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1 Acknowledgments

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2 Executive summary

The practices and context for agricultural RD&E are evolving rapidly, thanks in part to recognition of the vital importance of agriculture, international development assistance and research to the range of 21st century challenges encapsulated in the United Nations' Sustainable Development Goals (SDG). Positioned at the centre of the food, water, energy and carbon nexus, agriculture has multifaceted roles in local, regional and planetary scale socio-environmental outcomes (both positive and negative). Agriculture is especially core to the wellbeing of the more than 400-500 million farming families in the world, who - in low and middle income countries especially - are crucial to global nutrient supplies and landscapes, but face escalating climate change impacts at the same time as pressures such as competing land uses, halted agricultural land expansion, dwindling average farm sizes, declining land condition, and a need to increase productivity (Lowder et al., 2016; Herrero et al., 2017; Graeub et al., 2016; De Pinto et al., 2016; Turner, 2016).

Wealthy nations like Australia are linked to the rest of the world's family farmers through complex ethical, physical, social and economic relations. Two important avenues for potentially positive interaction are international development assistance and flows of knowledge and innovation. Like agriculture, both of these arenas are rapidly changing and deeply contested. Pressure is mounting for those working in each arena to demonstrate greater sustainable development benefits. Yet it is increasingly clear that transformation in outcomes is not going to occur without some transformation in ways of organising and doing research, innovation, and international development. Emerging shifts demonstrate superficial changes, but a growing number of critics, including many from an agroecological perspective, argue that far more fundamental change is needed if genuinely sustainable and socially just development models are to be achieved.

Agricultural RDE in Australia has become an important influence on agricultural developments in numerous other countries through the work of ACIAR. Sitting at the intersection of agriculture, international development and research/innovation, ACIAR needs to keep abreast and manage concurrent shifts in all three arenas. Encouraging convergence between them is recent high-level recognition of the importance of agriculture to global sustainable development and international development efforts, and the need for formal research to become more effective and strategic in producing impactful innovations that contribute positively to achieving the transformational change demanded by the SDG agenda. This convergence on the intersection of agriculture, development and research highlights the value of ACIAR's position. It also ups the ante on the organisation's capacity to meet the resultant demands. In particular, it calls for examination of the tools that ACIAR has at its disposal as it strives to fulfil its mission of achieving 'more productive and sustainable agricultural systems, for the benefit of developing countries and Australia, through international agricultural research partnerships'.

This project focuses on two tools, or areas of activity, that ACIAR could fruitfully engage with more thoroughly.

The first is the substantive focus of this project: agricultural extension. Stimulating the analysis was the seemingly simple question: what is the contemporary role of "agricultural extension" in today's world? For many people, the answer is simply "not much". It is a response that reflects the dismantling and discrediting of a particular state-based model of extension associated with past eras of agricultural development. But defying this normative and empirical turn away from extension is the ongoing - indeed escalating - need for, and presence of, extension-like practices (broadly defined); practices that are designed to help engage farmers and generate, disseminate and scale appropriate innovations in the rural sector.

For ACIAR the challenge, then, is not to move past extension, but to identify positive models such as Landcare and reimagine extension as an ongoing function and practice. In doing so, it is important to appreciate that extension overlaps considerably with contemporary preoccupations such as research translation, and is something that researchers can practice to a greater or lesser degree, or try to enable through others. In this engagement with extension broadly defined, it is crucial that researcher generally, and research funders like ACIAR in particular, are alert to the ongoing debates and contestation about the concept so that they can heed the lessons about its failures and harmful legacies. The key concerns raised about extension pose far-reaching questions about the linear Research-Development-Extension complex and international development initiatives that extension has traditionally been a part of. Notwithstanding efforts to increasingly coproduce innovation with local participants, these linear approaches are alive and well and are now being partially replicated by efforts to increase and demonstrate the distinct impact that research projects have on the world. Debates and contestation about extension, therefore, are important considerations for ACIAR as it considers how to position and amplify its research impacts.

Besides posing strategic questions about extension practices within the RDE model for ACIAR as an organisation, this project points to a second area of activity or tool of potential benefit to ACIAR: critical social science. Such scholarship can act as microscope, telescope, guidepost or advanced navigation aid for agricultural research.

This project has extensively drawn on critical social science to inform all of its work. It is this lens that has underpinned its useful identification of extension as a practice that anyone can participate in, and that has enabled its mapping of the deep socio-political and intellectual divisions and contestations that characterise the formal extension world.

In addition to offering specific insights about extension, the approach adopted here demonstrates the value of critical social science for making sense of the world and negotiating the immensely complex and shifting context that agricultural researchers and organisations are working within. As such, it points to the potential for ACIAR to build on its history of providing learning opportunities for Australian and international researchers and others by generating opportunities for such groups to learn about both:

- the particular insights this project has produced about changes and debates in the agriculture, international development and research arenas, notably extension; and
- critical social science methods and theoretical lenses and concepts, the utility of which this that the project has demonstrated.

Taking on the challenge of increasing the critical social science literacy of the agricultural research community would not only help ACIAR demonstrate intellectual leadership, enable it become a more reflexive, anticipatory, strategic organisation and build capacity for collaborative, transformational innovation within its network. Moreover, by helping explicate the conceptual origins of problematic assumptions in the world, engaging with critical social science more thoroughly would help ACIAR and its networks of reserachers understand and address specific key issues such as gender inequality.

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The objectives of the project were to (i) identify the assumptions, challenges and practices of agricultural extension (AE) and (ii) identify needs and opportunities for improving the theory and practice of agricultural extension. This project undertook a stocktake of past and contemporary approaches to agricultural extension.

Focusing on ACIAR's priority region – the Asia Pacific - the project held three workshops (Canberra, Cambodia and Townsville) with a diversity of stakeholders involved in Agriculture for Development (A4D). The workshops with ACIAR stakeholders and extension practitioners in Australia and Cambodia explored the contemporary challenges to effective extension. They presented a comprehensive analysis of current trends in agricultural extension to convey to ACIAR staff and researchers the nature of the underlying tensions, issues and paradigms that characterise AE and A4D. Also underpinning the project were 50 interviews with ACIAR researchers and other key informants involved in AR4D and extension. In addition, the project drew on multiple sources to inform its analysis, including an extensive cross-disciplinary literature review, researcher workshops and document analysis of relevant grey and digital literature (reports, websites).

To interpret these multiple sources the project developed analytical frameworks that enable a critical review of recent evolution and diversification in the structure, modes, models and agendas of agricultural extension. A broad post-structural, postcolonial and feminist geography theoretical framework was developed and used that focused upon the role of the paradigms, logics and worldviews that shape how the world is understood and engaged with and how agricultural extension is conceived of and practiced. The theoretical lens employed – governmentality, social practice theory, reflexive modernisation, coproduction, worldviews, and feminist philosophy – offers a raft of complementary perspectives and methods for analysis of agricultural extension and its broader context. They provided the theoretical framework for the approach adopted, emphasising the importance of ideas, narratives, language and paradigms, and how these are co-produced.

The project found that effective and appropriate agricultural extension practices remain critically important to the challenges facing agriculture and to enhancing the impact of R&D. Yet extension practice is evolving and changing, with more diverse actors and agendas involved, making it far from straight forward.

The project findings are documented in a comprehensive report, discussion paper, blog, fact sheet, and three manuscripts for peer reviewed journals, plus a book manuscript to be likely to be published by Palgrave Macmillan.

As indicated above, it is envisaged that the resultant insights can be used to support strategic planning at ACIAR, and professional development of staff, researchers and extension personnel. While the project did not include conversion of the findings to training materials *per se*, each of the three workshops functioned to some degree as professional development and intellectual stimuli for those involved. Given the positive feedback about these workshops, we suggest that producing more such opportunities for ACIAR staff, researchers and other stakeholders, designed to allow them to be more comprehensive and participatory, would be a useful and welcome capacity-building exercise. It could help them develop a nuanced understanding of the role of critical social sciences in informing A4D program design and project practice, and thus help to design better R&D projects, enhancing their impact. Overall, more critical and reflexive practice is likely to increase the impact of numerous ACIAR projects, resulting in high return on investment.

