecurity risk mitigation.

Harden et al. (2021) Decentralize Your Dollars: Incorporating Participatory Grant Making into Resource Allocation Decisions (United States)	Y		Participatory grant making is a concept that can support decentralized decision making, shared power, and racial equity in Extension programming. The underlying philosophy of participatory grant making is to empower individuals and communities with flexibility and support to make collective decisions about financial resources. In this article, we draw on our experiences and provide concrete examples to demonstrate the power of this model for improving Extension programming and internal procedures. We conclude that the concept could be adapted for an array of financial decision-making settings to help Extension stay relevant and rooted in the communities we serve. Not relevant. Recommendation, not applied.
Hassanzadeh, et. al. (2019). A framework for engaging stakeholders in water quality modeling and management: Application to the Qu'Appelle River Basin (Canada)		Y	Proposes a framework to understand and incorporate stakeholders' viewpoints into water quality modelling and management. The framework was applied to the Qu'Appelle River Basin, Saskatchewan, Canada. Q-methodology was used to understand viewpoints of stakeholders, namely agricultural producers (annual croppers, cattle producers, mixed farmers) and cottage owners, regarding a range of agricultural Beneficial Management Practices (BMPs) that can improve water quality, and to identify their preferred BMPs. A System Dynamics (SD) approach was employed to develop a transparent and user-friendly water quality model, SD-Qu'Appelle, to simulate nutrient loads in the region before and after implementation of stakeholder identified BMPs. The SD-Qu'Appelle was used in real-time engagement of stakeholders in model simulations to demonstrate and explore the potential effects of different BMPs in mitigating water pollution. Results show that although there are differences between viewpoints of stakeholders, they identified wetland restoration/retention, flow and erosion control, and relocation of corrals near creeks to sites more distant from waterways as the most effective BMPs for improving water quality. Economics was identified as a primary factor that causes agricultural producers to either accept or refuse the implementation of BMPs. Agricultural producers believe that incentives rather than regulations are the best policies for increasing the adoption of BMPs.
Higgins, et. al. (2017). Ordering adoption: Materiality, knowledge and farmer engagement with precision agriculture technologies (Australia)		Y	This applies theoretical work on ordering, which focuses on the materially heterogeneous processes and implicit strategies that hold together and perform particular social and organisational arrangements. Drawing upon qualitative data from a research project on adoption of precision agriculture (PA) in the Australian rice industry, we identify two principal modes of ordering: (1) commercial-technological, in which lack of compatibility between technologies produced by different machinery manufacturers creates challenges for farmers in integrating and adapting PA to existing farming practices and systems; and (2) biophysical, where drought and low water allocations create uncertainty and a reluctance by farmers to make large capital outlays for PA technology. While these modes of ordering constrain rice growers' capacities to adopt PA technology, we argue that growers also engage in their own

			alternative ordering practices to negotiate, work with, and work around these constraints. We refer to this work as tinkering and argue that it is a powerful, yet little recognised, form of ordering enabling growers to take advantage of the material benefits of PA in a way that is flexible, adaptable, and fits their immediate farming circumstances.
Hill et al. (2017) Evaluation of knowledge transfer; conceptual and practical problems of impact assessment of Farming Connect in Wales (United Kingdom)	Y		Comparison of two evaluation methods for knowledge transfer via Farming Connect (FC): a) the 'naïve' approach of asking farmers about impacts on their business, and b) the 'quasi-experimental' approach of comparing samples of beneficiaries and non-beneficiaries. Results evaluating the impact FC showed disparity between the two approaches, the 'naïve' approach returned broadly consistent positive impacts, compared with a lack of apparent impact shown by the 'quasi-experimental' approach. Caution is recommended when considering results from evaluations which depend on the 'naïve' approach.
Ivey and Myer (Ivey & Myer, 2019) Use of a Timely Topics Web Tool to Enhance Research-Based Extension Program Impact (United States)		Y	The Timely Topics Web (TTW) tool has four main components: a) general title and optional tagline, b) feature topic summary, c) central image relevant to the feature topic, and d) hotspot-linked images and associated text. Website metrics (page views, unique page views, time on page, bounce rate) suggest positive impact of TTW.
Jack et al. (2020) Investigating the Drivers of Farmers' Engagement in a Participatory Extension Programme: The Case of Northern Ireland Business Development Groups (United Kingdom)	Y	Y	Farm Business Development Groups (BDGs), a participatory advisory service, were established with a focus on 'peer-to-peer' learning. The study explored/analysed farmer decisions around participation in the BDG program, in relation to farmers characteristics: farm/herd size, farmer age and gross margin. Larger farmers who are younger were more willing to participate in the program, motivated by improving farm performance. Farmers value the opportunity to discuss farm performance to obtain and share knowledge with their peers. Although farmers were paid to participate, this was less important. Engagement in participatory extension relies upon skilled facilitation, and the provision of adequate, technical information. Design and delivery of participatory extension programs should consider the different characteristics of farmers.
Jack, et. al. (2020). Investigating the Drivers of Farmers' Engagement in a Participatory Extension Programme: The Case of Northern Ireland Business Development Groups (Ireland)	Y	Y	In order to drive sustainable agricultural production systems that address farm-level economic and environmental objectives, the College of Agriculture, Food and Rural Enterprise (CAFRE) in November 2015, developed a new participatory extension programme for farmers in Northern Ireland, the Business Development Groups (BDGs). This paper examines and analyses the drivers of farmers' decisions in relation to joining and participating in this new approach to farm extension, learning and advisory service provision. Making use of data from both primary and secondary sources, this study employs a mixed-methods approach which involves an empirical analysis of quantitative and qualitative data to examine the factors influencing membership of the BDG programme. The results of our analyses show that larger, more intensive farmers who are keen to access information from

			other farmers to improve their business performance are most likely to participate in the BDG programme.
Jiao, et. al. (2020). Science and Technology Backyard model: implications for sustainable agriculture in Africa (China)	Y	Y	This study analyses the Science and Technology Backyards (STBs) model, used in China, and investigated its use for the transformation of agriculture in Africa. Some key lessons for sustainable crop intensification in Africa can be found from analysis of the STB model which is well established in China. These include (1) scientist-farmer engagement to develop adaptive and innovative technology for sustainable crop production, (2) dissemination of technology by empowering smallholders, especially leading farmers, and (3) the development of an open platform for multiple resource involvement rather than relying on a single mechanism.
Kansiime et al. (2019) Effectiveness of mobile agri-advisory service extension model: Evidence from Direct2Farm program in India (India)	Y		This study examines the effectiveness of mobile as a novel approach for providing targeted and equitable agri-advisory services to farmers at scale. A cross-sectional survey of farmers was undertaken using a combination of telephone interviews, household survey and focus group discussions. Mobile service was ranked 5th as a source of information out of seven identified. Results raise two issues; firstly, how mobile services can be designed to best fit differences in gender and social realities; and secondly, how mobile services can be effectively monitored to ensure messages are being received by targeted users. Qualitative data gathered through FGDs were analysed using content analysis. Survey data were analysed using the STATA 12 statistical package. Descriptive and inferential statistics were used such as chi-square and t-tests.
Kenny, et. al. (2021). Co-designing a smartphone app for and with farmers: Empathising with end-users' values and needs (Ireland)		Y	Examines the factors which influence Irish farmers' engagement with smartphone use and new smartphone apps and explored the supports required by farmers to successfully engage with smartphone apps for agriculture use. Seven focus groups were conducted with a total of 41 farmers from four regions in the Republic of Ireland. Findings revealed that factors such as poor broadband internet availability, coupled with a lack of comfort with emerging technologies, technology trust issues, and a perceived lack of sufficient benefits deterred farmers' engagement with smartphone technology and agricultural apps. Perceived benefits of smartphone engagement also emerged including an enhanced sense of empowerment, a more flexible lifestyle, a reduction in stress, an improvement in time efficiency, an enhanced level of communication between farmers and their respective governing bodies and, an ability to make data-driven decisions on the farm. Perceived support networks to aid farmers in using agricultural apps included farm advisors, family members and peers.
Khoza, et. al. (2021). A gender-differentiated analysis of climate-smart agriculture adoption by smallholder farmers: application of the extended technology acceptance model (Malawi and Zambia)	Y	Y	An exploratory-sequential mixed methods study was conducted, using a socio-psychological theoretical lens to test the applicability of the extended technology acceptance model in predicting CSA adoption among at-risk smallholder farming communities in Malawi and Zambia. Spearman's rho correlation results show that relationship strengths between socio-psychological factors—perceptions on ease of use, usefulness and climate risk—differed

			between men and women household heads. Results also show that social processes are central in influencing women's decision-making on adoption. For practitioners and policy-makers, these findings reflect a critical need for gender-specific behavioural change communication strategies and inclusive participatory engagement.
Klerkx, et. al. (2019). A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda (Global)		Y	Presents 17 articles dealing with social, economic and institutional dynamics of precision farming, digital agriculture, smart farming or agriculture 4.0. An exploratory literature review shows that five thematic clusters of extant social science literature on digitalization in agriculture can be identified: 1) Adoption, uses and adaptation of digital technologies on farm; 2) Effects of digitalization on farmer identity, farmer skills, and farm work; 3) Power, ownership, privacy and ethics in digitalizing agricultural production systems and value chains; 4) Digitalization and agricultural knowledge and innovation systems (AKIS); and 5) Economics and management of digitalized agricultural production systems and value chains. The main contributions of the special issue articles are mapped against these thematic clusters, revealing new insights on the link between digital agriculture and farm diversity, new economic, business and institutional arrangements both on-farm, in the value chain and food system, and in the innovation system, and emerging ways to ethically govern digital agriculture. Emerging lines of social science enquiry within these thematic clusters are identified and new lines are suggested to create a future research agenda on digital agriculture, smart farming and agriculture 4.0. Also, four potential new thematic social science clusters are also identified, which so far seem weakly developed: 1) Digital agriculture socio-cyber-physical-ecological systems conceptualizations; 2) Digital agriculture policy processes; 3) Digitally enabled agricultural transition pathways; and 4) Global geography of digital agriculture development.
Knook and Turner (2020) Reshaping a farming culture through participatory extension: An institutional logics perspective (Scotland, New Zealand)	Y		Pressure to increase of environmental practices in farm management causes a clash with the beliefs and values underlying the culture of production and family business. This study explores the clash using an institutional perspective to i) analyse how farmer practices, beliefs and values change due to external pressure to adopt environmental practices; ii) identify mechanisms via which this change unfolds; and iii) understand the role of participatory extension programmes in this change. This approach is used to analyse the use of participatory extension programs to promote environmental farming practices in Scotland and New Zealand. The results of the study indicate participatory extension programmes influence practices, beliefs and values underlying the learning logic (changing from a 'linear' to 'multi-actor' logic). The study contributes to current literature by introducing a new lens for understanding change induced by participatory extension programmes.
Knook et al. (2018) Evaluation of farmer participatory extension programmes (International)	Y		Systematic review of qualitative, quantitative, and mixed method evaluation of participatory extension programs. Many studies base evaluation on practice change, consideration of

			other aims would offer more holistic evaluation. Quantitative methods should address endogeneity and selection bias to increase reliability. The use of qualitative data was not well integrated or was treated as an alternative to quantitative methods. Qualitative data should be used to complement quantitative assessments, to understand social context and insight into perceptions/motivations of participants. Reflexive ex-post evaluation should be considered when designing participatory extension programs.
Knook et al. (2020) The evaluation of a participatory extension programme focused on climate friendly farming (United Kingdom)	Y		Participatory extension programmes (PEPs) are advisory programmes based on voluntary participation where farmers, researchers, and rural experts collectively learn by sharing information and experiences. To evaluate the contribution of these programmes towards more climate friendly farming, this paper conducts an ex-post evaluation of a PEP focused on the voluntary uptake of on-farm emissions mitigation practices in the UK. The quantitative effect of the programme was estimated using a quasi-experimental approach, while for the qualitative indicators observations and semi-structured interviews were conducted. We find that participants in the PEP show a higher level of practice adoption compared to non-participants. However, the evaluation of the human-social indicators shows that the change cannot always be attributed to PEP participation.
Latawiec et al. (2017) Improving land management in Brazil: A perspective from producers (Brazil)	Y		To better understand the importance of the underlying factors that lead to or inhibit improvements to land management, we used focus groups and semi-structured interviews (N = 250) with farmers from the state of Mato Grosso in the Brazilian Amazon. To our knowledge, this is the first study to systematically assess the barriers to and the conditions surrounding the adoption of good agricultural practices in Brazilian pasturelands from the perspective of the farmers from the Amazon involved in the implementation of these practices. Check relevance. Context specific, extension services not considered.
Liang, et. al. (2021). Examination of Symptoms of Depression among Cooperative Dairy Farmers (United States)		Y	Farmers experience a high risk of stress, depression, and suicide. A survey was used to examine whether having access to cooperative programs and social support impacted symptoms of depression among dairy farmers. Farm bankruptcies, stress, depression, and suicide were identified as ongoing concerns. Having social support and cooperative educational opportunities and mentorship programs were associated with decreased symptoms of depression. Conversely, having cooperative policy discussions was associated with increased symptoms of depression. Results suggest that social support can potentially reduce symptoms of depression among farmers and having access to cooperative resources can reduce or increase it, depending on the type of program.
Maligalig et al. (2019) Off- farm employment increases women's empowerment: Evidence from rice farms in the Philippines (Philippines)	Y		Used investment game (new app for prioritising rice farmers preference for varietal trait improvements (VTI) Farming couples select VTIs individually and as couples and then invest in public rice breeding programs – decision making power was similar for men and women.

			Empowered women were more likely to choose based on their expected future outcomes while men were more likely to choose based on previous experience
Mankad, et. al. (2019). Motivational drivers of action in response to an environmental biosecurity incursion (Australia)		Y	Examines social and psychological drivers for proactive biosecurity action amongst banana farm owners (N = 57) in a region of northern Australia. This region was experiencing a biosecurity emergency after the incursion of a non-eradicable plant disease, Panama Tropical Race 4 (TR4). A telephone survey measured the influence of threat perceptions, response costs, biosecurity knowledge, self-efficacy, intrinsic and extrinsic rewards, and income dependency from bananas, as potential drivers for increased biosecurity activity on-farm. A regression model accounted for 47% of variance in proactive biosecurity action, with income dependency as the strongest individual predictor of action. Self-efficacy, intrinsic reward, and extrinsic reward were also significant individual predictors of motivation to act. Interestingly, perceived threat of TR4 and response costs were not predictors of biosecurity action. These results suggest that perceptions of threat and personal costs of action are less important in motivating proactive engagement and adoption of biosecurity behaviours in the early stages of a biosecurity incursion.
Mann, et. al. (2019). Do practitioners of holistic management exhibit systems thinking? (Canada and United States)		Y	Holistic management (HM) is a decision-making framework, first developed in grazing systems, which combines intensive, rapid rotation of grazing livestock with adaptive and holistic decision making. Holistic management's use of systems thinking concepts may help farmers cope with increasing complexity on their farms. We used Q-methodology, a mixed method approach for identifying discourses, to understand the levels and types of systems thinking employed by farmers and HM trainers along a gradient of HM engagement. we identified 3 main viewpoints: the Fluent Systems Thinker, with adherence to core systems ideas such as tackling root causes and mimicking nature; the Aspirational Systems Balancer, who appreciates systems thinking ideas but struggles with application; and the Independent Creative Farmer, who adheres to more conventional farming traditions but values creativity and learning. These groups differed in their levels of empowerment, creativity, goal setting, and willingness to learn, all of which can affect capacity to manage complex decisions. We concluded that stronger engagement with HM correlates with higher adherence to systems thinking ideas and different types of systems thinking.
Marabesi & Kelsey (2019) A Phenomenological Inquiry into Producers' Experiences Growing Organic Produce (United States)	Y		Phenomenological research methods focussed on producers pursuits and implementation of organic farming. Interviews with organic producers were conducted Analysed the motivations for producers moving to organic, as economical vs. social. Categorised producers as committed (to the organic philosophy) or pragmatic (organic farming is a way to secure income). Differences in their extension needs were identified: committed producers need education on marketing strategies and new techniques for local realities, Pragmatic producers need engagement with the organic producer community

Mayberry, et. al. (2021). New skills, networks and challenges: the changing face of animal production science in Australia (Australia)	Y	Y	They argued the need for a broader, more inclusive and more integrated concept of animal science, better connections among scientists, producers, consumers and policy makers, and more support for the next generation of animal scientists. Better engagement with the social and economic sciences can inform how animal scientists and extension services interact with producers to understand constraints to production as well as adoption of new technology and co-develop evidence-based solutions. Underlying this, the demographics of those who study and work in animal science are changing. Australian animal industries require the best and brightest minds to overcome future challenges and engaging these students as the new face of Australian animal science is an essential step towards sustainable future livestock systems.
Mbeche et al. (2021) The influence of privatised agricultural extension on downward accountability to smallholder tea farmers (Kenya)	Y		The research collected data through focus group discussions with smallholder tea farmers and key informant interviews after which the information was corroborated with semi-structured interviews with 104 smallholder farmers. A framework for analysing downward accountability in privatised extension services is proposed, considering Governance structures, Extension delivery, Relevance and responsiveness to farmer's needs, and Funding for extension services. Our findings show that KTDA (Kenya Tea Development Agency) extension service has in recent years embraced methodologies that allow two-way information exchange and farmers' involvement in planning, implementing and evaluation of extension programmes.
McDonough et al. (2015) Barriers to Participatory Extension in Egypt: Agricultural Workers' Perspectives (Egypt)	Y		Key barriers for engaging in participatory extension were identified using content analysis of semi-structured interviews, surveys and focus group discussion of 37 government agricultural workers along with participant observation and review of existing literature. Most workers surveyed understood basic participatory extension principles and desired to use these approaches. Changing from traditional 'top down' extension to systems that engage with farmers' needs at the community level is made difficult due to the aging and poorly functioning Village Extension Worker (VEW) network. Thus, it is far easier for the research driven extension programmes to use technology transfer models.
Menconi, et. al. (2017). European farmers and participatory rural appraisal: A systematic literature review on experiences to optimize rural development (Europe)		Y	A systematic review allowed them to analyse experiences related to 35 participation paths aimed at rural regions' development. The analysis has been made on the basis of 14 variables describing the path followed and its purpose, the agricultural holding involved, and the areas surveyed. The work has the objectives to identify some strengths and weaknesses in the involvement of farmers in decision-making and the strengths and weaknesses of the processes themselves. The review has shown that too often in participatory processes farmers are considered only as a source of information to be used by researchers rather than as active participants in the choices for the protection, management and transformation of the rural territory. An effective participatory rural appraisal requires greater empowerment

			of farmers. In participation contexts, it is not possible to establish standardized methods and tools, because each process should be tailored for the community that expresses it. Nevertheless, the work has highlighted the need to establish some minimum principles to avoid considering unsuccessful some participation paths which, in reality, have been only scarcely participated.
Meyer et al. (2015) A Call to Embrace Program Innovation (United States)	Y		In this article, we define Extension program innovation as driven by the productive tensions among three core program planning practices: design, construction, and evaluation. Not relevant. Guidance, not applied.
Miller & Walker (2016) Pros in Parks: Integrated Programming for Reaching Our Urban Park Operations Audience. (United States)	Y		Example of extension program implemented via an extension agency for park employees reports participant selection criteria, curriculum and learning impact and adoption intention from participants Context specific
Misyak et al. (2018) The Farmacy Garden: A model program for expanding services to low-income families (United States)		Y	The Farmacy Garden, a collaboration of multiple local partners, provides a point of access for learning about and obtaining fresh fruits and vegetables and represents an integrated programming approach for increasing food security for low-income families. these gardening efforts are being used to address food insecurity and strengthen community food systems
Mitchell & Currey, (2021). Increasing Participation of Women in Agriculture Through Science, Technology, Engineering, and Math Outreach Methods (United States)	Y	Y	Literature and data were reviewed associated with the prevalence and persistence of women's engagement in agriculture from youth-focused programs through to college and employment in order to learn which models of outreach may best attract women to and retain women in agricultural careers. We found that girls in Virginia have strong participation in early agriculture-related activities but that women constitute the minority of primary farm owners. Our systematic literature review shows that using science, technology, engineering, and math models of outreach and reframing agriculture as a career that builds communities and cares for the planet can engage more women in agriculture. Exposure to agroecological farming methods that benefit the community and awareness of other women who have succeeded and are leaders in the field is critical to supporting women who want to pursue agriculture as a career. Single-gender agricultural camps, campus trips, or all-female field days also can enhance the engagement and persistence of girls in agriculture. More women should be hired and promoted into faculty and leadership positions in agricultural programs at universities and in Extension roles.
Mitter, et. al. (2019). Exploring Farmers' Climate Change Perceptions and Adaptation Intentions: Empirical Evidence from Austria (Austria)		Y	They built on the Model of Private Proactive Adaptation to Climate Change (MPPACC) and apply a qualitative interview approach in two Austrian farming regions. We have identified four groups of farmers, which differ in the formation process of adaptation intention and avoidance: (i) climate change adaptors, (ii) integrative adaptors, (iii) cost-benefit calculators, and (iv) climate change fatalists. Farmers who are part of groups (i)–(iii) form adaptation intentions, whereas climate change fatalists do not intend to adapt. According to our analysis, adaptation intentions are only formed if farmers are aware of effective adaptation