Such training could be complemented by the development of a social science training manual or other materials for agricultural researchers trained in the positivist traditions. In particular, we propose that ACIAR consider a discrete project that develops and refines a 'crash course' in critical social science as a training module for agricultural researchers, given the complex and contested context in which they work, and the need for them to produce work that is more savvy, agile and impactful than ever.

More specifically, we recommend that ACIAR expands its program of social science research to engage in international conversations about and incorporate more research into:

- the shifting context of agricultural transformations and the identification of transformative techniques for scaling innovations and adoption;
- critical reviews of innovation systems and other new RDE models for agriculture, informed by theoretical work that pushes existing innovation and research scholarship to better appreciate how innovation and research processes are embedded within and co-constituted by social-ecological systems, including climate;
- agriculture's multiple roles in socially just sustainability transitions, given its unique characteristics, pressures and diversity;
- lessons from Landcare-based participatory extension models for other innovation initiatives, including identification of its key positive elements, the potential of the concept of care and regeneration, its resonance with multiple social movements, and ways of building on these feature to engender wider transformational change; and
- long-term case studies of regionally-based innovation processes and social experimentation directed at exploring pathways for sustainability transitions and multiple sustainable development benefits.

3 Background

The practices and context for agricultural RD&E continue to evolve and change. Agriculture's profile is growing with recognition of its vital importance to rural livelihoods and to a range of 21st century challenges, expressed in the Sustainable Development Goals (SDG).

Positioned at the centre of the food, water, energy and carbon nexus, agriculture has multifaceted roles in local, regional and planetary scale socio-environmental outcomes (both positive and negative). Adoption of effective innovations is required, at scale, to ensure the quality and quantity of the agricultural output needed and to address escalating threats – including those arising from a changing climate - while also reducing the serious risks posed to public goods, such as waterways.

Given this changing context and stimulating the analysis central to this project was the seemingly simple question of what is the contemporary role of "agricultural extension" in today's world?

Agricultural extension is anything but simple. It is best understood as a "boundary field" at the intersection of the highly diverse arenas of agriculture, international development and research/innovation, and as a microcosm of broader, shifting ideas about modernisation and humanity's challenges.

Calls for transformative change are becoming increasingly clear. These calls for 'fundamental transformations in the way the world lives, works, and does business', that 'directly tackle the roots of poverty, inequality and environmental destruction instead of the symptoms', are not just new research topics but are challenges to do research differently[1i].

This project takes up these challenges in the context of Agricultural Research for Development (AR4D). It aims to help researchers and research funding organisations, like ACIAR, increase the positive impact of their research by highlighting salient aspects of the historical, socio-political, institutional and intellectual context in which they work, and by introducing insights from a range of valuable theoretical perspectives. It examines questions about 'the social and political dimensions of agricultural development' (Leeuwis et al., 2018) p.20 in order to better understand the challenges and opportunities that AR4D sector faces in contributing to positive transformative change, including addressing deep gender inequities.

In the project report and journal papers our analysis of agricultural extension uses a theoretical framing of the coproduction of science and society exploring it as a site of this co-production. We provide a critical, historical analysis of how and why extension emerged, 'disappeared' and morphed into many diverse forms. Our approach recognises the value of agricultural extension as a field of practice and as an object of study and reflexive scholarship.

To develop an understanding of contemporary agricultural extension this project involved examining three somewhat paradoxical phenomena:

1. The complex history of agricultural extension, encompassing its rise, fall and present day metamorphosis into diverse, differently named practices and forms that accord with varied fashions and shifts in ideas about agriculture, international development and research/innovation; and

[1] These quotes are from the Transformative Innovation Policy Consortium Research Brief 2018-01, available

2. The proliferation of *extension-like* functions that are used in many contemporary approaches to generating impactful agricultural innovation, so while the formal term extension is rarely used, due to its fall from grace there is wide spread ignorance of it among new players, including those seeking to scale innovations.
3. The ways in which calls for transformative change approaches are becoming something of the new status quo, but that there are many conflicting strategies, philosophies and ideologies prosecuting their claim to be 'the way' to achieve transformation.

Failure to understand these phenomena, and their convergent roots in broader iterations of modernisation, results in approaches to AR4D that suffer from historical amnesia and deny the contextual complexities involved, including the imperative to deal with, not turn away from, global scale agricultural challenges in the Anthropocene.

The upshot and challenge is that agronomy and agricultural development have become highly contested and politicised, with those working in it are ill-served by pretending this is not the case (Sumberg and Thompson, 2012; Sumberg, 2017). This project examined the knowledge politics of agricultural research and extension, which are escalating in importance. It examined how and why "agricultural extension" and AR4D in general have become more politicalised and contested, exploring some of the possible implications of this for the future. However, as (Andersson and Sumberg, 2017) p.6 note:

> "Putting a spotlight on the politics of development-oriented agronomy and its pathways from the past to the future can contribute to the opening up and enrichment of debate and deliberation about desirable futures for farming, rural economies, food systems and the environment… Unfortunately, what the spotlight reveals is not always pretty, nor does it necessarily lead to simple recommendations for action."

Agricultural extension is characterised by diverse practitioners working in disparate institutional and national contexts often examined through conflicting analytical lenses. What they tend to share is a general commitment to positively "shaping change" in agriculture and rural communities (Jennings et al., 2011), whether the change wanted is to lift agricultural industry productivity, contribute to national economic performance, generate private profits, improve farm households' wellbeing, reduce agriculture's burden on others, or generate other social goods.

One of the reasons agricultural extension is poorly known as a field is that many people associate the term with "old" approaches to modernisation, not only in terms of its goals, but also in terms of a particular top-down, linear, "Transfer of Technology" (TOT) approach and theory of change. This has largely come to be seen as a cringe-worthy epitome of a misguided "imperial" approach to science, agriculture and international development. Although alive and well in some quarters (though often under a different name), the TOT approach has been largely replaced by more systemic and/or bottom-up "co-production" approaches. While there are many good reasons for rejecting top down extension, this does not necessarily resolve the needs that agricultural extension was devised to address.

Numerous alternative reasons for investing effort in "agricultural extension" have emerged, in large part thanks to the problems that the modernisation of agriculture has itself generated, including climate change. Concurrently, renewed concerns about agricultural capacity to contribute to food security at various scales and under climate change, and new interest in agriculture as a source of carbon sinks and new markets, are re-legitimising similarly modernist ambitions, analyses and 'deficit-based' approaches in agricultural extension.

For these reasons, the general goal of "shaping change" that first-generation agricultural extension was devised to fulfil remains relevant. Indeed, more groups than ever now want to stimulate and support positive change in agriculture and rural contexts. Yet, different objectives and types of knowledge require different types of dissemination or embedding into practice.

As the objectives of those currently involved in agriculture, or for the agricultural sector change, in response to new exogenous pressures or ambitions, there is a need to think how these processes can be supported. This includes rethinking the relationship between agricultural extension and knowledge (co)production of the sort generated in AR4D and thinking about what roles and intermediary functions agricultural extension can have.

These new challenges and objectives and the acceptance of the need for transformative change point to the need to reinvigorate the field of agricultural extension (whatever it is named). To do so requires a critical re-examination of its practices, its conceptual underpinnings, its public image and its outcomes. Crucially, this requires addressing certain fundamental tensions at the heart of agricultural extension that have led to its marginalisation. For example, alternatives to TOT struggle with a deep philosophical bias against them in Western culture; a bias powerfully institutionalised in many seemingly mundane practices that determine how agricultural extension and AR4D are governed.

The project's examination of the "gender agenda" reveal that this requires far more than equalising the number of women and men involved in socially visible and valued activities such as business or R&D. With the future of the world's agriculture and rural communities and landscapes arguably relying on our collective capacity to overcome this bias, it is timely to reflect on agricultural extension as a social program and to consider what historical and conceptual lessons its rise, fall and diversification hold for the future.

The project identified that the debates about agriculture are part of larger arguments about the past, present and future of human society. These arguments are representative of a broader "reflexive turn" about modernisation that is underway (Grin, 2006; Beck, 1994; Pickering, 2018). Colonisation, nation-building, international development and agricultural revolutions are increasingly recognised in hindsight as experiments; ones that have generated a range of unexpected and undesirable outcomes that now themselves demand solutions. Addressing these problems, as well as the risk of generating new ones, demands 'second order' reflexive modernisation and governance (Voß and Kemp, 2006) in which problems are addressed using new, improved tools, ideas and approaches, not just the further application of existing ways of doing things.

In agriculture, this is evident in growing debates about the how new ways of doing things are conceived and pursued in the sector. Everyone involved in agricultural research (broadly defined) are being pushed to think hard about what changes they are generating, what real world impact those are having, what impact they want to have, and how they might best achieve it.

The move to deliberately and more effectively generate positive, large-scale, real-world innovations and impacts is common across the research sector. However, it is especially pertinent for those involved in the increasingly-problematised and applied research field of agriculture, particularly because public funding for agricultural research has been scaled back in many countries (especially wealthy ones) over recent decades.

For those working on agricultural R&D in the context of international development — where issues are especially pressing and complex and research funding is especially precarious - the need to ensure that research generates positive real-world change is even more intense and complicated. To stimulate more effort in this area, a decade ago the World Bank called for a

reprioritisation of 'Agriculture for Development' (A4D) (World-Bank, 2007). Resultant efforts amplified the focus on Agricultural Research for Development (AR4D), including that pursued through the CGIAR, which has become more purposeful in interrogating and articulating theories of change that explain why certain research efforts will lead to desired, on-ground impact (Andersson and Sumberg, 2017).

In some ways present day calls for AR4D to generate positive impact are deeply familiar. Institutional support of research has been always been tied in some ways to the impacts or benefit to be achieved, even if the benefits wanted have changed over time. What is different now is that the impacts sought are more targeted, more conscientiously, cautiously and collectively produced, and more systemic. The reflexive modernisation turn mentioned above has fuelled an appetite for *transformational* change in and beyond agriculture, including re-evaluation of established ways of generating and "scaling" innovation in the agriculture, international development and research sectors.

This appetite for large-scale positive change is encapsulated in the United Nations (UN) (2015) agenda for transformational international action: *Transforming our World: The 2030 Agenda for Sustainable Development*. Although some question the actual environmental and social sustainability of the agenda (Hannis, 2017), it is indicative of the contemporary push for a more reflexive, or 'rebooted', modernisation process.

The agenda also flags the growing centrality of agriculture to (re)modernisation. Agriculture features in the 2030 Agenda as a cross-cutting theme, being especially pertinent to SDG 5: Gender Equality. It is also the focus of two Sustainable Development Goals (SDGs) (SDG 15: Life on Land and SDG 2: Zero Hunger). In its preamble to SDG 2, the UN underlines the need for transformational change in the sector:

> A profound change of the global food and agriculture system is needed if we are to nourish the 815 million people who are hungry today and the additional 2 billion people expected to be undernourished by 2050. Investments in agriculture are crucial to increasing the capacity for agricultural productivity and sustainable food production systems are necessary to help alleviate the perils of hunger[2].

Notable in this preamble are references to systems, and therefore, systems thinking. These are indicative of an emerging form of reflexivity. Besides framing agriculture in terms of sustainable food production systems, the preamble implicitly positions hunger not as a single problem requiring a single solution (increased agricultural production) but as a systemic outcome that needs to be countered with systemic responses.

The central questions are how to generate the sort and scale of genuinely systemic response needed. The UN suggests that investments needed include the cooperative provision of 'rural infrastructure', 'technology' and 'agricultural research and extension services'[3]. While, all are undeniably important, many of those experts, who work in AR4D, interviewed for project point out that the further rolling out of infrastructure, technology and "research and extension" is, at best, insufficient, and at worst, a major part of the problem. This is what (Voß and Kemp, 2006) call 'first order reflexive modernisation' in which old tools are used to address new problems, thereby proliferating the problems.

The project identified that many aspects of AR4D are heavily contested ((Leeuwis et al., 2018) leading to questions like:

[2] https://www.un.org/sustainabledevelopment/hunger/

[3] *https://www.un.org/sustainabledevelopment/hunger/*

- Does AR4D generate innovation and impact? And if so how?
- How it is organised and how it should be organised?
- Whose interests does it serve? And;
- What programs and activities are useful/useless?
- What frames and methods can be used for evaluative purposes?

The project found that it is increasingly clear that transformation in outcomes is not going to occur without some transformation in ways of organising and doing research and innovation. Although there is growing awareness that research needs to be positioned in and of the world if it is to generate positive impact, it is not clear if those in the research sector have accepted that they are part of what has to be transformed. If pursued unreflexively, an amplification of existing research and innovation, threatens to worsen, not alleviate the situation, particularly for those still structurally disadvantaged by the mistakes of the past.

4 Objectives

The main objectives of this project were to:

- To identify the assumptions, challenges, and practices of agricultural extension to date
- To identify needs and opportunities for improving the theory and practice of agricultural extension.

4.1 Activities

The project tasks and deliverables are described in the table below.

Table 1: Tasks and deliverables

Tasks	Proposed Deliverables
Literature review	i. Academic paper 1 ii. Academic paper 2 iii. Academic paper 3 iv. Final Report v. Fact sheet vi. Blog vii. White paper published by ACIAR on agricultural extension viii. Project presentation(s) to select ACIAR stakeholders, as appropriate
Interviews	
External workshops	
Internal workshops	
Writing	

5 Methodology

This project takes a critical, interpretive, historical approach to understanding agricultural extension. It is especially attentive to the role of unspoken assumptions, paradigms, ideals and worldviews in shaping what agricultural extension is on the ground, in policy and in the academic literature.

These methods included close analysis of what problems agricultural extension is considered to be needed in response to and what problems it poses and why, and how this has shifted over time.

The project conceptualises agricultural extension as a "boundary field" at the intersection of agriculture, international development and research/innovation, and thus affected by shifts and agendas in each of these sectors. The sections below outline the theoretical framework for the work (which is extensive given the nature of the project) and the methods used.

As indicated throughout the discussion below, the theoretical lens outlined – governmentality, reflexive modernisation, coproduction, worldviews and feminist philosophy - offer complementary perspectives and methods for our analysis of agricultural extension.

They provide the theoretical framework for the broadly interpretivist approach adopted. This emphasises the importance of ideas, narratives, language and paradigms, including how these are co-produced and interrelated.

The methodology used, therefore, is qualitative It combines literature reviews, interviews and workshops. As the researchers read across the resultant texts, they were inspired by ethnography in the sense of trying to interpret the cultural logics and practices at work (Spradley 2016). While ethnographic research has been used relatively frequently to try to understand the cultural logics of different farmer groups (e.g. Driessen, 2012; Roncoli, 2006), it has rarely been used to try to understand those who try to work with and influence them - that is, researchers and extension practitioners (for a partial exception see Funder and Marani, 2015).

It is also important to note that the methodology was exploratory and iterative. This meant identifying emerging issues and points of inquiry and following them up. For example, it was found that the semi-structured interviews raised many questions from interviewees, and were characterised by much pondering, wondering and confusion about the topic of extension, underpinned by implicit concerns about the world of international agricultural RDE they work in. This led to deeper exploration into what extension is and its convoluted history. Interviews were also iterative in the sense that a snowballing sampling technique was used, with names for further interviewees sourced from the initial purposively sampled group of interviewees, exploiting their understanding of this project's line of inquiry and knowledge of people in the field with relevant experience.

5.1 Theoretical framework

The theoretical approach underpinning this report weaves together six complementary, inter-related theoretical threads into a unique synthesis to draw out what is at stake in questions of agricultural extension and AR4D.

All of the theoretical threads – governmentality, social practice theory, reflexive modernisation, coproduction, worldviews and feminist philosophy - are positioned within the interpretive, post-structural social sciences, notably human geography, philosophy, and Science and Technology Studies. Based on initial reflection on the emerging findings from the project, they were identified as useful, complementary lenses to illuminate specific issues. Each represents the sort of critical social science lens that agricultural researchers could benefit from learning about.