			measures, accept personal responsibility for their farms, and evaluate adaptation costs positively (i.e., adaptation appraisal).
Montufar, et. al. (2019). Perceptions of agrodiversity and seed-saving practices in the northern Andes of Ecuador (Ecuador)	Y	Y	This exploratory study incorporated a community-based participatory research approach using mixed methods. We conducted (1) a timeline mapping for exploring the dynamics of intergenerational agrodiversity and (2) structured interviews to explore the perception of relevance of crops grown to identify criteria for characterizing conventional and non-conventional seeds and for identifying seed-saving practices. They computed ranks and frequencies from free listing data derived from the interviews to detect the most salient patterns for crop diversity and seed-saving practices. A principal component analysis was performed to illustrate crops distribution within the study area. Findings revealed that participants perceive an intergenerational loss of agrodiversity. Data derived from free listing determined that salient crops differ in each location of the study area, mostly due to geographic (altitude, climate), market factors, and crop management limitations. Responses from open-ended interview questions revealed that farmers discriminate conventional from non-conventional seeds using yield, adaptation to local conditions, pest tolerance, taste, and crop management as criteria. Analysis of free listing data determined that the most salient reported practices related to seed saving were soil fertility management, seed selection, safe seed storage, tilling and rowing, and weeding. Farmers clearly discriminate conventional from non-conventional seeds based on advantages and disadvantages, cultural motivation, and produce destination. The community-based participatory approach resulted in positive engagement from participants and promoted commitment from farmers to preserve agrodiversity and support practices at the community level.
Moravek et al. (2017) Quantifying the effectiveness of extension delivery methods on practice change – the experience of the Grazing BMP Extension Support Project (Australia)	Y		The aim of this paper is to quantify the effectiveness of extension delivery mechanisms of the Grazing Best Management Practice Extension Support project (p. 70). Extension activities and events included: workshops, one-on-one extension, producer demonstration sites, field days, e-extension. An extensive monitoring and evaluation framework was used incorporating quantitative and qualitative data on activity details, participant reactions, capacity gains, practice change, and water quality improvement. Check relevance. Not notably innovative
Morrone (2017) Outreach to Support Rural Innovation	Y		Book chapter – Lot to digest here but interesting Compares and contrasts developing countries and developed country in terms of extension approaches and incentives lots of international case studies 1. Improving relevance through demand-driven and decentralized extension; 2. Facilitation of human and organizational capacity for innovation; 3. Scaling out to reach more people; and 4. Sustainability of outreach.
Mueller et al. (2020) Using Design Interventions to Develop Communication Solutions for Integrated Pest Management (United States)		Y	Unique design interventions were developed to communicate integrated pest management strategies through a partnership between university agriculture and design schools. An important outcome of the project included non-specialist identification of six IPM challenges

			and the development of seven key messages for IPM communication efforts (p. 8). Additionally, the project the benefit of rebranding/renaming to improve identification and understanding. Although the communication approaches were not tested, the project shows how interdisciplinary partnerships can inform engagement/marketing strategies.
Mullins et al. (2015) Food and Nutrition Extension Programs: Next Generation Impact Evaluation (United States)	Y		This article reviews recent advances in evaluation methodology of food and nutrition programs. The Centers for Disease Control and Prevention framework is a practical tool that summarizes and organizes the steps and standards for effective program evaluation. Steps include engage stakeholders, describe problem, focus evaluation design, gather evidence, justify conclusions, ensure use and share lessons. Analysis of data from this project resulted in the following recommendations; strong administrative support and leadership is critical; extension personnel specializing in program evaluation; evaluation tools must be user friendly and audience sensitive. Check relevance.
Munden-Dixon (2015) Assisting small and mid-size farmers to increase their access to markets: A case study of an extension program to facilitate food hubs in Georgia (United States)		Y	connecting suppliers and farmer to food hubs A food hub is a value-based business model that manages the marketing, aggregation, and distribution of locally produced meat and produce, which offers small and mid-sized farms a means of economic diversification by linking growers to wholesale markets. They produced an interactive map that highlighted farmers interested in participating in hubs and what they produce and identified a need for facilities to aggregate product near these hubs
Narine (2020) Application of a Three-Phase Needs Assessment Framework to Identify Priority Issue Areas for Extension Programming (United States)	Y		The study used a three-phase needs assessment; a) developed a list of community issues, b) collect and analyse primary data from residents, and (c) identify priority issues; to describe Utah residents' perceptions of issue areas for Extension programming. Objective A: to extract and describe underlying priority issue areas, Objective B: describe residents' perceptions of the level of effort required for each priority issue area. Literature review data was collected and analysed for Objective A, using principal component analysis. Survey data was collected and analysed for Objective B, using descriptive frequencies and a point score method. This method is useful in reducing a lengthy list of items into constructs; priority issue areas can be viewed as themes for Extension programming, and individual items can inform goals and objectives of individual programs. Check relevance.
Ndlela and Worth (2021) Creating self-reliance and sustainable livelihoods amongst small-scale sugarcane farmers (South Africa)	Y		Key to fostering sustainable livelihoods is developing human capital. Building farmer capacity goes beyond improving knowledge and skills to genuine inclusive participation in farmer development programmes especially inclusion in decision-making. Check relevance. Literature review, application in MLA.
Nettle et al. (2018) How private-sector farm advisors change their practices: An Australian case Study (Australia)	Y		This paper presents a qualitative study of the processes of change in the advisory practices of private-sector farm advisors who were provided with formal training as part of an Australian dairy sector extension program. Three key processes enabled advisory practice change: envisioning new advisory roles; experimenting with new advisory identities; and

			legitimisation of new advisory practices from both farmers and the advisors' business. A wider conceptualisation of the advisors' world (their identity, practices and their needs) is required if private-sector advisors are to play a greater role in helping farmers respond to emerging challenges.
Newton, et. al. (2020). Farming smarter with big data: Insights from the case of Australia's national dairy herd milk recording scheme (Australia)		Y	Digitalization and the use of Smart Farming Technologies are considered a major opportunity for the future of agriculture. However, realisation of full benefits is constrained by: (1) farmers' interest in and use of big data to improve farm decision making; (2) issues of data sovereignty and trust between providers and users of data and technology; (3) institutional arrangements associated with the governance of data platforms. This paper traces the Australian history of the organisation of dairy herd recording (established in 1912 and digitalized in late 1970s) and then uses findings from a longitudinal study of 7 case study dairy farms, which were incentivised to become involved in herd recording in 2015. Applying a conceptual framework linking path dependency in farm decision making and collaborative governance capacity, we find three new important dimensions of the farm user context influencing farmer demand for big data applications: 1) the transition to a new business stage; 2) the additionality farmers seek from data generated in one component of the farm system to other subsystems, and 3) the use of data in long term or strategic decision making. Further, we identified critical attributes of support services in addressing digital literacy, capacity and capability issues at farm level, including diversity in data presentation formats and facilitation of the on-farm transition process through intermediary herd test organisations.
Niles, and Wagner, (2019). The carrot or the stick? Drivers of California farmer support for varying groundwater management policies (United States)		Y	In California, the Sustainable Groundwater Management Act (SGMA), a comprehensive groundwater policy was signed into law in 2014. Here authors explored farmer perspectives of groundwater availability and groundwater management policy preferences through a mail survey to farmers. Overall, farmers expressed widespread concern for the five applicable 'undesirable results' considered under SGMA, and the majority of farmers felt that these conditions were either occurring now or were likely to occur in the next ten years. The majority of farmers were supportive of individual or incentive-based policy options to address groundwater concerns (e.g., voluntary adoption of water management practices). However, a sizable group of farmers were also supportive of regulatory-based policy options (e.g., moratorium on drilling new wells). Multivariate regression models suggest that for both kinds of policies, individual support for SGMA positively predicts groundwater management policy support.
Niu & Ragasa (2018) Selective attention and information loss in the lab to farm knowledge chain;	Y		Assessing the effectiveness of communication; This study investigated the rate of knowledge loss in the knowledge chain that runs from researchers to extension agents to Lead farmers. The issue of overreporting of farmer satisfaction with extension programs is discussed as an

The case of Malawian agriculture extension programs (Malawi)			issue in some contexts and other evaluation approaches from the literature are reviewed. Information efficiency is proposed as a way to assess extension program modalities and identify if the loss of information is the result of teaching or learning failures
Nocco, et. al. (2020). Knowledge Co-Production with Agricultural Trade Associations (United States)		Y	Observes, documents, and critically reviews knowledge exchanges among scientists and agricultural stakeholders working on a multidecadal water conflict in Wisconsin. Differences in knowledge exchange and production were related to meeting spaces, organization, time management, and formality of interactions. We found that repetitive, semiformal meetings organized and led by growers facilitated knowledge exchange, co-production, and social learning. We suggest that this discomfort results from the widespread adoption of the deficit model of scientific literacy and objectivity as default paradigms, despite decades of research suggesting that scientists cannot view themselves as objective disseminators of knowledge. For example, we found that both scientists and growers produced knowledge for political advocacy but observed less transparency from scientists, who often claimed objectivity in politicized settings. We offer the following practical methods and recommendations for designing social learning processes as well as highlight the need to better prepare environmental and extension scientists for engaging in agribusiness spaces. "1. Training. Seek out alternatives to the deficit model of science communication (e.g., knowledge co-production), which will otherwise act as the default theory of engagement. 2. Training. When agricultural stakeholders have very different identities or world views, it is important for scientists to conduct identity-based risk assessments prior to engagement, similar to what is now recommended for biophysical field work. If scientists decide to accept these risks, they should develop coping strategies (e.g., trigger identification, response planning, mindfulness, strong practitioner networks) to deploy during and after engagement. 3. Study design. Physical, social, and extension scientists should collaborate from project proposal to completion to help establish biases, expectations, and share conditional outcomes. 4. Study design. Scientists should start all collaborative projects with agricultural stakeholders by critically acknowledging their own positionality, advocacy/stakeholder role, and biases. 5. Meeting organization. Choose grower-controlled spaces to hold meetings that facilitate knowledge exchange and co-production. These may be spaces that are either associated with agricultural trade associations or regularly used by agricultural trade associations. 6. Meeting organization. Keep an agenda, but relax schedule enforcement and promote questions, interruptions, and dialogue during scientific presentations. Ideally, a member of the agricultural trade association is responsible for agenda enforcement."
Nourani et al. (2019) Extension as a Multilevel Bridging Organization: Supporting Networked Environmental Governance (United States)	Y		Governmental and nongovernmental actors have information that can benefit natural resources management; however, barriers in communication and organizational culture often prevent information sharing and joint endeavours. We used social network analysis, a

			promising method for mapping Extension networks to visualize bridging in three of the emerald ash borer (EAB) task forces. Task force members were surveyed about their communication and collaboration a) with each task force member prior to the task force formation (retrospectively), b) with each task force member at the time of the survey, and c) with individuals and organizations who did not participate in the task force from whom they received information and advice on EAB. Developing networks that cross levels of government and sectors of society represents a promising paradigm in environmental governance, but it requires strategic bridging to develop and sustain relationships among organizations with divergent interests.
Nuritha, et. al. (2017). Designing Gamification on Social Agriculture (SociAg) Application to Increase End-User Engagement (Indonesia)		Y	Social Agriculture (SociAg) application is a web based social media application prototype which is used for providing active, interactive, and persuasive communication among farmers, farmer communities and professionals as space for sharing information each other to improve science and technology knowledge in agriculture. SociAg application is developed by implementing gamification concept for increasing user interest within using this application. Gamification is used as one of strategy end-user engagement to attract enthusiastic farmers, farmer communities, and professionals in utilizing SociAg applications to interact with useful information sharing especially in agriculture. Gamification method is able to apply in SociAg application. Gamification of SociAg application is designed as effort to improve user engagement and create a higher level of motivation.
Ofori et al. (2020) Duration analyses of precision agriculture technology adoption: what's influencing farmers' time-to-adoption decisions? (United States)		Y	Time-to-adoption for embodied-knowledge technologies such as automated guidance and section control were statistically shorter than for information-intensive technologies such as yield monitors (p. 647). Time-to-adoption of precision agriculture technologies is mainly driven by location of farm, generation of farmer, number of workers, years of farming experience, total acres cropped and the cost of crop insurance. Results are useful for planning marketing or farm outreach programs taking into consideration that, time-to-adoption differs across regions and by specific characteristic.
Oliver, et. al. (2017). Design of a decision support tool for visualising E-coil risk on agricultural land using a stakeholder-driven approach (England and Scotland)		Y	Enabling knowledge exchange between scientists and decision-makers is becoming increasingly necessary to promote the development of effective decision-support tools (DSTs) for environmental management. This study outlines the development of a DST to visualise and communicate the spatial and temporal patterns of E. coli (a faecal indicator organism) on agricultural land, as a first step in managing microbial pollution risks to the wider environment. A participatory approach was used to engage regulators, catchment managers, environmental scientists, farmers and farm advisors, researchers in geospatial technologies and water industry staff in the co-design of a novel, user-friendly and accessible DST for guiding on-farm microbial risk assessment. The resulting toolkit provides environmental

			managers and farm advisors with one of the first freely-available DSTs for visualising patterns of E. coli inputs to pasture in space and time.
Osorio-Garcia, et. al. (2020). Can an innovation platform support a local process of climate-smart agriculture implementation? A case study in Cauca, Colombia (Colombia)		Y	Analyses how an innovation platform can foster and provide a basis for multi-actor collaboration in order to enable climate-smart agriculture (CSA) implementation at the local level. Using a mix of social (interactions between stakeholders, knowledge changes, adoption of practices) and technical indicators (income, fulfillment of caloric requirements of the household, farm resource use, planned biodiversity or greenhouse gas emission changes), we monitored the collaboration between an NGO, local civil authorities, associations, and farmers that aimed to achieve a common goal linked to the participatory and contextualized development of CSA in Colombia. We found that multiple stakeholder engagements led to improved interactions between members of the platform and their local environment, a proactive participation in the platform meetings and a significant increase in farmer knowledge levels on the challenges posed by climate change and the resultant extreme events. The platform also facilitated the adoption of best-bet practices that contribute towards CSA when farmers both diversify their production and decrease the use of mineral fertilizers.
Ott E.S., Monaghan P.F., Israel G.D., Gouldthorpe J.L., Wilber W. Rain barrel owners as a piece of the water conservation puzzle: Segmenting extension audiences using their landscape water conservation practices (United States)	Y		efforts. Rain barrel owners reported performing significantly more water conservation behaviours, both outdoors and indoors, than those without a rain barrel. They have segmented clients on their existing water conservation behaviours using a survey and then recommend tailoring extension activities to the two segments accordingly
Oyinbo et al. (2019) Farmers' preferences for high-input agriculture supported by site-specific extension services: Evidence from a choice experiment in Nigeria (Nigeria)	Y		Site-specific extension recommendations that are better tailored to the needs of individual farmers and fields, and enabled by digital technologies, could potentially bring about yield and productivity improvements. In this paper, we analyse farmers' preferences for high-input maize production supported by site-specific nutrient management recommendations provided by an ICT-based extension tool. We use a choice experiment to provide ex-ante insights on the adoption potentials of site-specific extension services from the perspective of farmers. We find heterogeneity in preferences correlated with farmers' resource endowments and access to services. A first group of farmers are strong potential adopters; they are better-off, less sensitive to risk, and are more willing to invest in a high-input maize production system. A second group of farmers are weak potential adopters; they have lower incomes and fewer productive assets, are more sensitive to yield variability, and prefer less capital and labour intensive production techniques.
Patillo et al. (2021) Missouri's specialty crop beginning farmers cultivate resilience during COVID-19 (United States)	Y		Development of alternative educational opportunities for 'small farmers', incorporating social distancing and other preventative actions, in response to COVID-19. Alternative educational approaches, including video conferencing, online teaching, digital recordings,

			video repositories, social media communications, pick up and drop off locations, proved effective. Convenience of remote learning opportunities is noted as positive. Limitations associated with telecommunication access, and access to advisors is noted. Survey method is used to assess project outcomes. No differentiation between farmer characteristics, due to specific project group, i.e., 'small farmers'.
Petril'ak, et. al. (2020). Communication of local farmers' products through Facebook: the case study of Nase-Vase (Slovenia)		Y	The importance of communication with consumers through social networks, such as Facebook, is essential in today's marketplace for small businesses, for which this tool is one of the cheapest alternatives to communicating and selling products. highlight the importance of social media communication in the agri-food sector, specifically in the sub-sector of local fresh products, as well as to determine which consumers are most interested in local products from farmers communicated through Facebook. We conducted the research using our Facebook page called Ours-Yours (in Slovak Naše-Vaše). This account was created for research purposes and has a clearly defined objective of supporting and promoting local fresh products from small Slovak farmers. We discovered what form of marketing communication they had used in the past. Afterwards, we visited eight selected farms, took professional photos of their products, and promoted them under one brand using our Facebook page Ours-Yours (Naše-Vaše). The methodology of the research was based on an analysis of Facebook posts, which were visualised, uniformly graphically processed photographs of the products. Contributions were advertised on radio located 50 kilometres from the farms to ensure local marketing of the products. We measured demographic factors (gender and age) and users' interaction with individual posts. Research has shown that women between the ages of 45 – 64, who follow Facebook mostly from their mobile phones, are most interested in Facebook posts with local fresh products (and information about them).
Pincus et al. (2018) Seeing below the surface: making soil processes visible to Ugandan smallholder farmers through a constructivist and experiential extension approach Uganda (Uganda)	Y	Y	the experiential learning cycle of hands-on practice and reflection Soil fertility is an issue – need to deliver Fertility management Education Program – New knowledge assimilation is key component of adoption. Through farmer interviews, observation and focus groups (qualitative methods) they f found which concepts of soil fertility management were already understood by farmers and which ones would require more convincing and concerted extension effort. Combining scientific knowledge and hands on experimentation will increase their confidence in implementing new practice
Piñeiro et al. (2020) A scoping review on incentives for adoption of sustainable agricultural practices and their outcomes (International)	Y	Y	The purpose of this scoping review is to understand how the incentives offered to farmers motivate the adoption of sustainable agricultural practices and, ultimately, how and whether they result in measurable outcomes (p. 809). The review examines the evidence of nearly 18,000 papers on whether incentive-based programmes lead to the adoption of sustainable practices and their effect on environmental, economic and productivity outcomes (p. 809).

			Regardless of the incentive type, adoption rates are higher when programmes offer short-term economic benefits than those solely aimed at providing a positive ecological outcome (p. 815). In the long term it seems that one of the strongest motivations for farmers to adopt and maintain sustainable practices is the perceived positive outcomes of these practices for their farm or the environment (p. 815).
Pinxterhuis, et. al. (2018). Co-innovation to improve profit and environmental performance of dairy farm systems in New Zealand (New Zealand)		Y	To increase the likelihood of developing successful options for future dairy farm systems, DairyNZ adopted a deliberate co-innovation approach for two topics: heifer rearing and nutrient management. Co-innovation activities differed between projects, but common principles were adopted: being inclusive, valuing and learning from different kinds of knowledge, and being flexible to stay attuned to the wider context. Stakeholders, including end-users, were involved from the start, and reflexive monitoring supported process management. The projects were successful in their engagement with farmers and were flexible to adapt to feedback and changing context. Difficulties were experienced with attaining legitimacy for farmer knowledge and engagement with commercial entities. We suggest that the listed key principles, enablers and barriers, sourced from literature, provide a framework for regular reflection that will help to maintain a co-innovation approach and to define interventions or adjustments of project activities to improve impact.
Pircher & Almekinders (2021). Making sense of farmers' demand for seed of root, tuber and banana crops: a systematic review of methods (Global)		Y	They carried out a systematic review in order to better understand how farmers' demand for seed in root, tuber and banana seed systems is studied. The review is based on data from a consultation with an expert panel and a structured literature search in the SCOPUS database. Through qualitative analysis and categorization of these studies, they developed a classification scheme according to the types of approaches applied in the retained studies. One group of studies explicitly articulates farmers' preferences and choices through surveys or engagements in trials, auctions, choice experiments and interviews. Their conclusion was that a framework is necessary that purposefully combines the existing different methods and that it is necessary to involve stakeholders in a process where demand is articulated. Together, these two steps would characterise existing demands in a more effective and precise way, thus providing better guidance to decision-makers in farmer´s reactions pertaining to seed systems.
Pish et al. (2016) Anger management program participants gain behavioural changes in interpersonal relationships (United States)	Y		Introduces the RELAX alternatives to anger program and the survey instrument used to evaluate outcomes. Survey relates to behavioural changes
Prager K., Creaney R. Achieving on farm practice change through facilitated group learning: Evaluating the effectiveness of monitor farms and discussion groups Ireland and Scotland (United Kingdom)	Y		Group extension programs can be more effective than conventional approaches when combined with participatory approaches. Propose that learning and adoption are higher for discussion groups (Teagasc coordinated) than monitor farms (Scottish Government skilled development scheme) but monitor farms will make the most substantial practice changes.