Each of the theoretical lenses emphasises the iterative, interwoven relationships between how humans conceive of, and understand themselves and the world, and how these shape and are shaped by our interventions and understanding. These theoretical approaches intersect with, and help reveal and contextualise more specific analyses of agricultural extension in the literature that draw on more particular, applied concepts such as innovation systems, sustainability transition management, social learning and gender relations. Taking this broader approach enables an appreciation and understanding of how agricultural extension and AR4D are parts of far larger world-making projects. It also assists in identifying the fundamental philosophical questions involved and to suggest how agricultural extension could be remade philosophically in a fashion more suited to the challenges of the Anthropocene.

Table 2. Summary of theoretical lens and their application to agricultural extension (AE)

Theoretical lens used	Main elements	Application to Agricultural extension (AE)
Governmentality	Governing via relationships utilising mundane 'technologies' or 'apparatuses' of governing like reporting mechanisms, procedures and practices, and 'rationalities' of government	AE is a form of governmentality – shaping conduct and influenced by dominant ideas about how people and governments should conduct themselves. Governmentality and conceiving of governance generically as 'practices of shaping, ordering and/or challenging other practices'.
Social practice theory	Practices form the basic unit of society. They are repeated, purposeful patterns of interaction that co-constitute the world, which individuals participate in, often unthinkingly, as part of being in society.	AE is often used to try to change the practices of farmers but itself is made up of bundles of practices. These practices have changed over time in various ways, shaping and shaped by heavy contestation over what AE is or should be. Research and international development are also characterised by distinctive and shifting practices. How agricultural, research and international development practices intersect helps illuminate how those working at the interface of these arenas, such as ACIAR, might better negotiate their interactions.
Reflexive modernisation	Combining reflexivity and modernity to form learning loops or mechanisms. Reflexivity is embedded to a greater or lesser degree in governance regimes	People involved in AE are (need to be) reflexive about its past, its achievements and its failings. Reflexive modernisation approaches are evident in calls for transformational change in transition management – sometimes known as Sustainability Transition Management (STM)
Coproduction	Knowledge, meaning and order are coproduced. Coproduction, is a way of understanding processes of emergence and relational knowledge that can usefully be applied to AE practices	AE is a form of coproduction and often adopts methods and practices based on coproduction theory. Much can be gained by critically examining AE as multiple forms of coproduction of knowledge
Worldviews	Worldviews are a limited set of high-level ideas and narratives about the world. Worldviews are defined as cultural, shared,	Worldviews have a significant influence on how AE is conceived and applied. Used as a lens in our analysis they help explain dominant perspectives and positions about AE and why differing

	learnt and institutionalised outlooks.	approaches and positions are often at odds
Feminist philosophy	Feminist philosophy refers to the systemic, embedded way in which the world is gendered. As other Science and Technology Studies scholars argue, technology and innovation are not isolated or neutral but are part of sociotechnical networks of 'artefacts, people, organisation, cultural meanings and knowledge' including gendered approaches and ideals.	AE theory and practice reflect dominant and embedded values and approaches. The use of feminist philosophies provides a lens for critiquing these. For example, feminist philosophy enables an understand technology and innovation as a regime of practice, part of, not separate to, society and thus mutually shaped by gender relations. This lens enables the development of critiques that reveal bias, for example, they help explain the privileging of production and the higher status accorded to the "hard", experimental sciences relative to the "soft", qualitative ones, and the celebration of innovation over knowledge.

5.1.1 Governmentality

The first theoretical thread is Michel Foucault's idea of 'problematisation' and broader idea of governmentality. Although there is not scope here to develop a fully Foucauldian analysis of agricultural research and extension, the idea of problematisation is particularly apt. It is part of Foucault's larger argument that governing is an 'art'. Referred to as governmentality, this is the idea that power is exercised in (neo)liberal societies not (just) through shows of sovereign strength or through the direct disciplining of individual bodies (as in earlier eras), but primarily in a more indirect, diffuse ways. These utilise mundane 'technologies' or 'appartuses' of government and governing such as reporting mechanisms, procedures and practices, and 'savoirs' (knowledges) or 'rationalities' of government that shape how people understand themselves and the world, including their foci, desires, aspirations, roles, narratives and behaviours (Dean, 2010; Foucault, 1998).

Governmentality was defined by Foucault as the governing of conduct, or 'the conduct of conducts', involving the governing of one self and others at one and the same time (Faubion, 1994). As (Dean, 2010) notes, governmentality represents 'a way of thinking about how we conduct ourselves and others, and how we think about ourselves and others when we are doing this' (p. 36). As such it is a reflexive activity which attempts to clarify 'the conditions under which we think and act in the present' (p. 36). Governing is achieved through the development and application of specific 'rationalities of governance' such as the notions of evidence-based policy and democracy, and specific political 'technologies of governance', such as voting systems, project management, skill development and information provision such as in agricultural extension (Dean, 2010).

The conducting or "shaping" of others' conduct captures to a large degree the purpose and anxieties of agricultural extension, whether the latter is pursued via cumbersome bureaucratic systems, carefully crafted economic markets and/or the cultivation of certain knowledge, skills, norms or values. Of particular interest in this report is how the conduct of agricultural extension has become problematised as itself a target for improved conduct. Even though agricultural extension has been removed as a formal public sector, bureaucratic layer in many neoliberal countries - due in large part due to a crisis of legitimacy in the state's right to conduct others' conduct so overtly, following the evolution of liberal government into neoliberal government (Foucault, 2008) – agricultural extension arguably remains in the government's field of vision as the imagined interactional space between farmers and society in which (thanks to its own withdrawal) the government has implicitly legitimised and enabled multifarious other "conducting forces" to shape farmers' conduct.

A useful starting point for examining the dual nature of agricultural extension, as conductor and conducted, is the more specific Foucauldian notion of problematisation. Strongly related to the ethos of continual self-improvement that governmentality instils, the crux of problematisation is the act of problematising or calling into question settled truths and existing arrangements as a step towards ascertaining 'how and to what extent it might be possible to think differently, instead of legitimating what is already known' (Foucault, 1986) pp. 8-9). Indications of such a questioning stance are evident in the way agricultural extension is typically seen as a proposed *solution* to various perceived problems, but also, subsequently, as itself *a problem*.

As a solution, agricultural extension was and remains a product of a prior problematisation of agriculture and its absence. Arguably agricultural extension arose in the colonial era to promote the latest scientific advances, in step with the "discovery" of the absence of anything recognisable as agriculture in places it could and 'should' have been. Agricultural extension points to a powerful tension in the status of modern agriculture as a tool and symbol of modern civilisation (something to introduce, a tool of improvement). On the other hand, agriculture is represented as something in need of constant development (something to improve, a target for improvement); as never quite human, industrial, modern or post-material enough relative to other, always-more advanced human endeavours (Rickards, 2006). As discussed throughout the project report, this ambiguity in agriculture's social status complicates its role in international development and relationship with science, and helps explain the contrasting ways that efforts to improve it have been celebrated by some and lamented by others.

The problematisation of *agricultural extension* as a means of improving agriculture is characterised by the multiple lines of critique, including the sense that in its institutionalised form it was/is an overly clumsy, heavy-handed, unartful performance of government relative to the modern governmentality ideals. Reflecting the multiple faults found in agricultural extension, there has been a plethora of solutions proposed, from the abolition of anything called extension, to its privatisation, digitisation and/or metamorphosis into an emancipatory farmer-led activity. Together these proposed solutions indicate that not one but *many* problems have been identified with extension. Thus the question for analysis is not "what is the problem represented to be?" (Bacchi, 2012) (as Carol Bacchi puts it in her popular use of problematisation to understand public policy) but rather, what are the *problems* represented to be? It is because of a need to explain the multiple, intersecting ways agricultural extension has been problematised that this report has the developed a wider scope placing agricultural extension within a wider context of international development and the R&D sectors.

Foucault advocated problematization as an intentional method of inquiry, in keeping with others such as Paulo Freire. Whereas Freire advocated problematisation of the *status quo* as a critical act of resistance designed to enlighten and emancipate the oppressed (including small scale farmers oppressed by colonizing, capitalist forces), Foucault emphasised the mainstream possibilities of problematization to reveal the nature of contemporary governance. He presented problematisation as both a method and object of study. In doing so, he focused attention on both the stabilization and destabilisation of practices, by which he meant not individuals' behaviours but 'places' where 'what is said and what is done, rules imposed and reasons given, the planned and the taken for granted meet and interconnect' (Foucault, 1991) p. 75). Within particular institutional or sectoral setting, practices settle and interlock into what (Dean, 2010) refers to as 'regimes': 'fairly coherent sets of ways of going about doing things'. When combined with dominant rationalities and knowledges (sanctioned knowledges), including those that dictate certain problematisation practices, the result can be regarded as a *'dispositif'* or 'apparatus': a defensive and purposeful (though not necessarily conscious) 'system of relations' between institutions, roles, discourses, knowledges and norms. These become established as ways of

ordering things into a coherent, conservative whole that serves to secure established structures and power relations against counter-veiling forces.

Insight into practices is offered by considering the processes typically involved in research – e.g. investigating, reporting, communicating, "workshopping", leveraging – all purposeful, normalised, institutionalised activities that have an evolving meaning specific to the context, such as in relation to AR4D. Such an examination of research and extension practices makes clear, in turn, that problematisation is not just a research method, but a technique of governance in the wider world that researchers are part of and subject to. The degree to which researchers are willing and able to problematize the status quo that they are part of varies greatly due in part to the apparatus they are part of.

Evaluating (and problematizing) outcomes is now part of the mainstream art of governing research and extension, due to the expectations, structures and practices around accountability, innovation, competition and progress. These have become established practices that characterise the contemporary R&D sector's position at the intersection of liberal and neoliberal governance regimes. Thus, while practices are by definition relatively stable, and serve to stabilise how we understand and interact with the world, in the context of governmentality some are designed to deliberately and routinely destabilize and question – that is, to problematize – certain aspects of existing situations, adding to the deeply normalized sense of constantly needing to seek improvement.

Tension between "disruptive practices" that are normalized and scripted, and those that are genuinely unsettling of existing regimes is core to revealing deeper questions about governmentality. On the one hand, contemporary governance is characterised by the state and other elites *governing through* civil society and the private sector, including using reflexive and participatory practices. On the other hand, critics of governmentality contend that this cynical view analytically blinds them to the actual 'possibility of uninvited, oppositional practices of participation that *do* disrupt governmental routines or challenge government imperatives such as technoscientific innovation, economic growth or conflict management' (Braun and Könninger, 2018) p.682.

To use governmentality as a theoretical lens requires remaining open to conceiving of governance generically as 'practices of shaping, ordering and/or challenging other practices'.

5.1.2 Social practice theories

Besides Foucault, a growing number of theorists emphasise the importance of practices. Motivated by a desire to escape the dead-end choice between top-down and bottom-up analytical frames (that is, between structures and agents), these theorists focus instead on practices, generating a field of scholarship known generally as social practice theories.

Practices are the repeated, purposeful interactions between people and other elements of the world that we all engage in in different ways in order to live. A 'social practice' refers to a relatively regularised pattern of performances that diverse individuals participate in intermittently over time (Shove et al., 2012). Practice theory considers individuals and their behaviours but, in contrast to most heavily individual-focused readings of society, gives analytical priority to the wider physical-cultural processes they are participating in. It also challenges the notion of institutions and infrastructure as static, background features of the world by focusing on how they are continually reproduced (or disrupted) by dynamic, physical, meaningful relations between entities. As (Feldman and Orlikowski, 2011) p.1241 put it, 'Practice theory argues that everyday actions are consequential in producing the structural contours of social life'.

Social practice theory combines sociological accounts of knowledge with a close consideration of how these are 'co-produced' by the physical world (including environmental conditions, equipment, logistics) and bodily competences (including physical skills, acclimatisation, physical fitness). The heuristic for this analysis is that social practices are made up of three kinds of elements: meanings, knowledges, norms or beliefs; the materials or physical conditions that they interact with or use; and embodied competences or skills available to them. Social practices can be understood as 'what make sense' for people to do in relation to the elements available to them as they engage in everyday activities (Schatzki, 2010).

Practices highlight how actions (behaviours at the individual level, but all sorts of organisational processes) and social norms act back on and recursively make what is experienced as structures and order. 'What makes … any … activity a practice is that the action of engaging in it is consequential for the development of the activity. ' (Feldman and Orlikowski, 2011) p.1242). In this emphasis on the idea that 'phenomena always exist in relation to each other, produced through a process of mutual constitution' (ibid), there is some alignment with systems thinking approaches. At the same time, a practice lens side-steps conventional hierarchical depictions of scale, and along with associated theories such as assemblage they (see (Gillard et al., 2016)) complements systems thinking by addressing the risk that what is being studied is uncritically presumed to be a functional (closed) system rather than recognised a far messier, complex set of processes.

A practice theoretical lens complements ethnographic work on agriculture as a constant negotiation with shifting climatic, environmental and social conditions and a continuous performance and art (eg (Crane et al., 2011)). (Nettle et al., 2018) tentatively discuss extension practices using social practice theory, but in general it is yet to be applied to the agricultural RDE arena, despite one of the long-standing goals of agricultural extension being 'practice change' among farmers.

5.1.3 Reflexive modernisation

Grappling with a similar approach are scholars and policy makers who use Ulrich Beck and colleagues notion of 'reflexive modernisation'. Reflexive modernisation is shorthand for the dis-ease with which modernisation is now viewed. As Dean puts it, 'modernity now exists in an agonistic relation to an earlier modernity, [to] industrial society' due to growing awareness of the proliferating risks and other issues it has generated. Representing as a kind of learning mechanism for society, this reflexivity is embedded to a greater or lesser degree in actual governance systems. The ideal is what (Voss et al., 2006) and others call 'reflexive governance'. But in reality, this ideal is achieved to a highly variable degree. Underlying such variation is the two registers or "orders" at which it can be applied. 'First order' reflexive modernisation is the most common use of reflexivity and represents what some suggest is an attempt to nullify more far-reaching critiques. Here, problems with modernisation are identified and addressed using existing mentalities, tools and practices (Grin, 2006), in a move similar to what (Schön, 1983) calls 'single loop learning'. This reflex is core to the idea of development as intentionally ameliorating the side-effects of immanent capitalist development. Illustrated today by the paradigm of 'ecological modernisation' and 'green growth' – the idea that environmental catastrophe can be warded off by retro-fitting existing modernisation processes with more targeted science, technology and markets (Bäckstrand and Lövbrand, 2007) – first order reflexive modernisation is arguably the dominant mode of critique in most applications of problematisation today.

There is however a more disruptive option. Such 'second order' reflexive modernisation is more akin to Schon's 'double loop learning'. It encompasses existing norms, practices and thought within the scope of what is problematised (Grin, 2006). It thus not only addresses unwanted outcomes in the world, but thinks deeply about how and why they have come about. This is

where problematisation becomes a critical tool. Crucially for agriculture, it can lead to reappraisals of first order reflexive modernisation. This is not just familiar modernist calls for *further* change and improvement, or the doubling down on effort to address ongoing gaps and emergent challenges, of the sort often evident in conversations about food security. Second order reflexive modernisation is illustrated by emerging calls for transformational change and a new model of sustainable development suited to the systemic crises we face. It manifests as questions about the modernist growth trajectory, the very compulsion to continually grow, expand, and innovate rather than protect, stabilise, maintain or downscale what exists. Feminist scholars and others have pointed out that deep critiques of the dominant, gendered narratives of modernity are fundamental to addressing the world's interconnected social and environmental problems. They argue that a foundational level, these problems stem from the systematic devaluation of the feminised "reproductive" sphere of the world relative to the masculinised "productive" realm. The ambiguous position of agriculture and agricultural extension in relation to this critique is one reason that agricultural extension and AR4D more generally are so contested.