			Monitor farms want to make improvements and receive funding support etc for 3 years to make improvements host farmer and group member monitor and adopt the practices. They propose a 10 dimension framework for assessing effective ness of program; the key characteristics of a programme (commissioning and delivery, philosophy, objectives, financial incentives, and target audience), as well as characteristics of the group extension approach (information flow, facilitation, methods, benchmarking, duration) since both sets of characteristics influence what is measured (the notion of effectiveness), how a programme becomes effective, and how it can be measured.
Qu et al. (2019) Building bridges between producers and schools: The role of Extension in the farm to school program (United States)		Y	The aim of the Farm to School (F2S) program is to bring fresh, local produce into school cafeterias. Aligning with Extension goals, the F2S program provides an opportunity for both the development of healthful lifestyles and increases in agricultural profits. Through interviews with producers and school food service directors, we determined ways Extension programming can be used to improve the efficiency of the F2S program.
Quella, et. al. (2021). Visitors and values: A qualitative analysis of agritourism operator motivations across the United States (United States)	Y	Y	They analysed transcripts from semi structured interviews with small- and medium-sized farm owners engaged in agritourism from five states across the U.S. We examined the results through the theoretical lens of Allport's "contact hypothesis" in order to further understand how agritourism helps operators meet stated goals. Our results suggest that consistent with previous literature, nonmonetary motivations are high priorities for farmers engaged in agritourism. In particular, motivations related to community engagement/ leadership and quality-of-life emerged as forceful and reoccurring themes. We found that although Allport's contact hypothesis holds some important explanatory power for understanding agritourism operators' community-related goals, including reducing prejudice and increasing understanding between farmers and consumers in relation to agriculture, increased intergroup contact also has potential to create new conflicts between farmers and neighbours related to tourism.
Radcliffe (2021) Entwining indigenous knowledge and science knowledge for sustainable agricultural extension: exploring the strengths and challenges (Vanuatu, Papua New Guinea)	Y		The review describes the challenges and strengths of integrating indigenous knowledge and science through an alternative approach to agricultural extension, the Extension for Sustainable Agricultural Development (ESAD). The ESAD process is implemented four stages: construction of a knowledge, repository, thematic analysis of the knowledge, collaborative creation of new knowledge, and practical workshops (pp. 138-139) The potential of indigenous knowledge is through farmers' intimate knowledge of their environment and scientific knowledge contributes through its greater explanatory powers (p. 137). Whilst challenges of integrating indigenous knowledge and science knowledge for extension include perceived low value, issues of intellectual property, potential for disconnect from culture and context, access and misrepresentation, this study did result in the uptake of improved sustainable agricultural practices (p. 146).

Rees, et. al. (2021). Designing a National Veterinary Prescribing Champion Programme for Welsh Veterinary Practices: The Arwain Vet Cymru Project (Wales)	Y	Y	Outlines the design of a complex antimicrobial stewardship (AMS) intervention aimed at developing a national Veterinary Prescribing Champion programme for Welsh farm animal veterinary practices. The key phases identified when designing this complex intervention, are the following: (i) involving key collaborators in government and industry to stimulate project engagement; (ii) grounding the design in the literature, the results of stakeholder engagement, expert panel input, and veterinary clinician feedback to promote contextual relevance and appropriateness; and (iii) taking a theoretical approach to implementing intervention design to foster critical psychological needs for participant motivation and scheme involvement. Educational interventions have been shown to improve knowledge of pharmacovigilance and prescribing competency as well as to strengthen AMS, although the effects may be short-lived. Online learning as part of AMS programmes has been playing an increasing role and online training of GPs has been shown to reduce antimicrobial prescribing for respiratory disease.
Rezaei-Moghaddam et al. (2021) Entrepreneurial resilience of small and medium-sized businesses among rural women in Iran (Iran)	Y		This research was conducted in three stages. 1) the Lifespan Resilience Scale-Business was used to identify the factor structure of women's business resilience. 2) the resilience of women entrepreneurs' businesses was analysed. 3) path analysis was carried out to identify the factors affecting the resilience of women's businesses. The business resilience of rural entrepreneur women was determined by the following components: external resources, internal resources, innovation, opportunity and adaptation, risk management, and family support. The study was conducted using a survey, and 269 individuals were selected through stratified random sampling. Check relevance.
Rider et al. (2020) Assessing Healthful Eating and Physical Activity Practices in Places Children Learn (United States)	Y		Site-level assessment questionnaires (SLAQs), with Likert-scale series of response options, were developed to assess nutrition and physical activity practices and environments in schools and other places children spend time to facilitate program planning and evaluation. Findings indicate that the questionnaires are feasible and useful for planning interventions. Questionnaires were tested at a convenience sample of sites: three elementary schools, three secondary schools, two out-of-school programs, and three early care and education programs.
Robertson (2020) Ten Steps for Establishing a Succession Plan Addressing Volunteer Disengagement (United States)	Y		Succession planning is a great forecasting tool Extension professionals can use to ensure that programs are continued when a volunteer disengages. This paper outlines 10 research-based steps for establishing a succession plan with a volunteer group. Not relevant. Not applied, no M&E.
Roka et al. (2017) Lessons Learned Developing an Extension-Based Training Program for Farm Labor Supervisors (United States)	Y		This article outlines a four-step model for developing a training program for farm labor supervisors: 1) Form Stakeholder Partnerships, 2) Conduct Data Collection and Needs Assessment, 3) Design and Implement Initial Curriculum, 4) Revise Program According to Participant Feedback and Formal Evaluation. The formal program evaluation indicated that

			most participants found the quality of the experience to be high or very high, both in terms of overall satisfaction and likelihood of implementing what was learned. Check relevance. Methods of analysis not clear.
Rolfe, et. al. (2020). Can extension programs improve grazing management in rangelands: a case study in Australia's Great Barrier Reef catchments (Australia)	Y	Y	Outlines a conceptual framework that shows why extension may be a more powerful driver of management change than incentive programs, and then test this through an evaluation of a case study program conducted with beef cattle producers in catchments of the Great Barrier Reef, Australia. The pathway involving landholders to implement management change was through improved efficiency and productivity, as these are the issues that drive ongoing participation in broader environmental programs. The results present multiple lines of evidence to infer positive outcomes of an extension program in terms of changed management practices, which may be expected to generate improved productivity and better water quality outcomes. These can be grouped into three key areas. First, outcomes show positive improvement relative to the Grazing Water Quality Risk framework for the Great Barrier Reef catchments, which is designed to assess the links between land management and water quality. This indicates that resource condition is likely to improve, and sediment emissions should be reduced over time. A second outcome is increased landholder engagement and improved understanding of their business and engagement in future programs, which should underpin ongoing adoption. A third outcome is improved management of risk and developing the skills to do this through data collection and monitoring, which should improve management responses in drought years.
Ruggeri, et. al. (2018). Twitter communication of agri-food chain actors on palm oil environmental, socio-economic, and health sustainability (Europe)		Y	Palm oil is the world most used vegetable oil and its use as food ingredient is criticized for creating environmental, socio-economic, and health sustainability challenges. The research explores Twitter content of key palm oil agri-food chain actors on palm oil multiple sustainability dimensions, focusing on the European context. First, the study applied a qualitative deductive approach to categorize palm oil sustainability dimensions. Second, among the 463 palm oil agri-food chain companies identified, 198 have an active Twitter account, including world palm oil producers, European bakery and chocolate manufacturers, and European food retailers. Third, a term frequency analysis and an in-depth textual analysis of tweets on palm oil sustainability issues were carried out. Results confirms that all agri-food chain actors communicate about palm oil sustainability, adopting a multi-dimension outlook. Palm oil producers actively use Twitter to promote palm oil sustainability, whereas European manufacturers and retailers limit their activity to react to consumers' questioning. This study confirms that, in the case of sensitive issues, as for palm oil sustainability, Twitter is as able to drive companies' communication.

Salvia, et. al. (2018). Soil Conservation Practices and Stakeholder's Participation in Research Projects Empirical Evidence from Southern Italy (Italy)		Y	Adoption of soil conservation practices is promoted by increased engagement between researchers and stakeholders. By reporting a case study from southern Italy where farmers have been involved in research projects dealing with soil conservation over several years, we demonstrated that the rate of adoption of conservative technologies is positively linked to the degree of stakeholder participation in the project and that farmers (and other stakeholders) have been driven toward more conscious perception of the complex link between agricultural practices, environmental impacts and socioeconomic effects. The results of this study reinforce the pivotal role of effective participatory processes in soil conservation—evidencing the importance of (i) time required to build relationships and (ii) intensity (and persistence) of collaboration among similar initiatives. Involvement of stakeholders in ongoing research projects to foster greater uptake of soil conservation practices is costly and will not be difficult to achieve for many regions. Therefore, the construction and maintenance of trusted farmer/policymaker communication networks could provide an effective alternative.
Saptutyningsih, et. al. (2020). Does social capital matter in climate change adaptation? A lesson from agricultural sector in Yogyakarta, Indonesia (Indonesia)		Y	This study investigates farmers' willingness to participate in the process of climate change adaptation in Yogyakarta, Indonesia; particularly in facing the increasing risk of pest attacks. Using a logistic regression model, we tested the impacts of social capital on farmers' willingness to participate. The results showed that 70% of farmers were willing to contribute financially to the adaptation process. This participation was positively correlated with high social capital, which consists of high level of trust, community engagement, and personal relations with people in other villages.
Scheer S.D. Introducing the Human Development-EcoLogic Model: A Practical Approach for Outreach and Extension Education Programs (United States)	Y	Y	Introduces a theoretical model for incorporating human life /development stage, modified ecological systems theory and a revised logic model into extension program design. Supposedly this accounts for gaps in logic model based programs by considering how best to engage the target client and understanding the social context the client is operating in. Theoretical discussion no evidence presented that supports the claim
Schoolman, (2020). Local Food and Civic Engagement: Do Farmers Who Market Local Food Feel More Responsible for Their Communities? (United States)		Y	Draws on local capitalism theory to identify two different mechanisms, depth of economic reliance on local markets, and breadth of social networks related to local food sales, which might spur farmers who market local food to feel more responsible for their communities. Using data from a large-scale survey of specialty crop growers, I explore whether a relationship exists between farmer involvement with local food markets and attitudes toward civic engagement. Results suggest that while farmers strongly committed to local food markets attach greater importance to civic engagement, participation in multiple categories or kinds of local food supply chains is not necessarily associated with stronger civic values.
Sewell et al. (2017) Using educational theory and research to refine agricultural extension: affordances	Y		This paper examined the factors that support and hinder farmers' learning and to investigate the impact of an innovative learning program on farmers' practice change (p. 313). These

and barriers for farmers' learning and practice change (New Zealand)			learning experiences reflected the following educational principles: developing respectful relationships, using relevant and inclusive content and resources, providing multi-sensorial learning experiences and revisiting important concepts. The findings provide a basis for developing a sociocultural extension approach that considers personal and interpersonal factors, as well as institutional factors. These factors provide greater insight to the complexity of designing effective agricultural extension. Thematic analysis of interviews and focus group discussions was used to determine common themes of affordances and barriers to learning and actual practice changes. The affordances for learning and practice change include belonging to a learning community, enhancing self-efficacy, engaging with scientists, seeing relative advantage, reinforcing and validating learning, supporting system's integration and developing an identity as learners. Barriers to learning and practice change include issues of: trialability, complexity, compatibility and risk (p. 313).
Simoes et al. (2019) Assessing New England family forest owners' invasive insect awareness (United States)	Y		Looks at forest invasive pest (FIP) species awareness in family forest owners (FFO) using a mail survey. They found FFO awareness of FIP was higher than the general public. The low levels of exposure of FFO indicates outreach efforts should focus on knowledge and detection rather than management or mitigation
Son et al. (2019) Assessing the social media use and needs of small rural retailers: Implications for extension program support (United States)		Y	To assess small rural retailers' use of social media and the role of social media in their business sustainability, we conducted focus group interviews with small business owners/managers from rural communities in a midwestern state. Focus group session were transcribed and analysed using thematic analysis. Participants revealed strong interest in social media, especially for use in sales and marketing. Engagement was limited due to lack of knowledge and resources (i.e., time, human resources, financial resources, effectiveness measurement) related to developing and updating content. Modelling social media applications through Extension tool kits, disseminating how-to content, and hosting programs will provide assistance to rural retailers in need of competitive options.
Spiegal et al. (2020) Beef Production in the Southwestern United States: Strategies Toward Sustainability (United States)	Y		Changes in climate, vegetation, and human demographics threaten the sustainability of the regionally interconnected beef production system. Heritage cattle genetics, precision ranching, and alternative supply chain options are three strategies that show promise for addressing these sustainability threats, but major knowledge gaps exist. A coordinated project designed a 'boundary-spanning' approach to education, participatory research, and extension, which aims to span boundaries between science and decision-making to improve actions in both realms. A central pillar is participatory research: all research is conducted at least in part on commercial ranches, with direct involvement of ranch operators. Central tools have been on-ranch demonstrations, in-person events, podcasts, and surveys. The project is identifying trade-offs of the three strategies with explicit attention to peri-coupling (i.e., socioeconomic and environmental interactions) of regions. The 'Western Beef

			Knowledge System' is designed to aid decision-making around beef production and consumption, with geographically specific information for producers.
Stimpson, et al. (2019) Understanding grower demographics, motivations and management practices to improve engagement, extension and industry resilience: a case study of the macadamia industry in the Northern Rivers, Australia (Australia)		Y	Explores experiences among macadamia growers in the Northern Rivers region of New South Wales, Australia, with the aim to better understand and improve the targeting of development programs to meet grower needs and aspirations, for improved industry resilience using mixed-methods including, case study, focus groups and surveys. Results suggest that growers are a diverse, ageing demographic who came into the industry with a variety of skill sets. Noting a lack of previous farming experience for many growers, we highlight the need to consider information transfer and succession planning, along with aspirations to consolidate properties and skills. New engagement approaches are recommended, with tailored extension to different grower groups.
Stitzlein et al. (2020) Participatory design of digital agriculture technologies: bridging gaps between science and practice (Australia)	Y		The goal of this paper is to report on how different participatory design methods were used across two projects; one using digital technology to promote climate smart practice changes; another using digital technology to show farmers the relationship between nitrogen fertiliser uses and water quality in adjacent waterways. In both projects, the research teams considered the context in which farmers operate and feedback was obtained early in the product development process to help promote trust between developers and intended end users. The approaches reported here suggest how to recognise and incorporate farmers' beliefs systems into digital tools to increase the relevance of scientific research. Our experience demonstrates how to apply participatory design methods during the product development process (p. 14).
Stock, (2020). High Impact Extension Programming with Instagram (United States)	Y	Y	Provides recommendations on key behaviours, goal setting, and quantifying impact on Instagram for extension programming. Including the following: accounts should target one niche or market, a consistent and personal voice, and regular communication (new content at least three times weekly). Unique and productive connections between extension personnel, community leaders, farmers, students, and public influencers expands programming. Tracking program accounts, including the number of followers and engagement rates, can assess program impacts and target market needs.
Stokes et al (2020) Adapting to Provide Innovative In-Person Extension Programming During a Pandemic (United States)	Y	Y	COVID-19 pandemic prevented the annual Arbor Day Celebration from taking place in-person. Alternatively, a remote event was conducted, using Facebook to engage and enrol participants. Tree seedlings and accompanying educational material was delivered to members' place of residence, or via a drive-through event. Positive responses were posted on Facebook regarding the event. Check relevance. Limited M&E.
Stubbs et al. (2017) Increasing invasive plant pest early detection through interagency first detector education (United States)	Y		Shares the extension evaluation survey used at first detector training sessions (volunteers who are training on the identification of plants pests) Doesn't seem novel

Suvedi et al. (2017) Farmers' participation in extension programs and technology adoption in rural Nepal: a logistic regression analysis (Nepal)	Y		A sample of 198 farm households was selected for interviewing by using a multistage, random sampling technique. We employed a logistic regression model, frequency counts, and percentages to analyse the data. Adoption decisions were mainly affected by extension related variables; training, membership in a farmers' group, and off-farm employment. Extension participation was found to be influenced by socioeconomic variables; age, education, household size, and distance to the extension office. Our findings reveal that distance to the extension office and off-farm employment limited participation in extension activities and adoption, respectively, and education, household size, and group membership stimulated participation in extension programs.
Syrko & Kaylegian (2015) Developing a Contemporary Dairy Foods Extension Program: A Training and Technical Resource Needs Assessment of Pennsylvania Dairy Foods Processors (United States)	Y		The study used survey data to report on knowledge gaps and needs of the dairy foods industry, to prioritize program development. The survey was disseminated via mail, to dairy processor permit holders. The resulting extension program priorities included newsletter and website with focused information for dairy processors, regional workshops, and webinars. Check relevance.
Tasser, et. al. (2019). A simple biodiversity assessment scheme supporting nature-friendly farm management (Europe)	Y	Y	Agri-environment-climate measures (AECM) are therefore a central tool of the European Union to support its biodiversity conservation policy. AECM generally reward farmers for fulfilling predefined management actions or avoiding specific practices. In contrast, result oriented AECM are intended to reward farmers for the outcome of nature friendly management practices. This approach gives more flexibility in management and hence promotes farmers engagement and autonomy. Presents a biodiversity assessment scheme for farmland using a set of indicators, which covers different aspects of biodiversity (flower colour index, butterfly abundance, landscape structuring degree, patch diversity index, aggregated biodiversity index) and can be applied at different spatial scales. The proposed assessment scheme serves as a tool for the detection of differences in biodiversity resulting from land-use practices and can assist the monitoring of result oriented measures (ROMs).
Thron et al. (2017) Usefulness of Delivery Methods for Climate Change Programming: Perspectives of Extension and Research Faculty (United States)	Y	Y	The overall purpose of this study was to identify delivery methods useful for climate change communication to farmers, foresters, and other natural resources managers. Survey method was used to collect data on the perceived usefulness of specific delivery methods for disseminating information. The 13 delivery methods were grouped into three categories: traditional written and media publications, electronic dissemination, and face-to face meetings. The findings indicate that respondents considered field tours, videos, websites, and workshops as the best options for disseminating information and field tours and workshops as most useful for changing practices and behaviours. Together, these findings suggest that traditional Extension delivery methods that include face-to-face interactions are perceived by research faculty and Extension personnel as useful ways to engage with audiences about climate change.

Tjernstrom, et. al. (2021). Learning by (virtually) doing: Experimentation and belief updating in smallholder agriculture (Kenya)		Y	Studies how Kenyan farmers respond to an interactive app (MahindiMaster) that enables them to discover the returns to different inputs on a virtual farm that is calibrated to resemble their own. They measured beliefs by eliciting probability distributions and use an incentive-compatible experiment to measure behaviour change. The experiment gave participants an input budget that they could allocate across farm inputs. After playing several virtual seasons on the app, they could update these allocations. Farmers revise their input allocations along several dimensions after the virtual learning experience. They showed that farmers with the highest predicted returns to lime, an unfamiliar input in this region, increase their lime orders more than others.
Trejo & Lewis, (2017). Slow Fashion and Fiber Farming: Nexus for Community Engagement (United States)		Y	Evaluates the emerging visibility of fibre farms in the United States with sheep, alpacas, and angora goats in physical and virtual realms. The research methodology included a virtual ethnography on Facebook, and on-site visits to US fibre farms. Findings from the virtual ethnography conveyed how fibre farmers in Texas, Virginia, New York, and Illinois individualize the fibre animals with photographs, names, and descriptions of their personality characteristics. Individualizing fibre animals led to user engagement and interest in physically visiting fibre farms.
Tuck et al. (2020) Measuring the Economic Benefit of Extension Leadership Programs: McLeod for Tomorrow (United States)	Y		To address gaps in understanding the value of leadership development programs, we quantified the economic benefit of the McLeod for Tomorrow leadership program. Through an alumni survey and a mind-mapping session, we collected data on the program's public and private benefits. Public and private benefit was extrapolated from survey data. Analysis suggests that leadership programs provide a net benefit to participants and communities. The study has implications for measuring the economic benefit of Extension programming across disciplines.
Tui, et. al. (2021). Climate change impacts and adaptation for dryland farming systems in Zimbabwe: a stakeholder-driven integrated multi-model assessment (Zimbabwe)		Y	A stakeholder-driven, science-based multi-model approach was developed and used by the Agricultural Model Intercomparison and Improvement Project (AgMIP) to generate actionable information for adaptation planning processes. Distribution of outcomes were simulated with climate, crop, livestock, and economic impact assessment models for smallholder crop livestock farmers in a typical dryland agro-ecological zone in Zimbabwe, characterized by low and erratic rainfall and nutrient depleted soils. Results showed that in Nkayi District, Western Zimbabwe, climate change would threaten most of the farms, and, in particular, those with large cattle herds due to feed shortages. Adaptation strategies that showed the most promise included diversification using legume production, soil fertility improvement, and investment in conducive market environments. The most positive impact of adaptation was reached under Representative Agricultural Pathways for Sustainable Development, (RAP SDT) especially for the extremely poor.

Umar et al. (2021) Women Farmers Perception of Information Dissemination Skills among Agricultural Extension Workers in North Eastern Nigeria (Nigeria)	Y		This study examined the perception of rural women farmers on information dissemination skills of agricultural extension workers. Findings reveals that women farmers participated moderately in agricultural practices with overall mean value of 2.65. Also, agricultural extension workers had a lower level of information dissemination skill in dealing with women farmers with overall mean value of 2.25. There is the need for training and retraining of extension workers to boost their skills for information delivery to women farmers. Check relevance.
Umina, et. al. (2019). Escalating insecticide resistance in Australian grain pests: contributing factors, industry trends and management opportunities (Australia)		Y	Reviews the status of insecticide resistance and provide a context for how resistance is currently managed. They discuss emerging technologies and research that could be applied to improve resistance management, including generation of a baseline sensitivity data for insecticides before they are launched, developing genetic diagnostics for the full complement of known resistances, expanding resistance monitoring programs, and utilizing new technologies. Additional benefits are likely to be achieved through a combination of industry awareness and engagement, risk modelling, adoption of integrated pest management tactics, greater collaboration between industry stakeholders, and policy changes around chemical use and record keeping. Multiple tactics for managing pests through IPM programs will reduce exposure to insecticides. A proactive, integrated approach should include: "1. identifying risk: progress is needed in identifying pests likely to evolve resistance in the future, as well as understanding regional factors that reduce selection pressures. 2. resistance management: once resistance evolves, strategies need to be widely and consistently adopted to ensure resistances remain localized; an industry-wide and cross-industry initiative can minimize spread across regions and between industries. 3. socio-political initiatives: policy reforms and/or incentive programs that enforce and promote management changes across agricultural industries will significantly reduce selection pressures."
Uribe and Santamaria (2017) Exploring Hybrid Teaching Methods for Hispanic Agricultural Workers (United States)	Y		Hybrid teaching; which refers to course delivery through a blend of traditional, face-to-face teaching, along with online instruction outside of the classroom; is being implemented in some extension programs. Student performance was assessed via 'practice exams' at the first and last face-to-face meetings. Student feedback was collected via a quantitative survey and suggest positive outcomes. The pilot program has shown that overall, the method of delivery was well received by the target audience, the face-to-face components of the class are still an essential part of the learning process.
Venot, et. al. (2021). Below the Radar: Data, Narratives and the Politics of Irrigation in Sub-Saharan Africa (France)		Y	Explores whether new irrigation data can usefully inform these narratives. The paper investigates, through a pilot study, recent trends in the use of remote sensing methods to generate irrigation data; it examines the associated expectation that these techniques enable a better understanding of current irrigation developments and small-scale farmers' roles. The

			paper thus calls for moving away from a narrow debate on irrigation data and monitoring, and towards a holistic discussion of the nature of irrigation development in sub-Saharan Africa, which is necessary to support a constructive engagement with farmer-led irrigation development.
Voss, et. al. (2021). Encouraging technology adoption using ICTs and farm trials in Senegal: Lessons for gender equity and scaled impact (Senegal)	Y		This four-year study evaluates an Information and Communication Technologies (ICT)-enabled extension project in Senegal using radio and mobile phone services to encourage rural smallholder farmers' use of certified improved seeds and organic and inorganic fertilizers across Senegal. Data were collected using large-scale annual surveys in six regions over four years as well as focus groups. The findings suggest that, in general, the forms and format of ICT-enabled extension services deployed failed to significantly contribute to the adoption of promoted technologies. Personal connections to participatory farm trials were consistently associated with adoption, and phone-based voice messaging appears to have potential to increase technology uptake. Gender-based disparities in engagement with ICT services and Senegal's poorly developed systems for producing and distributing quality seeds emerged as key factors limiting the effectiveness of this project. Gender emerged as a particular area of concern in this project. Although women and men listened to radio programs at reasonably equal rates, women were much less likely to engage with phone-based services (in particular, the IVR call-in service).
Wang (2019) Evaluating Extension Program Impacts Through Comparison of Knowledge and Behaviour of Extension Clientele vs Others (United States)	Y		Case study looking at soil conservation practice. Evaluated the effectiveness of Extension programming by checking whether extension clientele differ in knowledge and behaviour related to a particular topic compared to producers not using extension services. Using a survey, they segregated participants on the basis of whether extension was not important in their decision making vs those who thought it was at least somewhat important. Questions included how knowledgeable are you about these practices, How many years have you been following these practices. Producers were then classified as adopters or non-adopters. Analysis showed significantly different adoption rates between clientele and non-clientele
Warriach, et. al. (2019). Impacts of improved extension services on awareness, knowledge, adoption rates and perceived benefits of smallholder dairy farmers in Pakistan (Australia)	Y	Y	Demonstrates the impacts of improved extension services on awareness, knowledge, adoption rates and perceived benefits of smallholder dairy farmers in Pakistan. An extension program was developed and implemented in several districts. The extension program involved the provision of research-based information on a monthly basis to smallholder farming families (FF = 523) over a 4-year period. The extension program was primarily a knowledge transfer-based system, but also relied on farmer engagement and feedback to help drive research and topics for discussion. A 'whole-family approach' was used in the extension program, where comprehensive interdisciplinary training on the whole dairy-farming system was provided to the males, females and children of the farming household. To encourage greater participation and support different learning strategies, several

			information transfer media were used (including group discussions, one-on-one visits, practical demonstrations, problem-based learning techniques and videos). Data were collected using a mixed-method approach from three different groups of farmers; registered (IMPreg = 179) farmers directly involved in the extension program, non-registered (IMPnon-reg = 116) farmers indirectly benefiting from the program and traditional (IMPtrad = 104) farmers not associated with any project activities. Overall awareness, knowledge and adoption rates relating to seven different recommendations in the extension program were significantly ($P < 0.05$) higher in the registered farmers than in the non-registered and traditional farmers. The perceived benefits of the adopted recommendations varied between the different extension messages, but farmers described that they observed increases in milk production, improvements in animal health (body condition and morbidity) and labour efficiency (time savings).
Weaver (2016) Capacity building and community resilience: A pilot analysis of education and employment indicators before and after an extension intervention (United States)	Y		This article reports on an analysis of the effects of a quasi-natural experiment in which 16 rural communities participated in public discussion, leadership training, and community visioning as part of an Extension program. Using received methods of statistical matching, a control group of 16 communities that did not participate in the program was constructed for comparative purposes. The results of the analyses offer convincing and consistent support for the hypothesis that participant communities were characterized by higher aggregate resilience than the control communities, following the Extension intervention. By engaging in more quantitative research that points to the potential effects of their capacity-building programs, Extension institutions can strengthen their position with public policy makers.
Wilkinson and Carroll (2019) Inclusive scholarship: Extension program participants as poster co-authors (United States)	Y	Y	Community partner and youth participants in an urban gardening program were engaged in program-related scholarship via creation of a poster and its presentation at a community engagement conference. This article explains how including partners and youths as co-authors and co-presenters helped Extension professionals reach a wider audience while deepening relationships, empowering youth participants, and improving data quality. Check relevance.
Wyckhuys, et. al. (2018). Maximizing farm-level uptake and diffusion of biological control innovations in today's digital era (Global)		Y	They conducted a retrospective analysis of the extent to which social science facets have been incorporated into biological control research over the past 25 years. It examines various biological control forms, concepts and technologies using a 'diffusion of innovations' framework and identify elements that hamper their diffusion and farm-level uptake. Also, introduces effective observation-based learning strategies, such as farmer field schools to promote biological control, and list how those participatory approaches can be further enriched with information and communication technologies (ICT). Video, smart phones, or tablets can be used to convey key ecological concepts and biocontrol technologies and facilitate social learning.

Yu & Spencer, (2021). Motivations, challenges, and self-transformations of farmers engaged in farm tourism on a tropical island (Hawaii)		Y	Reports on a qualitative field study of farmers engaged in farm tourism in Hawaii by reviewing the literature. The results revealed that farmers' motivations for such engagement included a desire to achieve higher profits, efficiently utilize farm resources, better educate people about the origins of their food, and/or perpetuate rural cultural traditions. Some farmers found it challenging to manage tourism in the midst of ongoing farm operations; others felt that farm tourism enhanced the image of farmers. As farmers became involved with farm tourism and interacted with other social groups, new identities, such as educator, culture disseminator, service provider, marketer, and product designer, fused with their traditional identities as agribusiness operators.
Zaga-Mendez, et. al. (2020). Mixing Public and Private Agri-Environment Schemes: Effects on Farmers Participation in Quebec, Canada (Canada)		Y	Analyses how the institutional characteristics and interactions of incentive-based mechanisms shape the type of farmers' participation and the achievement of desired socio-ecological outcomes. This research focusses on the institutional frameworks of two programs in the Province of Quebec, Canada: the 'Prime-Vert' Program (public agri-environment scheme) and the 'Alternative Land Use Services' (ALUS) initiative (a privately-funded payments for ecosystem services "PES" scheme). They revealed the impact of the institutional framework on farmers' participation by assessing the degree of farmers' engagement in the implementation and management of schemes. Other results showed a strong dependence of the private PES on the public scheme, rendering both programs ultimately managed under the remit of the provincial government. Study shows that low participation rates in both programs reflect major challenges in encouraging the provision of ecosystem services in intensive agricultural areas in Quebec. The low uptake can be partly explained by the rigid rules governing enrolment in the 'Prime Vert' public program (boundary rules), the limited conservation practices proposed within the overall ambit of the program (choice rules), and the constraints on coordinated and collaborative actions (aggregation rules).
Zhu & Habisch, (2019) Smallholder farmers' engagement in non-certified organic farming: a case from Southern China (China)		Y	Investigates the influences of smallholder farmers' motivations, opportunities and abilities on their satisfactions of non-certified organic farming practices in Southern China based on the motivation-opportunity-ability (MOA) model. The results show opportunity as dominant impact factor of smallholder farmers' satisfaction followed by motivation and ability. Also, their commitment to further non-certified organic farming is positively influenced by their satisfactory level. Mediation test reveals that satisfaction partially mediates the relationships between motivation, ability and commitment.

Table 6. Literature review Phase 2 – Summary table of articles, findings and consideration for implementation

(Author, Year) Title	Relevant Theme1	Key idea or findings	Consideration
Web of Science – Business and finance			
(Potdar et al., 2018) A process model for identifying online customer engagement patterns on Facebook brand pages	T4, T6	The purpose of this paper is to develop and empirically test a process model (comprising of seven dimensions), for identifying online customer engagement patterns leading to recommendation. The authors identified 22 unique pattern of customer engagement, out of which nine patterns resulted in recommendation/advocacy The findings will guide e-marketers on how to best engage with customers to enhance brand loyalty and continuously be in touch with their clients.	Testing a model for identifying online engagement.
(Cliffe et al., 2021) Can you see me? Participant experience of accessing a weight management programme via group videoconference to overcome barriers to engagement	T2, T4	A Registered Dietitian delivered a behavioural programme using Skype for Business in 10 sessions over 6 months. Participant perspectives were audio recorded in one-to-one, semi-structured interviews. Ten themes were identified, three relating to service engagement and seven relating to behaviour change facilitation. Key themes in engagement included 'reduced burden', described as saving time and travel and 'reduced threat' as participants perceived joining a group from home as less daunting compared to attending in-person. Despite reporting some initial technical difficulties with establishing video and audio connection, participants described beneficial peer support via videoconference.	Using Skype to deliver behaviour change on health.
(Coyne et al., 2021) Identifying economic and societal drivers of engagement in agri-environmental schemes for English dairy producers	T4	There are a growing number of private agri-environmental schemes (AES) now operating alongside public AES that offer farmers economic rewards to maintain and enhance the environment. Overall, farmers felt that income from the private AES provided	Role of private agri-environmental schemes.

[1] Relevant Theme:
T1: Understand target audiences
T2: Participatory approaches to program design and extension
T3: Catering to different learning styles
T4: Multimedia, e-extension, and engagement
T5: Hybrid (online/face-to-face) models
T6: Monitoring and Evaluation (M+E) methods

		stability and resilience to their businesses, permitting them to have greater confidence in business planning and budgeting for the upcoming year. Farmers compared the private scheme favourably to available public AESs, which they perceived as more restrictive and providing insufficient reward for the “red tape” involved. It is important that the design of future public AES does not “crowd out” private schemes	
(Yusuf et al., 2018) Influence of e-WOM engagement on consumer purchase intention in social commerce	T1, T4	This study is one of the early studies focusing on the influence of eWOM (electronic Word Of Mouth) engagement. The study offers comprehensive and empirically validated factors pertaining to eWOM engagement in s-commerce. The results of this study are also important to practitioners and online companies’ managers. The study’s model has demonstrated the contextualization of what makes customers engage in eWOM and its influence in s-commerce. The study will also offer insights for firms on how to encourage eWOM engagement among customers.	Understanding the role of electronic Word Of Mouth engagement.
Web of Science - Education			
(Leitao et al., 2022) Ocean literacy gamified: A systematic evaluation of the effect of game elements on students' learning experience	T4	In this study, we explored ways to address low levels of understanding about ocean science dimensions to climate change phenomena, cognisant of a growing awareness that formal education curricula do not adequately engage young people with developing ocean literacy. Using a gamified mobile application, it was examined relationships between the use of different game elements such as points, badges and leaderboards, and learning outcomes. Systematic evaluation of each element shows how different game features affected the participants’ learning experience and learning outcomes.	Use of gamification in ocean literacy.
(Hudson et al., 2019) Supporting urban change: Using a MOOC to facilitate attitudinal learning and participation in smart cities	T4, T5	This paper examines our use of a MOOC (Massive Open Online Courses) as a tool to facilitate attitudinal learning around the topic of smart cities and to explore whether the learners engage in local smart city activities. The results show that learners' perceived high levels of attitudinal learning on the topic of smart cities across four categories of learning outcomes (general, cognitive, affective and behavioural). Our findings also contribute to an understanding of the types of post-course activities learners participate in and their	Use of Massive Open Online Courses (MOOC).

		experiences of trying to apply what they learnt if they participated in local smart city activities.	
(Gilchrist et al., 2021) Using the Behaviour Change Wheel to identify barriers and enablers to the delivery of webchat counselling for young people	T4, T6	This qualitative study examined barriers and enablers to the delivery of webchat counselling through text communication and identified possible strategies to tackle these. The current investigation was conducted using the Behaviour Change Wheel, a validated and systematic framework employed to guide intervention development and optimisation. Online webchat counselling for young people can be optimised to better meet their service needs and provide more effective provision for this underserved age group. Behaviour change theory and tools can be used to identify appropriate and effective intervention strategies to improve the practice of webchat counselling.	Use of webchat. Use of behaviour change theory and tools – Behaviour Change Wheel.
(Zinoski, 2020) Living-dwelling | the importance of half-private spaces in the neighborhoods on the city borderline	T2,	Process Management (PM) is a method of approaching planning that can be used in complex, unpredictable situations common in the field of development and social change. The method allows stakeholders to pursue different goals or activities within a common project. Context specific, urban planning. The planning process must respond to many interests as a key aspect of the public interest of a particular community and helps planners by anticipating the precise events and activities to satisfy the larger goals and processes. Emphasizing the social content, general and specific objectives of the project interact and evolve during this process of implementation of sustainable methodology and become the subject to negotiations and compromises, which change during the process.	Use of process management for solving complex problems, involving a range of stakeholders.
Web of Science - Health			
(Keyworth et al., 2018) Are healthcare professionals delivering opportunistic behaviour change interventions? A multi-professional survey of engagement with public health policy	T3	"Making Every Contact Count" (MECC), a public health policy in the UK, compels healthcare professionals to deliver opportunistic health behaviour change interventions to patients during routine medical consultations. Future research should consider how healthcare professionals identify patients who might benefit from opportunistic behaviour change interventions and developing training for efficient delivery of interventions.	Use of opportunistic behaviour change interventions.
(Jay et al., 2019) Goal-directed versus outcome-based financial incentives for	T3	Financial incentives for weight management may intensify individuals' utilisation of evidence-based behavioural strategies	Understanding of goal-directed versus outcome-based financial incentives.

weight loss among low-income patients with obesity: rationale and design of the Financial Incentives foR Weight Reduction (FIReWoRk) randomised controlled trial		while addressing obesity-related economic disparities in low-income populations. The objective of this paper is to test the comparative effectiveness and cost-effectiveness of two financial incentive strategies for weight loss (goal directed vs outcome based). Our view is that challenges related to sustainability and acceptability are surmountable and that we can design incentive programmes in a manner that supports public perceptions of fairness.	
(Chiang et al., 2018) Interactive Two-Way mHealth Interventions for Improving Medication Adherence: An Evaluation Using The Behaviour Change Wheel Framework	T4, T6	There is growing evidence that mobile phone text messaging interventions (mHealth) connecting providers with patients positively impact medication adherence, particularly two-way engagement platforms that require bidirectional communication versus one-way in which responses are not mandatory. Our evaluation of WelTel using the Behavior Change Wheel suggests that most of its impact is delivered primarily through its personalized communication component.	Use of text message interventions. Use of behaviour change theory and tools – Behaviour Change Wheel.
(Keyworth et al., 2019) It's difficult, I think it's complicated': Health care professionals' barriers and enablers to providing opportunistic behaviour change interventions during routine medical consultations	T3, T6	Examines the barriers and enablers to delivering interventions during routine consultations and provides recommendations for the design of interventions to increase delivery of opportunistic behaviour change interventions. The Behaviour Change Wheel informed a framework analysis in which findings were mapped. Barriers related to workload, the clinical environment, competence, and perceptions of the health care professional role must be addressed, using appropriate intervention functions and BCTs, to support health care professionals to increase the delivery of interventions in routine practice.	Use of opportunistic behaviour change interventions. Use of behaviour change theory and tools – Behaviour Change Wheel.
(Harrison et al., 2022) Making every contact count with seldom-heard groups? A qualitative evaluation of voluntary and community sector (VCS) implementation of a public health behaviour change programme in England	T6	The study aimed to establish if (and how) MECC had impacted the workforce, including changes to staff knowledge, confidence, and behaviour; identify benefits, challenges and unintended consequences; and explore outcomes for service users. The findings illustrated positive early outcomes, including improvements in self-reported staff knowledge and confidence as well as emerging examples of organisational culture shift and individual behaviour change.	Use of opportunistic behaviour change interventions.