Despite the dominance of first order approaches to reflexive modernisation, aspects of second order reflexive modernisation are evident in current calls for transformational change in response to the Anthropocene. In particular, the conceptual framework of transition management – which encompasses the areas of scholarship known as Sustainability Transition Management (STM) and Strategic Niche Management - calls into question dominant rules, norms and other institutions. (Geels, 2002)'s 'multi-level perspective' approach to STM especially draws out the influence of what he calls 'regimes' (structures, institutions, relationships, practices) and higher level 'landscapes' of slow moving and exogenous variables such as the global trade and economic relations and, crucially, worldviews (discussed below). Contemporary agricultural systems - in low and middle income countries, as well as high income ones (Wieczorek, 2018) - are increasingly theorised using a transition management lens. While useful, in this report the relatively specific ideas of transition management are framed as part of broader processes of reflexive modernisation, problematisation and governmentality.

5.1.4 Coproduction

As indicated, one of the arguments underpinning the problematisation of agricultural extension has been neoliberal complaints that government-based agricultural extension is a clumsy, cumbersome way to govern farmers' conduct. An associated argument centres on the linearity and narrowness of engagements with farmers (and the many other rural actors it neglects).

Systems thinking and emancipatory scholar-activism problematize linear and "top down" approaches in different ways. Together they have encouraged a widespread embrace of "coproduction" approaches to generating and proliferating innovations within agricultural and rural sectors, including in AR4D. Aligned with 'Mode 2' knowledge production (Nowotny et al., 2003; Gibbons et al., 1994) as opposed to traditional, linear, expert based 'Mode 1' knowledge production, coproduction refers to initiatives that deliberately involve diverse actors, notably those often defined as "experts" and "end users".

Coproduction does not have a single, settled meaning, but given it many applications, this is not surprising. In the arena of water governance, (Lepenies et al., 2018) found that 'there are radically different understandings of what coproduction means', while in climate change research, (Bremer and Meisch, 2017) distinguish two types of 'descriptive coproduction' and 'normative coproduction'. The latter uses the idea of coproduction for a particular objective. Some approaches are motivated by concerns to include different voices and for procedural justice, some by an epistemological interest in improving knowledge, and some on a pragmatic desire to

share responsibility. By far the most common type of coproduction used in agriculture is 'iterative interaction': regular 'consultative interaction' between scientists and users to make scientific information more useful and usable (Bremer and Meisch, 2017). Other types of particular prominence in AR4D are 'extended science' using action research principles that result in 'social learning'.

An important distinction in coproduction practice is between those who advocate for the inclusion of policy makers, and those who advocate only for the inclusion of "local people". In the climate change work the dominant focus has been with policy makers, reflecting the need to introduce climate change into policy. In agriculture, the dominant focus has been on "local people", notably farmers, reflecting the sense that this is the necessary, feasible and/or desirable social scale of engagement to address problems. The localisation focus of research and engagement can reflect pragmatic concerns (e.g. access to farms for research trials and demonstration sites) but there is also the optics of focusing on "the farmers" and "the little people". Taking this view, coproduction is not just reflexive, but also an 'emancipatory project' in which 'knowledge co-produced with non-scientists holds the promise of more open-ended and inclusive deliberations over questions of common purpose' enabling problems to be dealt with that 'science in the aggregate has failed to live up to its promise to work for the benefit of society as a whole' (Lövbrand, 2011) p.227).

The commitment of working with local and diverse actors is underpinned by another approach to coproduction. This does not take coproduction as an ideal method or as a practice to look for in the real world, but as a general fact about how the world works. This 'descriptive' approach, is often associated with the work of Sheila (Jasanoff, 2004b) among others, who understand everything as coproduced by knowledge processes, and knowledge as itself continually being coproduced by the world. From this perspective 'the realities of human experience' are the emergent outcomes of interactions between knowledges and the social order they are shaped by and shape ((Jasanoff, 2004a) p.17).

Coproduction, in this sense as emergent and relational knowledge is not a particular, favoured way for scientists and researchers to interact with society (e.g. government, farmers, citizens), but a recognition of the more basic fact that these spheres are not discrete and separate, but are instead continually co-constituted at multiple levels. This aligns with the Foucauldian lens, introduced above, that emphasises the inseparability of knowledge and power and 'assumes that the ways in which we think about and represent reality [including in academic research] are intimately linked to the ways in which it is acted upon and governed' ((Lövbrand, 2011) p.227).

From this perspective, classical claims about academia's independence from society are viewed as 'boundary work' (Gieryn, 1983) designed to perform a strategic, false boundary between academic experts and society, notably the state, for the mutual benefit of both groups. From this vantage point, science and policy do not have to strive to work more closely together in the way normative coproduction scholars call for (e.g. in climate change research), because they are already deeply entangled. The task of critical research, like in this project, is to reveal the hidden judgements and normative presumptions embedded in scientific expertise, due to the way it is funnelled, filtered and shaped by higher order social/state influences, including the tying of research funding to assessments of its "relevance" and "usability" (Lövbrand, 2011).

As an analytical lens, coproduction can be used to attend to understanding how different knowledge producers interact with each other and the broader social structures in which they work. Like problematisation it pays special attention to "crisis" moments when "givens" about existing institutions, including general 'settlements' between science and society break down and new ones are emerging (see (Foucault, 1985)). 'Interactional' coproduction research focuses on the politics of the interactions between the different actors involved, whereas 'constitutive'

coproduction research focuses on the two-way relationship between the categories used to order the world and how the world is (Jasanoff, 2004b). These two veins of coproduction research overlaps substantially thanks to how the categories used to know, represent and order the world reflect the particular position and perspective of those authorised to do so. In other words, the "top" from which the linear model of innovation originates as an endorsed model and empirical reality represents a particular perspective, and it is the false universality of this as much as the hierarchism and linearity that underpins subsequent critiques of it. As Law writes about the history of sociology, in which the claimed universality of the middle-aged white male sociologist is jolted by the realization that *'"his" sociology had never spoken for "us": that all along the sociological "we" was a Leviathan that had achieved its (sense of) order by usurping or silencing the other voices'* (Law, 1991). p. 1)..

Recently, work from a descriptive coproduction stance has been pushing for more reflexivity about normative coproduction as an apparent solution to the limitations of linear approaches, including their assumption that "the public" or subsets such as "rural communities" exist ready to be (more) included (e.g. (Chilvers and Kearnes, 2016)). Sometimes discussed as 'ecologizing participation', this line of analysis calls for *'(1) a broad understanding of public participation including 'wild', uninvited interventions, partisan publics, participation in corporatist arrangements or expert bodies, public debates and more, (2) a sober, analytic view that does not a priori assume that we need more participation or deliberation, and (3) an emphasis on the need to study participatory processes, formats or activities within a larger context'* (Braun and Könninger, 2018) P.681.

These approaches are intended to tackle questions and methods of coproduction as more detailed than just including different social groups in certain stages of knowledge production or decision-making. The challenge instead is to see the issues as part of far broader and deeper inequalities. For example, resistance (e.g. farmer resistance) to a proposed solution (e.g. technology) is framed from a linear model of innovation. This perspective uses the "deficit model" in which people are cast as deficient in their capacity to recognise what they need. Criticisms of this framing are widespread, but as (Wynne, 2007) P.104 notes, they themselves generally do not recognise it as *'techno-scientific culture's systematic denial of 'the other', whether it is the 'epistemic other' of ignorance and associated lack of control, or the human other of ontological differences underpinning what are recognised only as mistaken public epistemic commitments.'* He points out that framing of uncooperative "resistors" as either ignorant or wrong is a deeper devaluation of them. Coproduction is not a universal ideal but a situated, Western, democratic model. As (Wynne, 2007) pp.101-02 asks, 'what is the larger significance for participatory processes of what is seen as the typical Asian propensity to avoid overt disagreement, even if it is there in spades, and often ostensibly (Scott, 1985) to defer to designated expertise and authority?'. Rather than necessarily teaching Asian smallholders to participate properly in the coproduction of knowledge, which simply replaces one Western ideal (rationally following expert advice) with another (participating in the production of scientific knowledge, more-than scientific knowledge, or some other coproduction process) – all of which may be desirable in a given context – the challenge instead becomes to turn the mirror on the Western self and think reflexively about its assumptions.

5.1.5 Worldviews

Thinking critically about how we think brings us to the fourth element of the theoretical lens to mention, which is the concept of worldview. In a general sense, worldviews are the normative-ontological lenses through which we understand the world. They are a broad categorization of how - given our experience, circumstances and education - we believe the world to work, our own

role and options within it, and how things should be. More than just a mental construct, worldviews are inseparable from how we engage with and "make" the world. Read through the coproduction analytical lens, worldviews are not only historically situated 'inescapable, overarching systems of meaning and meaning making' that substantially inform how humans interpret reality, but how they enact and co-create it (Hedlund-de Witt, 2013) (p.133). For example, different groups enrol 'water' in their various worldviews, to help reproduce certain affects (Loftus and Lumsden, 2008),p.109). Worldviews refers to a limited set of high-level ideas and narratives about the world, some of which are more dominant in a given setting than others. Used as a lens in our analysis, worldviews are defined as cultural, shared, learnt and institutionalised outlooks.

Agriculture is significant as a site for contestation between different worldviews. Certain worldviews (notably agrarianism) privilege agriculture, as arguably shaping society and individuals physically, politically and psychologically and shaping the world materially. Agriculture is therefore well suited to analysis utilising the concept of worldview. Prior research points to the utility of worldview analysis in understanding agricultural issues. (Wolford, 2005) for example, describes the competition between neoliberal and agrarian worldviews at work in the governance of Brazilian agriculture[4], while (Pretty and Bharucha, 2018) (p.6) suggest that a focus on human and social capital and open learning systems is needed in agriculture because the latter 'can cause fundamental changes in worldviews, precisely what may now be required to ensure successful transitions towards sustainable and higher productivity in agricultural systems worldwide'.

Pretty and Bharucha's (2018) reference to learning illustrates the strong relationship between the concept of worldview and education (as extension can be conceived as). Pedagogical principles require reflection on the lens being imparted, and different teaching approaches enact different worldviews. Environmental education has especially focused on worldviews, not only because the existing dominant 'Western' or 'modernist' worldview is seen as environmentally damaging, but because environmental education proposes a different pedagogical ethos, one more interested in the whole person (including individuals' values and beliefs) rather than just what they know (e.g. (Hernes and Metzger, 2017; Hedlund-de Witt, 2012)). In the sustainable development arena, moves to deliberately envisage and create different futures has also helped stimulate interest in worldviews.

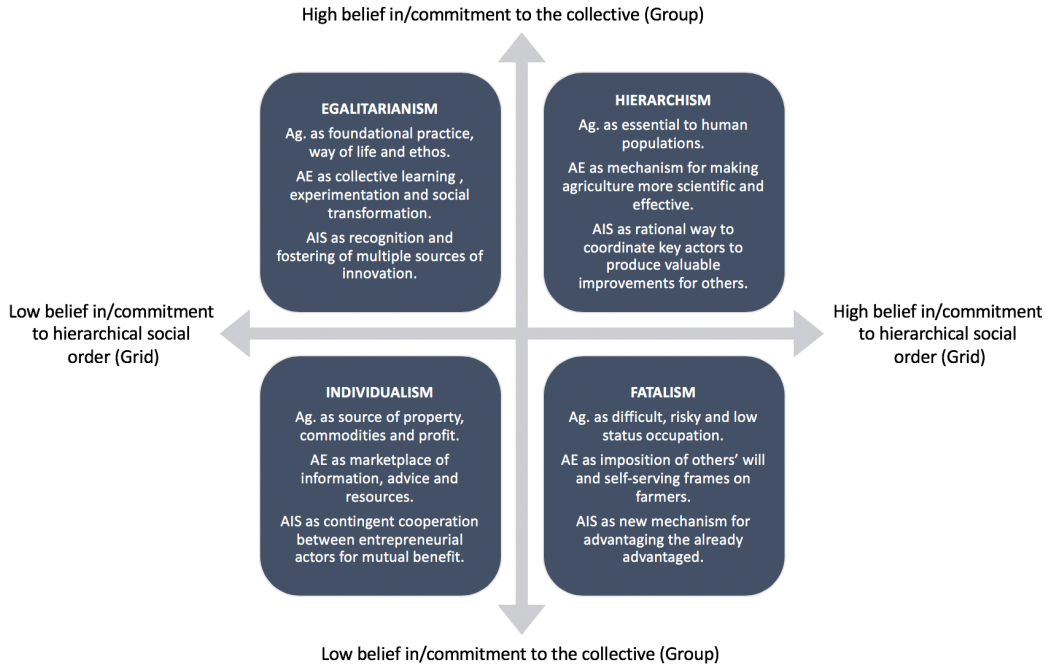
Anthropologist Mary Douglas and colleagues propose a "grid-group" model of four major worldviews (later renamed Cultural Theory), based on extensive comparative studies of different societies and sociological theories (Thompson et al., 1990). Although simple, it is a framework that has repeatedly proven useful in understanding the reason for some seemingly intractable differences between various social groups. In this framework, 'grid' refers to how regulated or prescriptive individuals think social life should be: how free individuals should be to do what they like. 'Group' refers to how loyal or ethically bound individuals feel to others: the extent to which they feel themselves to be part of a group, whether a community, nation or the human species. Comparing high and low responses along these two axes produces four main worldviews, which essentially represent different levels of social equality and connectedness. All tend to be present within a given context, and favoured by individuals at different times. Yet they interact and compete to shape specific social contexts, with different ones coming to be expressed and stabilized within social institutions (Douglas and Wildavsky, 1983).

Variously named, the four worldviews are as follows (see figure 1). Hierarchists see the world as ideally well-ordered, governed by enlightened experts who have a moral duty to help the less

[4] On a similar dynamic in Australian agricultural policy, see Botterill, L., 2016: Agricultural policy in Australia: deregulation, bipartisanship and agrarian sentiment. *Australian Journal of Political Science*, 1-16.

fortunate. Committed to improving the world, this worldview is animated by a shared *esprit de corp* of the sort evident in the United Nations and the Sustainable Development Goals. Second, Egalitarians are similarly animated by a shared sense of belonging and will to improve the world, but often retreat into enclaves of like-minded souls if broader society is deemed too antagonistic. Their ideal world is one characterized by much flatter structures than those favoured by Hierarchists, with no individuals seen as having the right to control others with all decision making needing to be radically democratic and shared. When translated into human-nonhuman relationships, this worldview overlaps closely with what is sometimes called an 'ecological' worldview (e.g. (Hampson, 2012)). In terms of agriculture, an exemplar of this worldview (in theory if not practice) is the permaculture movement, where even dominance among plant species is discouraged. (Ferguson and Lovell, 2014) refer to permaculture *as* a worldview. Third, Individualists side with Egalitarians in the essential equality of all individuals, but favour individual freedom in decision-making and actions over groupness. They eschew sociopolitical and moral prescriptions on behaviour and instead argue that it is up to each individual to shape their own future. This worldview celebrates entrepreneurism and the capacity of all individuals to be creative agents as is evident in neoliberalism. Finally, Fatalists (or sometimes called Pragmatists), see the world as full of individuals pursuing their own objectives. But they also perceive the world as controlled to a large degree by vested interests or at least uncontrollable forces, ones that have little interest in their lives. The upshot is that everyone must ultimately be responsible for their own wellbeing. Efforts to secure national or local food security, and strengthen the self-sufficiency of populations or households to impending disasters reflect this worldview.

Figure 1. The four worldviews of Cultural Theory (after Douglas and Wildavsky, 1983) and examples of the different perspectives on agriculture they engender.



In this research project, attentiveness to how these worldviews are expressed in various ways and combinations in debates about agriculture and agricultural extension has been used for analysis that can help to explain some of the key tensions involved in different agricultural extension models.

5.1.6 *Feminist philosophy*

Alongside anthropologists, feminist philosophers have led efforts to recognise worldviews as not just something "other cultures" have, but that the West has. The "Western worldview" has become amplified and increasingly dominant and globalised in the contemporary era. It is founded on a 'Human/Nature dualism' in which the Western Self identifies as Human in opposition to everyone and everything else that are cast by default as non-Western Others (Plumwood, 1993; Plumwood, 2002). Combined with a linear notion of time and modernist orientation towards the future (that is, progress and advancement), this foundational equivalence of the Self/Other identity with a Human/Nature dualism leads to numerous derivative distinctions that structure Western culture, including Subject/Object, Masculine/Feminine, Scientific/Non-scientific, Mental/Manual, Urban/Rural, White/Black.