(Brannan et al., 2019) Moving healthcare professionals - a whole system approach to embed physical activity in clinical practice	T5	This report provides an overview from the Moving Healthcare Professionals programme (MHPP), a whole-system educational approach to embed prevention and physical activity promotion into clinical practice. The MHPP model integrates educational resources into three core domains of medical education: undergraduate education, postgraduate education and continuing professional development. Interventions include spiral undergraduate education materials, e-learning, embedded post-graduate resources and face-to-face peer-to-peer education.	Farm advisor development.
(Varas-Doval et al., 2020) Evaluating an implementation programme for medication review with follow-up in community pharmacy using a hybrid effectiveness study design: translating evidence into practice	T6	To evaluate an implementation programme of a community pharmacy medication review with follow-up (MRF) service. A series of interventions were defined (1) to engage pharmacy owners with the implementation model and (2) to provide training to pharmacists consisting of clinical case studies, process of MRF, communication skills and data collection methods and (3) practice change facilitators. These PCFs were trained for 5 days and were educated on the implementation model, motivational and communication skills, and to identify barriers and facilitators for the practice change in situ in the pharmacy. An observation guide was designed to allow PCFs to identify, systematically and individually in each pharmacy, the determinants, that is, barriers or facilitators and their causes.	Practice Change Facilitator (with the main focus on monitoring and evaluation) for may be an innovative role that can support adoption.
Web of Science – Environment and NRM			
(Ko et al., 2021) Expanding Transformative Agency: Learning Lab as a Social Change Intervention for Racial Equity in School Discipline	T2	This study examined how Learning Lab (an inclusive, collaborative problem-solving process) created a collaborative problem-solving space wherein school stakeholders exercised their collective, transformative agency to bring about a qualitative transformation in the school discipline system. Learning Lab encouraged local stakeholders to exercise their collective, transformative agency in order to produce locally meaningful knowledge aimed at reshaping a dysfunctional, punitive system that historically has yielded racial injustice in school discipline. Learning Lab can be a powerful leadership tool for school leaders to unite school stakeholders, and leverage expertise, experiences, and ingenuity for the development of locally optimized solutions to inequity.	Use of behaviour change theory and tools – Learning Lab.

(Rolfe et al., 2021) GrazingFutures: learnings from a contemporary collaborative extension program in rangeland communities of western Queensland, Australia	T4, T5	GrazingFutures is an extension project focussed on enhancing business management skills of extensive livestock producers in western Queensland, Australia. Project delivery emphasised upskilling multi-agency staff and livestock producers to promote practice change within three whole of business themes: grazing land management; animal production; and people-business. GrazingFutures extension techniques: programmed learning utilising established industry training packages; information access through industry forums, neighbour days, newsletters and case studies; one-on-one grazier mentoring and on-property support; on-property demonstrations featuring emerging industry technologies; and eExtension and online learning modes	Farm advisor development.
(Nettle et al., 2018) How private-sector farm advisors change their practices: An Australian case study	T1, T3, T6	This paper presents a qualitative study of the processes of change in the advisory practices of private-sector farm advisors who were provided with formal training as part of an Australian dairy sector extension program. Three key processes enabled advisory practice change: envisioning new advisory roles; experimenting with new advisory identities; and legitimisation of new advisory practices from both farmers and the advisors' business.	Farm advisor development.
(Mulley & Ma, 2018) How the longer term success of a social marketing program is influenced by socio-demographics and the built environment	T1, T4	This paper examines a community based social marketing program, TravelSmart, which targeted reducing vehicle kilometres travelled as part of a transport demand management strategy. Different trajectories in the reduction of car trips after the implementation of TravelSmart, suggested social marketing interventions work better when supported by hard policies such as a supportive built environment.	Use of social marketing.
(Nguyen et al., 2020) Innovations in creative education for tertiary sector in Australia: Present and future challenges	T2, T3, T4	Recent significant changes in technology such as Artificial Intelligence(AI) and big data analysis have a wide impact in many areas of human societies, not least in education. This paper presents some key changes in Australian educational areas in recent years that are important and relevant to the subject of education innovation and philosophy to achieve outcomes in training and sustainable economic development, as anticipated by the community and government. To foster creativity and adaptive skills, an innovative educational approach enhanced by interactive tools and methods should supplement conventional approaches	Integration of technology changes in tertiary education.

		dominant in current courses. Instead of focussing on content delivery as understood in many models of knowledge transfer, innovation will place learners at the centre of focus with self-learning, self-discipline, self- and peer-assessment as more important than teacher assessment.	
(Baynham-Herd et al., 2020) Intervener trustworthiness predicts cooperation with conservation interventions in an elephant conflict public goods game	T1, T2	This study demonstrates how experimental games offer opportunities to test behaviour change interventions and help to inform evidence-based conservation. Trust-building and greater consideration of who is best placed to intervene in conflicts may help improve natural resource management and increase stakeholder support for conservation interventions. We develop an experimental, framed public goods game to test how support for otherwise identical elephant conflict interventions varies with perceptions of the trustworthiness of two different intervening groups—a community group or a conservation organization—and compare game behaviour to pre- and post-game interviews.	Using 'public goods game' to test conflict interventions.
(Simmons et al., 2021) Psychosocial drivers of land management behaviour: How threats, norms, and context influence deforestation intentions	T1, T6	Behavioural frameworks from the social sciences have a lot to offer researchers and practitioners, yet these insights remain underutilised in describing what drives landholders' deforestation intentions under important political, social, and management contexts. Using survey data of private landholders in Queensland, Australia, we compare the ability of two popular behavioural models to predict future deforestation intentions and propose a more integrated behavioural model of deforestation intentions. We found that the integrated model outperformed other models, revealing the importance of threat perceptions, attitudes, and social norms for predicting landholders' deforestation intentions.	Using behaviour science frameworks for describing landholder intentions.
(Woolley et al., 2021) Public willingness to engage in backyard conservation in New Zealand: Exploring motivations and barriers for participation	T1	Understanding how personal characteristics (e.g. age, gender, education, connection to nature) relate to people's interest in participating in different nature-based activities is important for understanding what sort of uptake might be expected from recruitment and could inform the design of participatory projects that appeal to a wider section of the community. To understand how the appeal of pest trapping compares with that of other conservation activities, we investigated relationships between sociodemographic characteristics of participants and willingness to	How personal characteristics relate to interest in intervention activities.

		undertake three different backyard conservation activities. Understanding why some activities appeal across a wide sociodemographic spectrum may allow improved project design that maximizes participant recruitment.	
(Petersen et al., 2020) Smiling Earth-Raising Awareness among Citizens for Behaviour Change to Reduce Carbon Footprint	T4	This paper describes Smiling Earth, a mobile app to increase citizens' awareness about their own carbon footprint, by integrating energy and transport-related data. The main aim of our work is to explore the ways in which Information and Communication Technologies could help raise awareness and educate and motivate citizens about their actions and their consequences on the environment. Smiling Earth provides feedback to users by visualising data about their daily activities with the aim to motivate citizens to change their behaviour to reduce their CO2 emissions by adopting a healthier lifestyle.	Using communication technologies to raise awareness and educate and motivate citizens about their actions.
(Ungar et al., 2020) Social-ecological resilience through a biocultural lens: a participatory methodology to support global targets and local priorities	T2, T4	More research is needed to properly represent social-ecological system (SES) interactions. In this paper we develop place-based indicators and engage young people as coresearchers in two communities that rely on resource extraction industries Young people's SES experiences were explored through a suite of participatory qualitative methods, including Q methodology, visioning exercises, ESRI Survey 123, participatory mapping and photography, and spatial image capture via drones. We conclude that a focus on place supports the feedback loop between existing SES frameworks and local experiences.	Use of spatial tools to represent socio-ecological systems.
(Hayik, 2021) Through their lenses: Arab students' environmental documentation and action	T2, T4	Using PhotoVoice to document and report problems in the environment. PhotoVoice is a tool that invites participants to capture photos of areas requiring attention, elaborate on them in writing, and share the information, hoping to raise awareness of the highlighted issues.	Community-based reporting.
(den Heyer et al., 2021) Tracing the Link Between Transformative Education and Social Action Through Stories of Change	T1, T2	The Learning from Stories of Change (LSC) methodology brought together stories-based techniques with aspects of the Most Significant Change and the SenseMaker frameworks. The combination of methods was designed to facilitate reflection and a degree of participatory analysis in an online environment that reached over 400 graduates in 64 countries. It produced a rich set of data that provided key insights into program design and	Use of behaviour change theory and tools – Learning from Stories of Change (LSC), Most Significant Change, SenseMaker.

		confirmed the transformative adult Education model. Increases in knowledge and skills must be accompanied by changes in attitudes and motivations to make the leap from concepts to practice.	
(B. Williams et al., 2022) What is equine hoarding and can 'motivational interviewing' training be implemented to help enable behavioural change in animal owners?	T1	Motivational Interviewing is a well-researched and evidenced intervention used across a range of difficult to change human health behaviours, including substance misuse and other addictions. This paper describes the evaluation of motivational interview training which was delivered after a preliminary exploration of equine welfare officers' experiences. The training taught motivational interviewing skills and theory to equine welfare officers, in order for them to be able to use this approach during their general duties as well as more specifically in equine hoarding cases. The findings indicate that, for many equine welfare workers these skills can be beneficially applied to their caseload and can have good outcomes in the most difficult of areas, that of equine hoarding.	Using motivational interviewing in behavioural change interventions.
(Bahho & Vale, 2020) A demonstration building project: promoting sustainability values	T3	e Log Cabin Project in Napier, New Zealand, is a demonstration facility for displaying sustainable building and living practices situated on the campus of the Eastern Institute of Technology (EIT). The aim was to investigate the effect visiting a demonstration sustainable building might have on people's knowledge of and attitude towards sustainability issues, and more specifically whether the methods for making a building more sustainable displayed in the building affected how people thought about their own living environments.	Parallels to MLA's Producer Demonstration Sites.
Scopus – Business and Finance			
(Li et al., 2020) A Men Who Have Sex With Men–Friendly Doctor Finder Hackathon in Guangzhou, China: Development of a mobile health intervention to enhance health care utilization	T4	A health hackathon is an intensive contest that brings together participants from multidisciplinary backgrounds to develop a proposed solution for a specific health issue within a short period. The purpose of this paper was to describe a hackathon event that aimed to develop an mHealth tool to enhance health care utilization, summarize characteristics of the final prototypes, and discuss implications for future mHealth intervention development. This study demonstrated the feasibility and acceptability of using a hackathon to create mHealth intervention tools. This suggests a	Context specific software development.

		different pathway to developing mHealth interventions and could be relevant in other settings.	
(Egfjord & Sund, 2020) A modified Delphi method to elicit and compare perceptions of industry trends	T1, T6	One reason why incumbent firms fail at radical business model innovation is the existence of cognitive barriers, such as a dominant core business logic. In the present article, we propose and demonstrate a 7-step Delphi based method to elicit and examine differences in the perception of industry trends, comparing innovators, core business employees, and external experts.	Use of behaviour change theory and tools – 7-step Delphi based method.
(Holdsworth et al., 2020) Adapting rapid assessment procedures for implementation research using a team-based approach to analysis: A case example of patient quality and safety interventions in the ICU	T6	Learning health systems must understanding the implementation and effectiveness of complex interventions, but may be limited by timelines and implementation into fast-paced clinical environments. Rapid assessment procedures are a pragmatic option for producing timely, contextually rich evaluative information about complex interventions implemented into dynamic clinical settings. We describe our adaptation of rapid assessment procedures and introduce a rapid team-based analysis process using an example of an evaluation of an intensive care unit (ICU) redesign initiative. We generated in-depth case summaries describing the overall implementation process for each site; implementation barriers and facilitators for all four sites are presented.	Use of rapid assessment procedures.
(Cassaniti et al., 2021) Influence networks relating to health knowledge among Nairobi's micro-retailers and their clients	T2, T4	Digital programs have enabled social enterprise partnerships to expand the reach of their initiatives to broader audiences including specifically defined groups that hitherto were untapped or difficult to reach. A systematic and participatory tool known as Net-Map was used to explore and understand potential frameworks for establishing digital-based community-driven partnerships with the private sector for health promotion through behavior change. The Net-Map approach was used to help individuals and groups clarify their view of a situation (including networks and power structures), foster discussion, and develop a strategic approach to their networking activities.	Use of behaviour change theory and tools – Net-Map.
(Ernst et al., 2016) The art museum as lab to re-calibrate values towards sustainable development	T3, T4	The implementation of radical change requires efforts across a range of disciplines and fields of knowledge, including interpretative and expressive forms of cultural communication such as art. Given the highly dynamic ICT driven environment and an increasing pluralistic culture at a global level, these institutions have the	Facilitating social innovation via cultural communication: of "art as tool – museum as lab".

		potential to play a crucial role in preparing for change, introducing new social desires, and managing fear. The focus of this case study will be on a business model innovation project, developing the idea of “art as tool – museum as lab” facilitating sustainable social innovation.	
(Nahmias, 2018) The changemaker lawyer: Innovating the legal profession for social change	T1, T2	Changemakers are individuals who harness innovation to solve social challenges, a notion arising from the global movement of social entrepreneurship. I identify three key themes that changemaker lawyers appear to have in common: (1) they seek to overcome long-standing norms in the legal profession; (2) they design novel organizational structures that reflect their values, and (3) they create trans-disciplinary practices that bridge legal fields and sectors. By proposing the idea of changemaker lawyers, this Note seeks to help create a new identity, unite a diverse community of advocates, and trigger a new movement in the legal profession.	Understanding ‘changemakers’ to advocate for best practice.
(Gomez et al., 2018) The impact of market segmentation and social marketing on uptake of preventive programmes: The example of voluntary medical male circumcision. A literature review	T1	This paper investigates what segmentation is, how it has been applied to voluntary medical male circumcision (VMMC), how it can be applied in development, and the challenges in both measuring and adopting segmentation as part of program design. We performed a detailed search of peer-reviewed literature using PubMed, ProQuest, ScienceDirect, Google Scholar, and the abstract directories of the International AIDS Society (IAS) published between January 2015 and September 2018.	A literature review on segmentation in health.
(Scuotto et al., 2020) Uncovering the micro-foundations of knowledge sharing in open innovation partnerships: An intention-based perspective of technology transfer	T2, T3	Firms are concerned about whether to manage innovation centrally or through decentralized business units. Two needs emerge 1. Guaranteeing organizational efficiency and 2. Exploiting effectively market opportunity. Therefore, drawing on the theory of planned behaviour (TPB) we propose a micro-foundation model for collaborative innovation and technology transfer.	Management of innovation intechnology.
(Ryan et al., 2019) "Working on Wellness:" Protocol for a worksite health promotion capacity-building program for employers	T2, T3	The Massachusetts Working on Wellness (WoW) program is an innovative, statewide capacity-building model designed to increase the number of smaller employers (200 or fewer workers) adopting health promotion initiatives. Employer organizations applied to the program and committed to designating a champion responsible for program implementation. Interventions were to include policy and environmental supports, and targeting individual behavior change	Adoption of health promotion in smaller construction companies.

		through raising awareness and education. Supports provided to employers included seed grants for qualifying activities, community linkages, data collection and organization-specific feedback tools, an on-line curriculum supplemented with technical assistance, and an expert webinar series.	
(Hoolohan & Browne, 2018) Reimagining spaces of innovation for water efficiency and demand management: An exploration of professional practices in the English Water Sector	T2	The core argument of this body of research is that, having focused on informing and incentivising behavioural change, demand management has largely neglected the social and material dimensions of everyday action that shape how and why resources are used. Using mixed methods, we demonstrate how specific modes of intervention emerge as priorities within a social, political, semiotic and material landscape of professional practice. Our empirical analysis highlights four particular contingencies of demand management that constrain the scope of interventions pursued. These are industry expectations and ideals; modes of collaboration; processes of evidencing action; and hydrosocial disturbances.	Using social practice theory to improve urban water demand management. Reference to 'modes of collaboration' in the four contingencies of demand identified, may be relevant to MLA.
(Mackenzie et al., 2021) Using co-production to develop “sit less at work” interventions in a range of organisations	T1, T2, T3	This paper describes the use of co-production in four diverse organisations, aimed at reducing sitting times. Workshops with staff in each organisation were conducted to develop an organisation-specific strategy. An ecological approach was used to consider behaviour change determinants at a range of different levels including intrapersonal, interpersonal, organisational, and environmental-level factors. Co-production resulted in bespoke interventions, tailored for different organisational contexts, maximising their potential feasibility and acceptability.	Co-production of interventions tailored for different organisational contexts.
Scopus – Education			
(Chattoo, 2019) A funny matter: Toward a framework for understanding the function of comedy in social change	T3	This article creates a practical framework toward the understanding of mediated comedy in social change communication by presenting a typology of distinct formats of comedy – scripted entertainment, satire news, humorous ads, and stand-up comedy – and synthesizing multidisciplinary scholarship that deals with the role of comedy in audience understanding of civic and social issues. The resulting framework for comedy’s influence in social justice includes: attracting attention, persuasion, offering a way into complex issues, dissolving social barriers, and encouraging message	Understanding the role of comedy in promoting social change.

		sharing. Implications for leveraging comedy in social change public engagement efforts, as well as directions for future innovation and research, are discussed.	
(Krakower et al., 2021) Academic Detailing to Increase Prescribing of HIV Pre-exposure Prophylaxis	T2	This review provides an overview of academic detailing and how it is currently being used to increase pre-exposure prophylaxis prescribing. Academic detailing is outreach education that engages with clinicians in 1-to-1 or small group interactions focused on identifying and addressing an individual clinician's needs to increase their use of evidence-based practices.	A literature review of academic detailing in healthcare.
(Cory et al., 2021) CHECK UP: A student-designed model for creating innovative patient education materials that your patients will actually use	T3, T4	Currently, patient education is often handouts printed from the electronic medical record system; however, these pieces of paper often do not have the desired impact. Well-established advertising methods reveal that repeated exposure is key in recall and swaying consumer decisions. The Creating Health Education for Constructive Knowledge in Underserved Populations (CHECK UP) Program is a medical student-led program that aims to improve patient recall of health information, health promoting behaviors and health outcomes by applying modified advertising concepts to the delivery of health education.	Using advertising to deliver health education.
(Shah et al., 2018) Children With Medical Complexity: A Web-Based Multimedia Curriculum Assessing Pediatric Residents Across North America	T4	We assessed resident satisfaction, knowledge, and behavior after implementing a novel online curriculum composed of multimedia modules on care of children with medical complexity utilizing virtual simulation. A Web-based curriculum of 6 self-paced, interactive, multimedia modules was developed. There was high satisfaction, significant knowledge acquisition, and specific behavior change after participating in this innovative online curriculum.	Using an online multimedia curriculum and virtual simulation on care for children among medical residents.
(Forsetlund et al., 2021) Continuing education meetings and workshops: effects on professional practice and healthcare outcomes	T5	Educational meetings are used widely by health personnel to provide continuing medical education and to promote implementation of innovations or translate new knowledge to change practice within healthcare systems. Compared with no intervention, educational meetings as the main component of an intervention probably slightly improve professional practice and, to a lesser extent, patient outcomes. Educational meetings may improve compliance with desired practice to a greater extent than other kinds of behaviour change interventions, such as text messages, fees, or o-ice systems. Our findings suggest that multi-	Using educational meetings for medical education.

		strategy approaches might positively influence the effects of educational meetings.	
(Lee et al., 2017) Development of tailored nutrition information messages based on the transtheoretical model for smartphone application of an obesity prevention and management program for elementary-school students	T4	The transtheoretical model (TTM) is comprised of stages and processes of change and can be adopted to tailored education for behavioral change. This study aims to develop TTM-based nutrition contents for mobile applications intended to change eating behaviors related to weight gain in young children. Tailored nutrition messages at each TTM stage were developed and visual materials such as figures and tables were developed to provide additional nutritional information.	Develop nutrition contents for mobile applications intended to change eating behaviors.
(Willis et al., 2016) Distance learning strategies for weight management utilizing social media: A comparison of phone conference call versus social media platform. Rationale and design for a randomized study	T4	The dramatic increase in technology and online social networks may present healthcare providers with innovative ways to deliver weight management programs that could have an impact on health care at the population level. A randomized study will be conducted on 70 obese adults to determine if weight loss (6 months) is equivalent between weight management interventions utilizing behavioral strategies by either a conference call or social media approach.	Comparison of conference call and social media engagement in a healthcare intervention.
(Usman et al., 2021) Educational strategies and roles of stakeholders in reducing antisocial behavior of football supporters	T3	This study aims to determine the strategies and roles of stakeholders in an effort to reduce antisocial behaviors of football supporters. Stakeholders had six roles in an effort to reduce antisocial behaviors of football fans, namely: supporting fans' activities, giving ideas, consolidating with supporters, controlling, mediator, and giving consideration. Therefore, this research attempts to investigate ways stakeholders introduce and implement ARIF (aggressiveness, religiosity, innovative behavior, and fanaticism) among supporters in Sinjai Football As-sociation (Perssin). Educating supporters in-volves knowledge sharing, skills and capacity building, and motivation to increase their under-standing of football rules so that they can act more wisely when supporting the team in either home game or away game.	Education strategies to improve antisocial behaviour – peer-to-peer learning, Community of Interest
(Johnson et al., 2020) Engaging parents in education for discharge (ePED): Evaluating the reach, adoption & implementation of an innovative discharge teaching method	T4, T6	This paper describes the evaluation of the implementation of an innovative teaching method, the "Engaging Parents in Education for Discharge" (ePED) iPad application (app), at a pediatric hospital. The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework was used to guide the evaluation. The ePED app operationalized how to have an engaging structured discharge	Using a tablet application to structure engaging conversation between health care providers and patients.

		conversation with parents. While the Reach of the ePED app was low under the study conditions, the adoption rate was positive	
(Tkacova, 2018) Erickson health coaching: An innovative approach for weight management in obese patients with obstructive sleep apnoea?	T3	Erikson coaching intervention as a form of lifestyle intervention to obese patients with OSA may increase their adherence to healthy lifestyle behaviour. Results of our recent pilot observational cohort study suggested that Erickson coaching is a powerful tool to address behavioural modification in obesity.	Use of behaviour change theory and tools – Erikson coaching intervention.
(Wang et al., 2017) Evaluation of a WeChat-based dementia-specific training program for nurses in primary care settings: A randomized controlled trial	T4	This paper describes a two-arm cluster randomized controlled trial to improve community nurses' knowledge, attitudes, and practice changes using an innovative and interactive mobile phone applet-based activity in primary care settings. The intervention sites received dementia-specific training and control sites received care training for older people with disability. The main results show that the intervention group demonstrated significant improvement in dementia knowledge and attitudes from baseline immediately after training and at the 3-month follow-up.	Use of mobile phone application to improve community nurse practice.
(Ouariachi et al., 2020) Gamification approaches for education and engagement on pro-environmental behaviors: Searching for best practices	T3, T4	This paper aims at exploring the role of gamification in affecting pro-environmental behavioral change and searching for best practices for educational purposes. For that aim, pro-environmental gamification platforms are identified and analyzed by applying two different frameworks: the Octalysis Framework and the Climate Change Engagement through Games Framework. In conclusion, the more attributes are enclosed in the gamification design, the stronger physical and mental connections it builds up with participants. Insights from this study can help educators to select best practices and gamification designers to better influence behavioral change through game mechanics.	Role of gamification in environmental change.
(Cheng et al., 2021) Playing Edcraft at Home: Gamified Online Learning for Recycling Intention during Lockdown	T3, T4	Gamification is an innovative approach to engaging in activities that people believe as less interesting. The main objective of this study is to explore the factors related to youths' recycling intentions after experiencing a gamified online recycling learning activity, Edcraft Gamified Learning (EGL). Gamified recycling education is believed to be a practical and engaging approach for youths.	Role of gamification in recycling behaviour.
(Tantillo et al., 2020) The recruitment and acceptability of a project ECHO® eating disorders clinic: a pilot study of	T2	This pilot study describes an innovative telementoring project (Project ECHO® Eating Disorders) that builds a geographically defined collaborative learning community to bridge the knowledge	Innovative tele-mentoring project to build geographically defined community and meet knowledge gap.

telementoring for primary medical and behavioral health care practitioners		gap between eating disorder specialists located in eating disorder service sites and community-based practitioners, often living in remote areas. This pilot study's Project ECHO®- Eating Disorders Clinic (PE-EDC) model has created a regional collaborative learning community consisting of an interprofessional team of eating disorder specialists forming a "hub" linked to a network of community-based providers across the 30-county Western region who can earn Continuing Education credits free-of-charge. Program evaluation findings revealed that PE-EDC successfully recruited participants from half of the targeted 30-county region, as well as a majority of participants who care for individuals in medically underserved communities targeted by PE-EDC.	
(Harvey et al., 2020) The use of actor-based immersive health and safety inductions: Lessons from the Thames Tideway Tunnel megaproject	T3	In this paper we report on the evaluation of an innovative, full day, actor-based health and safety induction called EPIC, currently being used on London's Thames Tideway Tunnel megaproject. This evaluation examines the impact of EPIC from the perspective of participants and other stakeholders, and considers the utility of actor-based immersive health and safety inductions for use more widely, in both construction and other sectors.	Actor-based health and safety induction.
(Pullen et al., 2019) Utilizing RE-AIM to examine the translational potential of Project MOVE, a novel intervention for increasing physical activity levels in breast cancer survivors	T3, T6	The purpose of this study is to utilize the RE-AIM framework to evaluate the translational potential of Project MOVE, an innovative intervention focused on increasing physical activity (PA) in breast cancer survivors. Reach was evaluated by the representativeness of participants. Effectiveness was reflected by change in PA levels and perceptions of satisfaction and acceptability. Adoption was examined using participants' perceived barriers/facilitators to program uptake. Implementation was examined by participants' perceived barriers/facilitators to implementing the program. Maintenance was assessed by participant retention.	Utilize the RE-AIM framework to evaluate an innovative health intervention.
(Meinzen-Dick et al., 2018) Playing games to save water: Collective action games for groundwater management in Andhra Pradesh, India	T2, T3	We present an innovative use of collective action games to not only measure propensity for cooperation, but to improve local understanding of groundwater interrelationships and stimulate collective governance of groundwater The games simulate crop choice and consequences for the aquifer. A slightly modified game was played in the same communities, one year later. Games were followed by a community debriefing, which provided an entry point	Use of community games to address complex issue of ground water use.

		for discussing the interconnectedness of groundwater use, to affect mental models about groundwater. Our study finds communication within the game increased the likelihood of groups reaching sustainable extraction levels in the second year of play, but not the first. Individual payments to participants based on how they played in the game had no effect on crop choice.	
(O'Brien et al., 2018) The VOICE study – A before and after study of a dementia communication skills training course	T3, T6	We aimed to develop and pilot a dementia communication skills training course that was acceptable and useful to healthcare professionals, hospital patients and their relatives. The two-day course was based on experiential learning theory, and included simulation and video workshops, reflective diaries and didactic teaching. Evaluation entailed: questionnaires on confidence in dementia communication; a dementia communication knowledge test; and participants' satisfaction. Video-recorded, simulated assessments were used to measure changes in communication behaviour.	Evaluation aspect of this training useful, links to advisers.
(Galy et al., 2019) Improving pacific adolescents' physical activity toward international recommendations: Exploratory study of a digital education app coupled with activity trackers	T1, T4	Although studies have shown the potential of digital technologies to change behaviours, none has been proposed to guide adolescents toward achieving these recommendations. Aim 1: to investigate whether a technology-based educational program that combines education, objective measures of physical activity (PA), and self-assessment of goal achievement would be well received by Pacific adolescents and help change their PA behaviors toward the international PA recommendations. Aim 2: to create more insightful data analysis methods to better understand PA behavior change. This self-paced user-centred program was delivered via an app and provided health-related learning content as well as goal setting and self-assessment tasks.	Good example of specified behaviours and using digital tools to evaluate.
(Smith & Petosa, 2016) A Structured Peer-Mentoring Method for Physical Activity Behavior Change Among Adolescents	T1, T3	This article describes how a structured peer-mentoring method provides a feasible, flexible, and tailored means to meet the current guidelines for best practice in a school setting. Through structured peer mentoring, adolescents are provided consistent social support in a caring and personalized manner. This support builds skills and competencies enhancing self-efficacy to sustain a lifetime of physical activity behavior	Use of structured peer-mentoring for self-efficacy.

(Sordahl et al., 2018) Interprofessional case conference: Impact on learner outcomes	T3, T6	The patient-aligned care team interprofessional care update (PACT-ICU) is an interprofessional workplace learning activity with the goals of simultaneously addressing educational and patient care needs. Context specific, heath care teams. This study demonstrates that interprofessional case conferences involving trainees and staff from multiple professions can increase awareness of other professions roles in patient care as well as facilitate interprofessional collaboration.	Good example of interprofessional practice, i.e., advisers from different disciplines involved in training and evaluation. Reflects needs in agriculture.
(Echaubard et al., 2020) Fostering social innovation and building adaptive capacity for dengue control in Cambodia: A case study	T2	Social Innovation (SI) in the context of implementation research for vector-borne diseases (VBD). Describe the processes of community engagement and transdisciplinary collaboration underpinning community-based dengue management in rural primary schools and households in two districts in Cambodia. The program facilitated processes of community engagement towards creating ownership of dengue control interventions tools by community stakeholders.	Use of participatory processes and social innovation in intervention development.
(Saez et al., 2018) Using facilitator-receiver peer dyads matched according to socioeconomic status to promote behaviour change in overweight adolescents: A feasibility study	T2, T6	To evaluate the feasibility of an innovative peer intervention promoting healthy eating and physical activity matching peer facilitators according to socioeconomic status to target less-advantaged overweight receivers. The present study suggests the peer intervention is feasible provided organisational difficulties are addressed.	Using facilitator-led peer-intervention for individual level change.
(Sarage et al., 2021) There is no I in Escape: Using an Escape Room Simulation to Enhance Teamwork and Medication Safety Behaviors in Nursing Students	T3	We report on the strategies and resources used to create and implement an escape room simulation for a problem-based learning activity to practice medication safety behaviors. We developed a team-based, four-hour escape room simulation activity around detecting and reporting medication errors in the hospital setting. The flow of the escape room parallels the phases in Kolb's experiential learning cycle where learning is viewed as an iterative process involving new experiences, reflection, decision-making and problem-solving, and new understanding. The escape room platform served as a foundation for incorporating other simulation modalities and provided a stimulating learning activity.	Using simulation to promote experiential learning.
Scopus – Health			
(Robinson, 2021)A Biodesign Approach to Designing, Packaging, and Scaling a	T4, T6	Different frameworks and models exist for translating and disseminating public health policies, programs, and services. This	Se of IDEAS framework for assessing digital health innovation.

Pediatric Weight Management Program: The Stanford CORD 3.0 Project		article describes an approach, grounded in the Integrate, DEsign, Assess, and Share (IDEAS) framework for digital health innovation and the Stanford Byers Center biodesign innovation process. The process considered the relevant stakeholders, the current market landscape, and the potential market. An iterative process resulted in a potential solution that combines both technology and human affordances and addresses high fidelity delivery, needs of providers and patients, training and support, likely customers, potential revenue models, intellectual property, and regulatory issues.	
(Duval et al., 2021) A community-based group randomized trial to increase aspirin use for primary prevention of cardiovascular disease: Study protocol and baseline results for the “Ask About Aspirin” initiative	T3, T6	We describe a state-wide campaign using innovative methods to educate the public and health communities about appropriate aspirin use. The initiative has two educational components: one aimed at increasing public awareness of effective heart attack and stroke prevention, through a variety of media and public relations outlets; and a second aimed at integrating recommendations as a part of a health system’s quality improvement program. Matched pairs of geographic territories will be randomized to intervention (12 territories) or control (12 territories). The primary outcome of appropriate aspirin use will be measured at the individual level, by community-based telephone surveys of 100 participants in each of the 24 geographically determined clusters.	Combined approach, media and improved advisor training initiative. Context based evaluation useful for MLA.
(O. Williams & Swierad, 2019) A multisensory multilevel health education model for diverse communities	T1, T3, T6	Socio-Ecological Model highlights important social and ecological influences on health behavior by delineating the different levels of influence. However, the SEM lacks a complimenting framework for understanding the role of conventional and unconventional approaches to health education. Addressing this gap, the current article presents an integrative Multisensory Multilevel Health Education Model (MMHEM), which incorporates three key domains—(1) Art (innovativeness/creativity), (2) Culture (cultural tailoring), and (3) Science (evidence-based), while promoting the importance of considering the socio-ecological levels of influence on targeted behaviors. Using a successful health education intervention, called the Hip Hop Stroke, we deconstruct the MMHEM and discuss its potential role as a guide for developing public health education interventions.	Integrating different levels of influence to promote behaviour change.

(B. Meyer et al., 2021) A personalized, interactive, cognitive behavioral therapy-based digital therapeutic (modia) for adjunctive treatment of opioid use disorder: Development study	T3, T4	Digital therapeutics are an innovative class of interventions that help prevent, manage, or treat diseases by delivering therapy using software programs. MODIA was developed by an international, multidisciplinary team that aims to provide effective, accessible, and sustainable management for patients with opioid use disorder (OUD). MODIA offers individuals with OUD a custom-tailored, interactive digital psychotherapy intervention that maximizes the personal relevance and emotional impact of the interaction. We expect access to MODIA will improve the OUD management experience and provide sustainable positive outcomes for patients.	Use of interactive software for individual level change.
(Langdridge et al., 2019) A visual affective analysis of mass media interventions to increase antimicrobial stewardship amongst the public	T3, T6	We have analysed the presence and nature of affect within the visual materials deployed in antimicrobial stewardship interventions targeting the public identified through systematic review. A novel method was devised drawing on concepts from semiotics to analyse the affective elements within intervention materials. Three thematic categories of affect are identified within the materials in which specific ideological machinery is deployed: (1) monsters, bugs, and superheroes; (2) responsibility, threat, and the misuse/abuse of antibiotics; (3) the figure of the child. The study demonstrates how affect is a present but tacit communication strategy of antimicrobial stewardship interventions but has not – to date – been adequately theorized or explicitly considered in the intervention design process.	Analysis of image-use and tacit communication to promote individual and community level change.
(Tucker et al., 2017) Crowdsourcing to promote HIV testing among MSM in China: Study protocol for a stepped wedge randomized controlled trial	T2, T3	Crowdsourcing, the process of shifting individual tasks to a group, has been increasingly adopted in public health programs and may be a useful tool for spurring innovation in HIV testing campaigns. We designed a multi-site study to develop a crowdsourced HIV test promotion campaign and evaluate its effectiveness against conventional campaigns among MSM in China. With a large-scale, stepped wedge, randomized controlled trial our study can improve understanding of crowdsourcing's long-term effectiveness in public health campaigns, expand HIV testing coverage among a key population, and inform intervention design in related public health fields.	Use of crowdsourcing to develop innovative interventions.
(Rudov et al., 2017) Evaluation recommendations for nonprofit social	T4, T6	The Louisiana Campaign for Tobacco-Free Living, a nonprofit public health program, implemented a mass media campaign in 2012, with	Use of mass-media to promote smoke-free living. Use of Google

marketing campaigns: An example from the Louisiana Campaign for Tobacco-Free Living		the goal of increasing advocacy for policy change around the smoke-free movement. The campaign was accompanied by a mixed–quantitative evaluation that was grounded in the diffusion of innovations theory. Results from this study demonstrate that the 2012 Tobacco-Free Living mass media campaign was moderately effective in reaching its target audience and highly effective in using Google Analytics to identify a group of activists (i.e., innovators) in support of the smoke-free policy change.	Analytics to identify innovators/leaders.
(Lenert et al., 2021) Informatics for public health and health system collaboration: Applications for the control of the current COVID-19 pandemic and the next one	T3, T4	Data systems for public health are siloed by jurisdiction (by law), but also by program (as a result of federal funding restrictions.) Successful collaborations will require public health to change from its historical hierarchical information supply chain model to an ecosystem model with a peer-to-peer exchange with population health providers. Examples of the types of informatics innovations necessary to support such an ecosystem include a national patient identifier, population-level data exchange for immunization data, and computable electronic quality measures. Rather than think of these components individually, a comprehensive approach to rapidly adaptable tools for collaboration is needed.	Developing innovative ways to access existing data, via peer-to-peer exchange. Useful for sharing information between government and advisors.
(Zhang et al., 2017) Innovation contests to promote sexual health in China: A qualitative evaluation	T2, T3	Innovation contests call on non-experts to help solve problems. We implemented an innovation contest in China to increase sexual health awareness among youth and evaluated community engagement in the contest. Contest promotion activities included in-person and social media feedback, classroom didactics, and community-driven activities. The results of this study suggest that innovation contests may be a useful tool for public health promotion by enhancing community engagement and re-orienting health campaigns to make them more patient-centered.	Use of innovation contests to enhance stakeholder engagement in program development.
(Schillinger et al., 2017) Reducing Cancer and Cancer Disparities: Lessons From a Youth-Generated Diabetes Prevention Campaign	T2, T3	The purpose of this paper is to encourage innovative health communications that target youth; youth behavior; and the structural, environmental, and social determinants of youth behavior. The authors describe the rationale, processes, products, and early impacts of an award-winning youth diabetes prevention communication campaign model (The Bigger Picture) that harnesses spoken-word messages in school-based and social media presentations. Instead of encouraging young people to modify their	Stakeholder-led interventions, integrating structural, environmental, and social determinants of behavior.

		behavior for future health benefits, TBP motivates individual and structural change by mentoring minority youth to create authentic and captivating content that taps into the values that are most compelling to young people	
(Ali et al., 2020) Social media as a recruitment platform for a nationwide online survey of COVID-19 knowledge, beliefs, and practices in the United States: Methodology and feasibility analysis	T4	Social media platforms have been explored as a research recruitment tool in other settings; however, their feasibility for collecting representative survey data during infectious disease epidemics remain unexplored. This study has two aims 1) describe the methodology used to recruit a nationwide sample of adults residing in the United States (U.S.) to participate in a survey on COVID-19 knowledge, beliefs, and practices, and 2) outline the preliminary findings related to recruitment, challenges using social media as a recruitment platform, and strategies used to address these challenges. The social media advertisement campaign was an effective and efficient strategy to collect large scale, nationwide data on COVID-19 within a short time period.	Investigation into use of social media marketing.
(Musker et al., 2020) Using behaviour change theory to inform an innovative digital recruitment strategy in a mental health research setting	T1, T4	Our team describe a pragmatic portal recruitment process for facilitating timely recruitment into multiple research studies focusing on mental health. A web-based recruitment portal was developed by the research team in collaboration with the South Australian Health and Medical Research Institute (SAHMRI) Consumer & Carer Research Advisory Group. We learnt that 77% of participants were recruited within seven days of promotional events, providing an interesting pattern of recruitment that may assist future recruitment design.	Use of post-event, web-based recruitment.
(Budney et al., 2020) Workshop on the development and evaluation of digital therapeutics for health behavior change: Science, methods, and projects	T4	Digital therapeutics offer the potential to extend the reach of effective interventions at reduced cost and patient burden and to increase the potency of existing interventions. Intervention models have included the use of digital tools as supplements to standard care models, as tools that can replace a portion of treatment as usual, or as stand-alone tools accessed outside of care settings or direct to the consumer. This paper summarizes a workshop conducted on the Development and Evaluation of Digital Therapeutics for Behavior Change, which addressed (1) principles of behavior change, (2) methods of identifying and testing the underlying mechanisms of behavior change, (3) conceptual	Development of digital consulting tool using behaviour change theory.

		frameworks for optimizing applications for mental health and addictive behavior, and (4) the diversity of experimental methods and designs that are essential to the successful development and testing of digital therapeutics.	
(Burns et al., 2016) A systematic review of randomised control trials of sexual health interventions delivered by mobile technologies	T3, T4	This systematic review identified recent randomised controlled trials that employed mobile technology to improve sexual health outcomes. The findings suggest interventions delivered by SMS interventions can increase uptake of sexual health services and STI testing. High quality trials of interventions using standardised objective measures and employing a wider range of behavioural change techniques are needed to assess if interventions delivered by mobile phone can alter safer sex behaviours carried out between couples and reduce STIs.	Insights on multiple interventions, investigating SMS interventions.
(Kelleher et al., 2017) Barriers and facilitators to the implementation of a community-based, multidisciplinary, family-focused childhood weight management programme in Ireland: A qualitative study	T6	To explore the barriers and facilitators experienced by those implementing a government-funded, community-based childhood weight management programme. Most barriers occurred at the level of the organisational context. Barriers arose due to the multidisciplinary nature of the programme and health professionals' low-perceived self-efficacy. The main facilitators of implementation, occurring at the level of the health professional. Having a local lead and supportive colleagues were further implementation drivers. This study highlights the complexities associated with implementing a multidisciplinary childhood weight management programme, particularly translating such a programme to a community setting.	Highlights issues around implementing multidisciplinary programs, also found in agriculture.
(Djian et al., 2019) From “Stoptober” To “Moi(S) Sans Tabac”: how to import a social marketing campaign	T6	The purpose of this paper is to analyse the specific national contexts of two positive social marketing campaigns that aim to trigger mass quit attempts among smokers. A contextual analysis was performed to determine differences between the two countries regarding smoking prevalence, health services and culture. Campaign progress and cessation tools provided during both campaigns are quite similar, however, Santé publique France needed to adjust the British model by favouring a regional smoking prevention network and by building an innovative partnership strategy to reach the target.	Regional differences require tailored approach, reinforce findings in agriculture.

(Taylor et al., 2017) Beyond the Page: A Process Review of Using Ethnodrama to Disseminate Research Findings	T3	Researchers are increasingly exploring innovative dissemination techniques to reach broader audiences, one technique is ethnodrama, a written or live performance based on study findings. We present a case study describing the process of planning and implementing an ethnodrama in the context of the Durham Focus Group Study, which explored men's health-seeking behaviors and experiences with health and healthcare services	Use of ethnodrama for communicating research.
(Steinman et al., 2021) Deprescribing and deimplementation: Time for transformative change	T6	Identified the target(s) of the interventions and mapped the types of interventions used with the elements of behaviour change articulated in the COM-B model. The COM-B model, which posits that behavior change arises from the interaction of capabilities, opportunity, and motivation. The majority of deprescribing interventions focused only on one element of behavior change; deprescribing interventions tended to target clinicians; interventions rarely addressed clinician, patient, or health system motivations	Insights on multiple interventions, finding indicate more holistic approach to capabilities, opportunities and motivations required.
Scopus – Environment and NRM			
(Anibaldi et al., 2020) Eating Behaviors in Australian Military Personnel: Constructing a System of Interest for a Social Marketing Intervention	T1, T3	Social marketing could assist in changing unhealthy eating behaviors of personnel through implementation of feasible interventions co-created with stakeholders that are valued by Australian Defence Force (ADF) personnel. This approach assists in expanding the focus of change beyond the individual to include factors in social, economic, and policy environments. The article reports the first phase of a systemic co-inquiry into unhealthy eating behaviors of military personnel. Data were thematically analyzed to construct a system of interest in which to explore how eating behaviors emerge among personnel and ADF-controlled leverage points that can be used to increase healthy eating for ADF personnel through social marketing intervention.	Use of co-developed (researcher and stakeholder) social marketing for behaviour change in structured environment. Model for engaging stakeholder in development of messaging.
(Perry et al., 2020) Designing solutions for clean water on Cape Cod: Engaging communities to improve decision making	T1, T2	The Area Wide Water Quality Management Plan (208 Plan Update) seeks to support mitigation of nitrogen pollution and restore estuarine health through active community engagement with elected officials, town staff, citizens, and other stakeholders across its 53 embayment watersheds, 35 of which are deemed impaired. The process specifically applied a number of different mechanisms for community engagement which enabled progress in addressing	Using community engagement to address nitrogen management for waterway health.

		nitrogen management needs. The process helped to determine and address barriers to successful implementation of nitrogen mitigation plans and resulted in a framework for watershed-based planning that relies on regional coordination and supports local selection of mitigation strategies. As a result, communities in the region are developing innovative cross-municipal partnerships and committing to fund infrastructure necessary to decrease nitrogen loading to coastal embayments.	
(Ogletree & Thomas, 2019) Air quality community action network	T4	Denver, in partnership with Denver Public Schools (DPS), is creating a citywide air quality monitoring network to provide real-time air quality data – utilizing low-costcutting-edge air pollution sensor technology, redeveloped with solar, battery storage, and data connectivity to make it useful for widescale deployment and replicable in any municipality. Each participating school will receive a sensor, air quality dashboard and programming. The dashboard will display real time data and suggested behaviour changes, while the backend data platform will create insights for air quality patterns near each school – leading to policy and institutional changes for the City and DPS – as well as generate automated alerts for stakeholders.	Using community operated real time monitoring equipment for policy change.
(Hu et al., 2020) Enhancing individual commitment to energy conservation in organizational settings: Identity manipulation for behavioral changes	T1, T3	This paper tries an innovative behavioral intervention strategy, i.e. identity manipulation, for curbing energy use in organizational settings. First, the links between pro-environmental identity (PEI) and energy conservation behaviors are tested under an expanded TPB (theory of planned behavior) model, with survey data collected with living-on-campus students and office occupants. Based on the confirmed identity-behavior link, we design an identity-based intervention, linking the undesired excessive energy use behavior to a dissociative group, and we find the intervention may exert moderate influence on behaviors involving substantial energy consumption, but may not quite change behavioral habits involving only minor energy consumption.	Understanding the role of 'identity manipulation' in sustainable behaviour.
(R. Gupta et al., 2018) Exploring innovative community and household energy feedback approaches	T3, T4	This paper describes the application and evaluation of more visual energy feedback techniques (carbon mapping, thermal imaging) at different scales, alongside traditional methods (web-based energy and environmental visualization platform, home energy reports)	Use of visual feedback techniques.

		delivered through community workshops, home visits and the internet, across six low-carbon communities in the UK. Overall, most of the feedback approaches were able to engage and raise awareness amongst the householders.	
(Sharma & Siu, 2018) Gaming as a driver for social behaviour change for sustainability	T3, T4	Gamified Behaviour Change Programmes (GBCPs) have been quite effective in stimulating a positive change in behaviour and in establishing a culture of sustainability within the targeted groups. By investigating some of the effectively implemented cases of GBCPs, the study intends to develop a deeper understanding of the process of social behaviour change, particularly of the role that elements of game mechanics play in engaging and motivating the participants and in facilitating an influential social environment for behaviour change. This understanding would provide some essential touchpoints for applying game mechanics to the process of social behaviour change for environmental benefit.	Using gamification to promote sustainable behaviour change.
(Lopez-Carreiro et al., 2020) Identifying key factors for efficient travel-planners: End-users' expectations	T1, T4	In the digital age, real-time information travel planners become a key enabler of travel behaviour change and can be applied for encouraging more sustainable habits. This paper explores the motivational drivers underlying the adoption and use of these Smart Mobility solutions. Our results highlight the different needs of each group of travellers, but also point out their common motivations: the need of user-friendly devices, the need for control and their environmental awareness.	Understanding the role of digital travel planners for promoting sustainability.
(Davis-Street et al., 2020) Leveraging behavior change theories in program design improves workforce health	T3	Creating healthy physical and social environments enhances behavior change programs by addressing change at multiple levels - individual, interpersonal, group and community Using examples from our workforce health programs, we describe how behavior change theories have been used effectively in health promotion programs to improve workforce health. In addition, we identify success factors for health communication, program design and implementation in deploying global health programs. Leveraging data and health behavior theory in communications and program design can positively impact health and wellness program participation, engagement and outcomes	Use of behaviour change theories.

(Zavratnik et al., 2019) Living Labs for rural areas: Contextualization of Living Lab frameworks, concepts and practices	T2, T3	Living Labs are spaces for innovative and participative research, development and activities that use multidisciplinary approaches and promote the co-creation paradigm. Our specific interest lies in exploring the value of the Living Lab concept for creating environments that enable equal opportunities for people living in rural and urban areas, and for making rural areas attractive places to live. Living Labs are a valuable player in enhancing circular economy, digital transformation, local self-sufficiency and other elements of sustainable living.	Participatory research and development inro rural-urban equality, through Living Labs.
(Orth & Cheng, 2019) Organizational Change in the US Forest Service: Negotiating Organizational Boundaries in the Collaborative Process	T2	In the United States and across the globe, forest governance officials are seeing a rise in the demand from local community members to participate in forest management decision-making. We empirically examined the boundary negotiations occurring at the field office level of the United States Forest Service in order to understand organizational change with respect to the collaborative process. By examining the defining characteristics of organizational boundaries, we found that boundary negotiations are facilitating organizational change through individual-level learning and behavior changes.	Role of individual learning and behaviour change to organisational change.
(Epanchin-Niell et al., 2022) Private land conservation decision-making: An integrative social science model	T1, T3	We propose a conceptual model of private land conservation decision-making that integrates theoretical perspectives from three dominant disciplines: economics, sociology, and psychology. The conceptual model is designed to facilitate better communication, collaboration, and integration across disciplines and points to methodological innovations that can expand understanding of private land decision-making. The model also can be used to illuminate how behavior change interventions (e.g., policies, regulations, technical assistance) could be designed to target different drivers to encourage environmentally and socially beneficial behaviors on private lands.	Interdisciplinary model for private land conservation.
(Noguera-Méndez et al., 2016) The role of social learning in fostering farmers' pro-environmental values and intentions	T2, T3	In interventions to achieve sustainability, social learning plays a prominent and growing role as a framework strategy in changing behaviors and intentions. This paper studies the effects of the Local Agrarian Innovative Programme (PIAL), which aims to promote sustainability, through learning, cooperation and social interactions. In this paper, outcomes and actions are considered a first category	Promoting sustainability, through learning, cooperation and social interactions

		of learning (single loop learning), and subjective perceptions and intentions imply a superior category of learning (double loop learning). We have concluded that PIAL, by using social learning as a framework strategy, has had a significant impact, not only on behaviors, but also on pro-environmental values and intentions.	
(Kim et al., 2020) Social entrepreneurship education as an innovation hub for building an entrepreneurial ecosystem: The case of the KAIST Social Entrepreneurship MBA Program	T1, T2	This study proposes a design and assessment framework for social entrepreneurship education (SEE). An entrepreneurial ecosystem is a group of systems, networks, or interconnected elements formed by the interaction of entrepreneurial communities or stakeholders with their environment. The main purpose of SEE is to help students to develop sustainable business models that enable them to work with private and public partners to create social value in innovative ways. The framework emphasizes strengthening internal connectivity among SEE program members and external connectivity with outside entities, including universities, firms, government agencies, civil societies, and natural environments	Use of SEE to build networks and innovation. Contribute to innovations systems perspective.

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8.2 Appendix 2. Extended activity plans and costings

This appendix is confidential and not provided in the publicly available final report.

8.3 Appendix 3. Selected program case studies

Case Study 1:

Red Meat Profit Partnership (New Zealand)

Snapshot

The Red Meat Profit Partnership (RMPP) was a Primary Growth Partnership (PGP) program tasked with helping the New Zealand red meat livestock sector to increase productivity and profitability. The program ran from November 2013 to March 2021 with funding from New Zealand's Ministry for Primary Industries (MPI) in partnership with Beef + Lamb New Zealand (B+LNZ) and a consortium of agribusiness partners across the red meat value chain including meat processors and banks. The RMPP recognised that the key to farmers successfully lifting their profitability has been

working together in small Action Groups with paid professional support, to make the necessary changes on their farms. A key initiative of the RMPP from 2017–2020 was an evidence-based farm extension program known as the RMPP Action Network. The Action Network mobilised farmers to turn ideas into action through participation in Action Groups, increasing sector knowledge and beneficial on-farm practice change.

Program Features

- **Small group learning**: The Action Network was a small group learning and support extension approach that involved connecting like-minded farmers into Action Groups of seven to nine farm businesses with clear steps to making positive changes in their chosen area of interest. The Action Groups were farmer-led collaborations supported by trained facilitators. During the program 229 Action Groups were created with the involvement of 1,964 farm businesses. RMPP trained a total of 694 facilitators. Of these, 96 facilitated Action Groups during the life of RMPP. In focusing on this small group approach RMPP Action Network has offered a step change for the sector.
- **Access to tools, resources and a network of experts and other farmers:** When developing the program, lack of confidence was identified as a significant factor preventing farmers working towards and making changes on-farm. This was largely due to a lack of adoption support and follow up. The extension pilot identified one-to-some farm businesses (small group) as the most efficient approach in terms of resources and level of engagement and adoption. Farmers were provided with access to tools, resources and a network of experts and other farmers, and up to $4,000 (NZD) was allocated per farm business to pay for approved group activities. Action Group leaders worked with businesses with a set of common goals over a period of 3 years to connect the group to experts and work through practice change on farm. Four key aspects were identified as vital to an effective extension program:
    1. **Information resources** – Action Groups have access to B+LNZ's knowledge hub, a fully searchable web-based centre with more than 400 videos, podcasts, fact sheets, resource books, user guides and learning modules.
    2. **Activities providing opportunities to learn about a subject** – workshop, field-day or small-group learning.
    3. **Adoption support**, in particular follow-up support on farm – mentoring, webinars, one-to-one coaching or discussion with a group of peers.
    4. **Recognition of different roles** – the RMPP Action Network, centred around farm teams, included connectors, facilitators, subject matter experts and mentors.

Program Insights (from RMPP Video – The Power of Partnerships)

'Being involved in this group has really been a key driver in bringing about change in our business, through the access to industry experts and the relationship to our processor, and meeting other farmers in similar situations'

— Sarah and David Smith, farmers in East Otago, NZ

'The biggest opportunities for improvement actually sit within our farm gate'

— Malcolm Bailey, Chair RMPP Board

Critical Success Factors

- **connection:** Well-formed and functioning groups have proven to develop a strong foundation of support and connection. At the core of the RMPP Action Network are interlinked connections within and between Action Groups and sectoral partners.
- **peer-to-peer learning:** Peer-to-peer learning is about using the 'power of the knowledge in the room' as a primary focus. Small group size encourages participation and develops an understanding of peers in the group. The limit of seven to nine farm businesses in an Action Group is core to their success. This small group learning environment breeds an environment of trust and support, builds confidence to share ideas, knowledge and experience and ultimately leads to strong accountability.
- **farmer-led/focused**: Farmers determine the structure and rules of their group and how they spend their funds. Action Groups have the interests of the farming businesses at the centre of the activity. This provides a shared vision and a platform for accountability.
- **effective facilitation**: Facilitators bring structure to groups that help to ensure farmers' needs are being addressed at Action Group activities. Where good effective facilitation is in place, groups report ongoing engagement, strong accountability and successful group and individual outcomes.
- **structure with flexibility**: RMPP Action Network approach allows for both short and long-term focuses, and the ability to adjust and narrow or broaden the focus to suit the common needs of
the Action Group.
- **support**: Support is provided the program level, with funding allocated to each participating farm business as a financial 'carrot', and at the Action Group level with repeat connection building confidence.

Outcomes and Evaluations

- Monitoring and evaluation ran through throughout the program including 6-monthly surveys, interviews with 30 farmers, facilitator self-reflections, case study creation, overall impact and financials.
- In economic terms, the evaluation showed that the benefits to participating farmers in Action Groups is another $24/ha ($20,435 for an average-sized farm) per farm of profitability, each year, building over an eight-year period. These gains in profitability represent a ROI of $27.50 for each $1.00 invested in the RMPP Extension and Adoption work program.
- The main non-economic benefits arising from Action Groups are improved wellbeing, environmental outcomes, animal welfare, social licence and succession planning.
- The results from the RMPP six monthly surveys showed most farmers agreed they had made production changes and increased their farm business skills and confidence to make changes on-farm, as a result of being involved in an Action Group.
- By August 2020, 91% of Action Groups remained active while 6% had, or were in the process of, transitioning **Red Meat Profit Partnership - Farmer Action Groups** to self-funding or had met their group objective. 3% disbanded for various reasons, 14% of participants had left a group, but 13% joined another group.

- The average rating for the group given by farmers was 78 out of 100 as it was supportive, well organised and strongly focused.

What is Innovative about this Approach?

- The high level of collaboration with the processing sector, industry, Beef and Lamb was the innovation i.e. it is a social innovation
- Big focus on connecting people, ability to connect across a range of organisations and in a variety of ways to build social networks that are trusted
- The reach of farmers incorporated a diversity of farmers, widening the "usual suspects" involved in practice change

Next Stage

From 2019 to the completion of the program in March 2021, management of the RRMP Action Network program and Action Groups shifted to B+LNZ who have committed to providing funding assistance for a further two years. Much of the learning material is available on-line so that it can continue to be used. It remains to be seen how many farmers continue to participate in Action Groups and meet all costs once external funding assistance ceases.

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Case Study 2:

Agriculture and Horticultural Development Board (AHDB) – United Kingdom

Snapshot

Agriculture and Horticultural Development Board (AHDB) is a UK industry-funded organisation that aims to deliver transformational projects to drive productivity and boost farming and supply chain businesses. To cover the whole supply chain, AHDB works with farmers, growers, packers, processers, agronomists, vets and abattoirs. This approach helps to bridge gaps in knowledge, encourage collaboration and unify the industry. The work of AHDB is funded by farmers, growers and others in the supply chain through statutory levy.

AHDB's work includes opening and developing markets for farmers' and growers' products in the UK and overseas, developing new tools and techniques through innovative research and development, and building farmers' and growers' capacity through collaborative knowledge exchange programs. ADHB's four priorities are:

- **Competitiveness:** Inspiring British farming and growing to be more competitive and resilient

- **Productivity:** Accelerating innovation and productivity growth through coordinated research and development, and knowledge exchange
- **Consumers:** Helping the industry understand and deliver what consumers will trust and buy
- **Thought Leadership:** Delivering thought leadership and horizon scanning to keep the industry ahead of the game

Program Features

- **Tailoring programs by segmentation of end-users:** In a 'complete flip' for the organisation, AHDB is moving away from a knowledge transfer or delivery of research outputs to a services design approach. This change in approach builds from a better understanding of target audiences and engaging producers in different segments differently and at different levels. While mainly focused on existing knowledge and the development of new products and services, the approach is used in considering new services in the carbon farming and contested knowledge areas.
- **Increased focus on knowledge exchange in co-design and delivery:** Drawing on social and behavioural sciences, AHDB's process starts with the end in mind, seeks to understand the behaviours to change and then considers the journey needed to get there. AHDB co-designs outputs with farmers, growers and target audiences. Key elements in the design approach include:
    - emphasis in messaging to include the social and cultural dimensions of farming
    - different messages and levels for producers to engage with and providing a unique 'journey' for them
    - engaging with and drawing other partners into co-design and delivery. For instance, deciding if farmer-to-farmer or farmer-to-advisor or farmer-to-community is the key influence relationship
    - increased online delivery to reach new audiences for entry-level engagement and awareness on topics of broad interest.

Critical Success Factors

- **Building the evidence base**: ADHB uses insights from the social and behavioural sciences to support intervention design. ADHB staff are trained in key frameworks (for example, mindsets for change) that they can bring into their work
- **Reaching audiences with 'influencers':** A specific area for change is targeted and key influencers of adoption and practice change are identified. AHDB work directly with the influencers to co-design the intervention approach.
- **Tailoring audience engagement**: ADHB is developing campaigns that pilot and evaluate design approaches in terms of success in engaging and receiving feedback from different producers. Greater effort is now put into tailoring language and distribution channels and piloting and testing different options.

Outcomes and Evaluations

Some of ADHB's campaigns have in-built evaluation. ADHB continually evaluates its services and events, and farmer and grower feedback through reporting to ADHB staff has been positive. Some of the service design projects are relatively new and are still

developing baseline data. Longer term impacts such as changes in engagement require years for measurement and analysis.

What is Innovative about this Approach?

- Cultural change from knowledge transfer to service design
- Deploying user centred design processes that may have originally come from the public, industry or private sectors and applying them in an agricultural setting
- Designing agricultural services based on targeting an end-user 'persona' (type of farmer) - these personals provide behavioural insights that uncover the barriers and enablers to changing behaviour
- Personas for segmentation/tailoring of services are applied per program/project area
- Personas are constructed through a process of social research often using a third party organisation
- Any tools that are designed through this process are developed with both the farmer and adviser in mind, where quick/direct feedback loops are created for continuous improvement of these tools
- The tools can add value to an adviser's commercial offering to their clients (farmers) e.g. an adviser learning how to use a farm business review tool and offering this business review service to their clients - Farm Business Review tool offers a combination of an online tool, expert advice and peer support to help prepare farm businesses in the context of reduced EU funding.
- Approach is outcome orientated – measuring attitudinal and economic change over time from the services delivered

Next Stage

In the first half of 2022 AHDB is conducting a wide-scale survey to 'Shape the future of farming'. Levy payers are invited have their say on the challenges they want AHDB to focus on and the services they will deliver in the future.

References

Agriculture and Horticulture Development Board (AHDB) website
https://ahdb.org.uk/

Case Study 3:

AgriLink Living Labs - Europe

Snapshot

AgriLink – Agricultural Knowledge: Linking farmers, advisors and researchers to boost innovation was a multi-actor project funded by the European Union's Horizon 2020 research and innovation programme from 2017–2021. The project brought together 16 partners from 13 countries, including universities, applied research institutes, advisors and consultants from public organisations, private SMEs, a farmer-based organisation and specialists in communication and distance learning. AgriLink aimed to stimulate sustainability transitions in European agriculture through better understanding the roles played by farm advice in farmer decision-making. The project also interactively engaged end-users to enhance the contribution of farmer advice to learning and innovation.

Program Features

AgriLink established six 'Living Laboratories' (Living Labs) in Italy, Latvia, Spain, Romania, Norway, The Netherlands and Belgium where farmers, advisors, and researchers develop and test together innovative advisory tools and methods. Living Labs is an inquiry process using design-thinking for co-creating innovative solutions between farmers, advisors, researchers and other partners.

- **applying design-thinking to agricultural challenges**: Design thinking is a methodology for solving complex challenges for which no solution has yet been found. At the base is a challenge articulated by end users (e.g. farmers, advisors, consumers) involved in a problematic situation. This challenge is addressed by developing a 'test product' (e.g. support services or advice products). While there is no design blueprint and each Living Lab is unique, they share these common features:
    - **real life settings**
    - **active user involvement**
    - **co-creation of new knowledge, ideas or processes**
    - **multi-stakeholder participation**
    - **multi-method approach**

A free 10-hour online course developed by AgriLink and delivered by The Open University provides an introduction to Living Labs in general and as used in agriculture, and describes the principles, approaches and tools used by AgriLink's six Living Labs. The online course is supplemented by other digital resources in the AgriLink Living LabToolbox.

Program Insights

- New focus for Living Labs is on 'innovation' rather than compliance, where the premise is – you need ideas and views from a diversity of innovation actors to understand the complexity involved and the range of possible responses.
    - Program Informant, Zoom Interactive April 4, 2022

Critical Success Factors

- **farmer centred:** Farmers are at the centre of developing solutions to local problems, enhancing skills and co-producing knowledge with advisors, researchers and other partners.
- **quality facilitators**: Well-trained advisors combine soft skills with up-to-date and developing agricultural knowledge on for example, new crops, responses to climate and disruptive innovation.
- **commitment to collaborate to achieve outcomes:** Reflexive monitoring of the quality of learning within each Living Lab is assessed collaboratively between the labs.

Outcomes and Evaluations

- Within AgriLink, two people are assigned to specific roles in each Living Lab. One has the role of a facilitator and is responsible for the progress of the process. The other has the role of monitor and is responsible for the quality of the process. This means that the monitor considers the process itself as an investigation and reports on it. Furthermore, the monitor is responsible for evaluating the process against agreed criteria.
- Experimental, interactive methods and the use of a co-design toolbox enable insights to be progressively captured and shared within a community of practice.
- Living Labs are found to be efficient and effective when the context or situation has a high degree of complexity and urgency; where the people brought together have a strong willingness to learn; there is time for trust building; and there is flexibility or openness towards the expected outcomes.

What is Innovative about this Approach?

- Co-design from 'problem setting' to 'solution forming' involving multiple actors across the agricultural innovation system
- Framing the problem collectively and agreeing on the need to co-develop a solution together
- Co-development of solutions – developing a prototype (not just a technology/software, but experiment on farms or process) in logical steps, and farmers/producers learning how these solutions could fit into their context through experimentation
- The process is dynamic and open-ended (as it was described in the session) and requires stakeholders to approach the sessions and sustain no fixed ideas or perspective about what the problem is, what is causing the problem and how it will be "fixed" whilst they work through the process. If the design thinking approach (as example outlined below) is applied, there is no focus on "solutions" which takes a considerable shift in thinking for most people.

Next Stage

AgriLink is working with stakeholders beyond the project to implement a web-based strategy with options for integrating Living Lab approaches in European Agricultural Knowledge and Innovation Systems (AKIS) and emerging governance models of advisory systems. AgriLink has also developed an online practical assessment tool that policy makers, innovation brokers or researchers can use to explore if a Living Lab could contribute to working on an identified challenge.

References

AgriLink website
www.agrilink2020.eu

Living Labs online course
https://www.open.edu/openlearncreate/course/index.php?categoryid=514

AgriLink Living LabToolbox
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AgriLink Practice Abstract Nr. 37: How is design thinking used in the Living Lab
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Assessment Tool: Conditions for a Living Lab
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Case Study 4:

Extension 350 – New Zealand

Snapshot

Extension 350 is a long-term farmer-led mentoring and extension program designed to lift farm profitability, environmental sustainability, and farmer wellbeing in the

Northland region of New Zealand. The project was an initiative of Northland Inc, the Regional Economic Development Agency with funding from the New Zealand Ministry for Primary Industries, Northland Regional Council, DairyNZ and Beef + Lamb NZ. Extension 350 has run for five years, with three intakes, from 2017 to 2022.

Program Features

- **farmer led and farmer focused small-group learning:** A target farmer is matched with a more experienced farmer mentor and agri-consultant for a three year period. The peer-to-peer learning ethos is supported by three focus areas:
    - increasing farm profitability,
    - improving farmer wellbeing,
    - increasing environmental sustainability.
- **regional approach:** The project is based on 10 clusters of around 35 farms. Each cluster is made up of 5 mentor farms who share their knowledge and experience, 5 target farms who are ready to step up and make changes, and who work closely with a mentor farm, and 25 associate farmers who are involved through observing and learning from what the target farms are doing. The agri-consultant works closely with the target and mentor farmers of each target team and the learnings are passed on to the associates at meetings throughout the year and via online farmer reporting. With seven dairy clusters and three sheep and beef clusters spread across the Northland region, the project is working with farmers from the Far North to Southern Northland.
- **adapting with digital technology:** Extension 350 met the dual challenges of the COVID-19 lockdown and the region's severe drought conditions by driving a digital initiative including pilot videos with farmers, called 'What's on your mind? accessible via the project's YouTube channel. The interview format encourages the farmers to share their thoughts on issues impacting their businesses and the process they expect to follow in developing and implementing responses to protect or enhance their businesses.

Program Insights (quotes from Northland website)

'I've gained skills in managing staff, managing the animals and managing the pasture, and the production has gone up 20 per cent'.

- Dairy farmer who was mentored under the E350 program

'It's about farmers learning from farmers, and it's about achieving regional impact.'

- Luke Beehre, Extension 350 Project Lead

Critical Success Factors

- successful mix between peer-to-peer and one-on-one learning
- small group learning model that can adapt to individual learning preferences
- the project delivers timely and relevant skills and support

Outcomes and Evaluations

- Within the third year of the project Extension 350 reached its target of engaging 350 farmers; by late 2021 the project had engaged more than 400 livestock farmers, which is about a quarter of sheep and dairy farms in Northland.
- In a survey of 379 farms engaged in the project, impacts were recorded across the three focus areas:

Profitability

  - 50% target farms positively affected
  - 71% mentor farms positively affected
  - 14% associate farms positively affected; 7% negatively affected

Environmental sustainability

  - 63% target farmers positively affected
  - 43% mentor farmers positively affected
  - 21% associate farmers positively affected

Wellbeing

  - 75% target farmers positively affected
  - 23% mentor farmers positively affected
  - 50% associate farmers positively affected; 7% negatively affected

- Farmers involved in the project have learned new ways of collaborating around shared objectives in their own interest.
- Monitoring and evaluations included six monthly surveys and end-of-project qualitative interviews with randomly selected E350 participants.
- Further evaluation by a private company will be conducted beyond the end of the project to better capture the on-farm impacts generated by E350, analyse financial data and calculate the project's return on investment.

What is Innovative about this Approach?

- Intentional focus on farmer vision for their triple bottom line
- Collaborative approach with lots of organisations all with a common purpose
- Ability to pivot and change based on what's working (adaptive)
- Farmers learning from farmers (relationships and observing)

Next Stage

The disruptions of COVID-19 introduced new ways of working and have extended out the term of some clusters from three to four years and. Extension 350 secured some additional funding from MPI's Sustainable Food and Fibre Futures to deepen evaluation and strengthen engagement aspects of the project, particularly with associate farmers.

References

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Extension 350 What's on your mind? YouTube channel
https://www.youtube.com/channel/UCRB-jY8v1LO-VjkwernUr8w

Case Study 5:

The People in Dairy - Australia

Snapshot

The People in Dairy is an industry-wide change management program funded by Dairy Australia since 2006 to support training and development in the people space. The program has worked to reframe thinking around the diverse ways in which people function within the whole-farm system – as farmers, managers, farm workers, new entrants or advisors. To achieve this, the People in Dairy program has focused on the design and implementation of mechanisms to catalyse systemic change across work practices in the dairy farm environment and for regional workforce development. In 2013 Program leader Pauline Brightling and the core People in Dairy Program team were recognised with an *Australasia-Pacific Extension Network* (APEN) Excellence in Extension award. The program has matured, expanded and developed over the past decade or so and remains an important pillar in building success for the industry.

Program Features

- **building advisory capacity**: the program started from the premise that farm advisors (farm consultants, extension officers, milk company field staff and financial advisors) are a first point of contact for farmers in thinking about their businesses and that enhanced advisor capacity will result in more farm businesses taking a proactive role in people management, ultimately making them more sustainable and profitable. The program utilised existing advisory relationships and expanded them to include a people dimension, rather than attempting to introduce specialist human resource advisory services.
- **participants gain skills, a qualification and networks**: the program established the Diploma of Human Resource Management (Dairy), a custom-designed formal training qualification co-designed with the dairy industry and VET providers to enhance the sustainability and growth of farm businesses through better management of the people resource. Advisors were supported to use their training with farms and share their learning in a community of practice.
- **online resources and tools for continued learning and development:** the program delivered on a comprehensive communication strategy to support e-extension, research and ongoing training to farmers and advisors. The resource-rich People in Dairy website hosted by Dairy Australia provides tools, forms and templates to support legal compliance and best practice.

Program Insights

"You're only as good as your people"
— Dairy farmers whose advisor completed The People in Dairy Human Resource Management Diploma

"It's really about helping them manage their business better and a lot of the time they can be very good at the productivity things on the farm, but if they are not retaining people and people aren't happy, we need to somehow fix that because it's a cost to them."
— Advisor who completed The People in Dairy Human Resource Management Diploma

Critical Success Factors

- focus on the sphere of influence of farm advisors (rather than human resource specialists)
- building off what is already known or has been done to establish the new strategy
- depth and breadth of industry experience built into design and delivery phases
- monitoring and evaluation embedded in processes of reflection, review and refinement
- program longevity allowed observation of the adoption curve within program development timeline

Outcomes and Evaluations

- The People in Dairy program provided important baseline measures on key performance areas of people management and practice change in the dairy industry.
- The Diploma of Human Resource Management (Dairy) ran for the first time in 2008 with an intake of 23 participants. From 2009 – 2012 123 participants from across completed the course. An online survey of advisors involved in the Diploma of Human Resource Management (Dairy) was conducted four times over five years. Survey results published in 2014 reflected a range of advisory experience (from one to 40 years of advisory work), gender (21% female) and age (29–65 years).
- Annual advisor forums were held from 2009 to 2013 as part of *The People in Dairy* program to encourage shared learning between advisors in working with farmers in employment and workforce issues.
- Advisors completing the diploma were more likely expand their service offerings and enable process for practice change if they:
    - worked in larger, supportive organisations supportive of this area of service
    - personally, embraced the potential for growth and reinvention
- Younger and less experienced advisors took more time to develop confidence, but increased impact by expanding their services to more farms when compared to experienced advisors.
- Australian dairy farms continue to implement, review and improve people management practices through accessing the Dairy Australia resources on the People in Dairy website and applying these to their individual business needs.

What is Innovative about this Approach?

- Dedicated and formal training that was provided to advisers in workforce issues, with the outcome of creating a new service offer for dairy advisers
- Extensive and long term industry support to develop a service that had not been previously invested in.

References

The People in Dairy website
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Case Study 6:

Young Farmer Business Program - Australia

Snapshot

The Young Farmer Business Program (YFBP) was a $6 million investment by the NSW Government to enhance the business resilience of young farmers and fishers in NSW. The program was delivered by the NSW Department of Primary Industries (DPI) and ran from July 2017 until June 2021. Two surveys conducted in 2016 and 2017 identified that the three biggest barriers to young people pursuing a farming or fishing career are confidence in making business decisions (self-efficacy); a sense of connection to networks that support them on their business journey; and business skills and knowledge. YFBP was designed to address these barriers. The broader goals of the program were to improve the drought preparedness of the agriculture industry to reduce producers' reliance on subsidies during future adversity.

Program Features

- **Tailoring programs by segmentation of end-users:** YFBP provided a full suite of tailored offers including coaching, mentoring, and access to online toolkits across a range of topics such as business planning, financial systems, succession planning, workplace health and safety and new models of land use. Program

design and delivery was informed by the social and professional needs of both existing and newly formed groups.

- **Peer-to-peer learning and support**: Key activities to support shared learning and support included on-farm field days, walks and tours, community social events, networking and collaboration and workshops on specific skills.
- **Flexible pathways:** YFBP formulated a theory of change with two clear pathways— **business resilience** and **connections and networks** — and worked flexibly with groups such as Young Aggies, Young Farmers Connect, and Young Country Networkers, Future Farmers Network, NSW Young Farmers to build out activities towards the program's broader goals.

Program deliverables included:

- **Facilitating capacity building and knowledge exchange**: over 120 events, five coaching courses, two conferences, 21 external courses, and multiple resources.
- **Shared network spaces**: over 120 events and two conferences, including 102 face-to-face events.
- **Bespoke coaching/mentoring:** six coaching courses, including three individual coaching courses.
- **Sharing success stories with peers:** 19 start-up stories events and two conferences speaking about successful start-ups, video and blogs of all individual coaching participants and advisory committee members.
- **Provision of tools and resources:** eight toolkits, three podcast series.
- **Communications and marketing:** continued Facebook presence, consistent promotions of all events, average of 30 young farmers registering and attending each single-night event.

Program Insights (From the final evaluation of program document)

"One big thing I learned about young farmers is how open they are to other young farmers. I always had the perception in farming that 'nobody tells anyone why what they are doing and why they are doing it', there has always been a really secretive nature. But in the program, I have realised that young farmers were really open to sharing with others and learning a lot from each other." - Program team member

"After the Bank Ready workshop, I went to the bank and tried to get a loan. I was unsuccessful, but I kept trying. After the Business Ready [workshop] I tried again and got a small loan. Now I've got a paddock, and I've got the cows. I got the GST, ABN, and BAS all setup - I've never had them before." - Young farmer

Critical Success Factors

- Investing time and resources to understand target audience and build early engagement
- Utilising social media platforms for marketing and networking
- Engaging local champions as role models

Outcomes and Evaluations

- Over the course of the program, 4,094 participants attended 127 events.
- Ongoing monitoring and evaluation included post-event interviews, annual surveys, case studies and program report card
- Final evaluation conducted by external consultant Clear Horizon found the YFBP to have 'successfully improved the resilience, business mindset, and networks' of program participants
- Involvement in the YFBP program prompted approximately 32% of aspiring young farmers and fishers to move towards owning a business in the future
- All participants who received coaching increased the profitability of their businesses, some with significant gains with post-program profits up by more than 100%
- Approximately 60% of young farmers who own a business took actions to improve their business resilience
- Approximately 36% of participants are continuing to draw upon the networks developed through the program

What is Innovative about this Approach?

- Applying behavioural insights to tailor social marketing using multiple communication channels
- Use of engagement template: EAST (easy to engage; attractive to engage; social; timely). Applied this to all engagements:
    - Simplify message: what to do, how to do it, why do it;
    - reduce 'hassles'
    - be attractive (personalise/authenticity);
    - draw on social networks: commit to others and bring in friends;
    - timely (e.g. not on weekends; consider the cost:benefit) ; text to remind and follow up)

Next Stage

External evaluation provided by Clear Horizon to the NSW DPI in June 2021 assessed that YFBP 'has achieved its mandate to build the drought preparedness of young farmers by improving their business skills knowledge, and networks' and recommended

that the program continue. There are four sub-recommendations related to continuing the program:

- maintain the individual coaching program
- develop an offer to support succession.
- stop or reconsider subsidising external courses
- consider how to further improve attitudes towards networking.

In particular, the evaluation produced strong evidence that the individual coaching program should continue with all participants benefitting from this tailored approach. The important intellectual property developed by YFBP — such as networks and knowledge of how to engage with young farmers — can be leveraged for a future program.

Other Examples

Peer-to-peer (P2P) mentoring is a form of dialogue between a person who has a certain professional question, and peers who are willing to listen and assist in deepening the question and sharing their expertise to explore solutions. P2P mentoring is a key design concept in the AgriLink project in Europe and in Extension 350 in New Zealand. For example, P2P mentoring has been used during collective sessions of facilitators of AgriLink's six living labs. One person brings a dilemma related to the development or situation in the living lab. Peers of other labs listen and assist in the reflection on thinking and acting, resulting in better insights on the topic and ideas for new interventions.

Fast-track P2P mentoring is a method to support farmers, advisors or facilitators to problem-solve in a quick and structured way for and can be an aid to farm decision making. **The resources needed:** 35 minutes; a 'problem owner'; a panel (of peers (3or 4)); a facilitator. **The process:** The problem owner describes their problem (5 min); the panel asks questions (why, how, what, who, where?) without providing advice (10 minutes); the problem owner considers if they need to reformulate their problem based on the questions they have been asked (5 minutes); following a decision to keep the same question/reformulate the question; the panel provides their advice (10 minutes); the problem owner describes what they have learnt or what advice they can use (5 minutes).

Factors for Effective P2P Mentoring

- problem is clearly defined
- diverse panel contributing a range of responses
- participants stick to the process and the scope of the problem

References

AgriLink Practice Abstract Nr. 77: Peer to Peer Mentoring for facilitators of innovation groups and Living Labs
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Case Study 7:

Resource Consulting Services - Australia

Snapshot

Resource Consulting Services (RCS) is a private company specialising in whole-farm system education, training and advisory services to the agricultural sector, both within Australia and internationally. Over 35 years the company has developed a strong clientele and engagement in the rangelands and remote regions, working with individuals, families, corporate and government groups, and empowering them to grow productive, profitable agricultural businesses within regenerative landscapes.

Project Pioneer, a key initiative from 2014–2021, was funded by a partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation and built upon the RCS teaching platform to help producers achieve profitable agribusinesses through farm management practices that promote soil health and biodiversity and reduce sediment run-off. Project Pioneer involved eight key organisations and 150 family businesses across a land area of more than one million hectares.

Program Features

- **business-driven sustainability:** regenerative movement in agriculture links ecological health and profitability
- **holistic approach:** whole-farm system at the centre, with focus on change management for better business, environmental and personal outcomes
- **adaptable pathways and integrated learning:** education program integrates training and micro-credentials in business, forecasting, financial management and decision tools with direct advisory support, coaching and professional development; advisors provide ongoing support to embed learning back on-farm

Program Insights

"In our experience, working with RCS consultants on a monthly basis has unified, structured and challenged our business. Our communication and decision making is more effective."
— Andrew and Claire Mactaggart, Marlborough, QLD

"RCS brings great and transformational benefits to rural people including the simple bringing together of positive and innovative people to give each other more momentum."
— Rod O'Connell, Chelmer, QLD

"RCS as an organisation isn't an organisation. It's a cleverly gathered group of people with wide ranging knowledge, varied experiences, and an experimenting and pioneering ethos. RCS support people, families, businesses and communities, innovating, developing and improving by clever design and constantly liberating potential."
— Allan Parker, Managing Director of Peak Performance Development Pty Ltd

Critical Success Factors

- Meeting people where they are at and working with people in the whole-farm system
- Linking peers together to promote accountability and responsibility to goals
- Connecting people with support and empowering people to solve problems and help them achieve their vision
- All RCS delivery staff working with RCS began their journey as clients.

Outcomes and Evaluations

- Since 1985 RCS have partnered with more than 10,000 clients
- Project Pioneer supported 150 families through RCS's Grazing for Profit™ school, with 16,592 hectares land area of erosion directly treated and 1.3 million hectares of land under regenerative management
- Producers enrolled in Project Pioneer reported enhanced financial literacy and improved profitability; better farm management system, the ability to measure and monitor ground cover and soil health; and measurable improvements to herd performance and production efficiency
- An independent report commissioned by Department of Agriculture, Fisheries and Forestry (DAFF) 2012 that surveyed 1,050 producers concluded that RCS was the strongest national consulting firm in terms of capacity to provide information and advice.
- Focus on looking after people and building relationships leads to long-term engagement (some clients are 3rd generation) and word-of-mouth referrals

What is Innovative about this Approach?

- Using traditional wisdom about farming systems – how people/ecology work and the science of the system
- Not technology focused
- Dedicated marketing: adaptable approach, not all social media – more WhatsApp, word of mouth referral/grapevine
- No target audience – all sectors, all ages, all states – systems management: 'Work with anyone who wants to work with us'
- Don't engage with the political or the negative
- Start with base camp
- Model is /ha retainer but is adaptable
- Soil health, businesspeople

Next Stage

RCS's calendar of events includes on-site clinics, workshops and courses in locations across Australia and online. In July 2022 RCS is hosting *Convergence: agriculture, human and planetary health* – a two-day regenerative agriculture conference in hybrid format,

bringing together world-class consultants, practitioners and educators to help farmers meet their economic and environmental goals and offer knowledge about food development and its impact on people and planet. RCS invites producers to participate in future projects and offers localised projects including benchmarking, training, follow-up support, reviews and R&D at a regional level.

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https://www.rcsaustralia.com.au/

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