The notion of dualism refers to a double move. First, something (e.g. the Human) is sharply distinguished as different in kind from "the rest" (e.g. Nature – a concept non-Western cultures do not operate by (Descola, 2006)). Second, the first category is raised to a far higher status on the basis of distinguishing characteristics. As Australian ecofeminist philosopher Val (Plumwood, 2009) explains in relation to the foundational Human/Nature dualism:

> The hyperbolised opposition between humans and the non-human order I call human/nature dualism is a western-based cultural formation going back thousands of years that sees the essentially human as part of a radically separate order of reason, mind, or consciousness, set apart from the lower order that comprises the body, the woman, the animal and the pre-human… Human/nature dualism conceives the human as not only superior to but as different in kind from the non-human, which is conceived as a lower non-conscious and non-communicative purely physical sphere that exists as a mere resource or instrument for the higher human one. The human essence is not the ecologically-embodied 'animal' side of self, which is best neglected, but the higher disembodied element of mind, reason, culture and soul or spirit... The other side of this is the reduction of nature that is part of the dualist formation. On the one side of this hyperseparation, we set ourselves sharply apart from everything else as essentially mindful beings. On the other side we get the concept of nature as dead matter, all elements of mind and intelligence having been contracted to the human. The idea of nature as dead matter, to which some separate driver has to add life, organization, intelligence and design, is part of human/nature dualism… [T]he resulting delusions of being ecologically invulnerable, beyond animality and 'outside nature' lead to the failure to understand our ecological identities and dependencies on nature.

Underpinning the Human/Nature dualism is Rene Descartes' (1596-1650) idea that the Mind and Body are separate and hierarchically ranked, with the Mind over the Body. In this framework, true humanness (the unique status of humans among other animals) is associated with one's capacity to mentally escape the influence of one's body and the material world in order to engage in objective thought and access genuine truths about the world (Bordo, 1999; Plumwood, 1993).

An expression of the Human/Nature of particular relevance to this report is the distinction and valuing of *theoria* over practice in Ancient Greece (the Mental/Manual dualism), which (Godin, 2006) argues is the origin of the dominant 'linear model of innovation' that more recently has involved the prioritisation of pure research over applied research. Not only has this model been influential in agricultural extension, it emerged out of the classed devaluing of agriculture and early twentieth studies of "the problem" of how to improve farmers' practices (Godin, 2015). For, although agriculture has long been used to symbolise human intelligence and design relative to "wild" ("wasted") Nature and less interventionist and sedentary (non-Western) livelihoods such as hunter gathering, it still is a form of land and business ownership, in modern society. Rurality is more generally devalued on account of being "stuck in" and vulnerable to the natural realm relative to less manual, more "mental", indoor and urban pursuits. It is because of this framing of

agriculture as by definition not-quite-Human, that it has been consistently problematised as needing to become more rational, scientific and business-like.

All of this is deeply gendered, with the problematisation of agriculture as dependent, weak, vulnerable, irrational, and even emotional making it relatively "feminine" and thus in need of masculinisation. This is mutually reinforced by the masculinisation of science on account of a long-standing belief that men are more capable of achieving Descartes' feat of virtual disembodiment than women, who are considered more stuck in their bodies, hampered by hormones, heaviness and hysteria (Malson, 2003). It is important to note here that the focus of this theoretical lens is not on individual men and women *per se.* It is on the gendering of the interlocking cultural, social, economic and political ideals that shape all aspects of social life, including research, innovation and agriculture and international development.

From this post-structural perspective, while gender does not deny biological sex differences, it focuses on the learnt ways in which individuals perform being male or female (Butler, 2004). Furthermore, it refers to the systemic, embedded way in which the world is gendered. Feminist philosophies of technology, for example, understand technology and innovation as part of, not separate to, society and thus mutually shaped by gender relations. As other Science and Technology Studies scholars argue, technology and innovation are not isolated or neutral but are part of sociotechnical networks of 'artefacts, people, organisation, cultural meanings and knowledge' including gender ideals ((Wajcman, 2010) p.149). A post-structural approach further underlines how non-human things, whether other animals, types of work, or technologies can be coded as relatively masculine or feminine. Although femininity (of people or things) is valorised in some settings (Dowling, 2016), and there are multiple, shifting, competing types of masculinity (Connell, 1995), the general pattern is the privileging of the "most masculine" in any given context (Plumwood, 1993).

We come then to the fact that the devaluation of Nature and the body, outlined above, is only half the story about the gendered Self/Other, Mind/Body dualism of the Western "master subject". Besides claiming the Mind side of the equation (mental superiority), masculinity is also associated with superior Bodies. That is, types of bodies are differentiated and the qualities associated with male bodies are reified as ideals for all humans.

Men are thus considered superior to women and nature in *bodily* contests because their "muscular" advantage is idealised and utilised as a form of power over them. Hardness, strength and size are reified qualities because they are coded as masculine, whether the entities in question are facts, bulls, trucks, pipes, businesses, or nations (e.g. (Shah and Memon, 2018; Liebrand and Udas, 2017; Cole et al., 2015; Hovorka, 2012; Connell, 2016)).

This version of masculinity is strongly apparent in diverse rural and agricultural contexts (e.g. (Brandth, 2006; Brandth and Haugen, 2000; Coldwell, 2012; Bell, 2000; Hansda, 2017; Saugeres, 2002)), and is equally evident in the business world. Recent versions similarly value lean, mean, aggressive, agile and smart entities for their implicit masculinity (e.g. (Heywood, 1999; Miller, 2002; Meriläinen et al., 2015)).

The masculinisation of both rationality *and* physical power converge in the relative devaluation of the feminised sphere of cyclical re-production (domestic work, care work, nutrition and hygiene, maintenance, emotional labour, community building, and even agriculture) (Gibson-Graham, 2006) relative to the privileged, masculinised sphere of production (making new things). They also converge in the higher status accorded to the "hard", experimental sciences relative to the "soft", qualitative ones, and the contemporary celebration of innovation (actual change) over mere knowledge.

All of these theoretical lenses help researchers understand the context they are in and issues they face in their work.

5.2 Methods

Literature reviews

Two broad, overlapping types of literature were analysed for this report: academic literature (e.g. journals, books) and grey literature (reports, websites). In each case, the literature encompassed not only agricultural extension *per se* but the broader topics that it intersects with in AR4D, notably agriculture, development and research/innovation, but also wider topics such as governance, modernisation, gender and environmental change (Table 3). The academic literature was also read in two ways: as part of the empirical field of interest, shaping and reflecting AR4D and agricultural extension in practice, and as a factor in the report's overarching theoretical perspective outlined above.

Table 3. Outline of literatures reviewed

	Specifically on agricultural extension	**On agriculture, development, research and related topics**
Academic literature	Eg. *Journal of Agricultural Extension and Education*	Eg journals such as *Agricultural Systems, World Development, Research Policy*
Grey literature	Eg GFRAS, APEN and CGIAR websites, conference reports, and reports	Eg UN, CGIAR and NGO websites and reports

These literatures were examined to develop a broad understanding of the key themes and arguments in and positioning agricultural extension. This desktop analysis used standard academic research search engines and citation trails to identify and filter relevant literature.

Discourse analysis was used to analyse all of the material (eg conference presentations and programs, interview transcripts, websites). (Dryzek, 2005)'s pragmatic approach to discourse analysis was particularly used for the way it focuses on identifying the problems, solutions, images, catchphrases, metaphors and actors as prioritised in different arguments about social and environmental change and futures.

Interviews

Interviews were conducted with agricultural extension experts and other key informants from the AR4D world including some ACIAR researchers and staff. For this, the agricultural extension community was defined in consultation with ACIAR to focus it on the group(s) of most interest. An initial list of potentially relevant organisations, individuals, conferences, meetings and sites was generated and a sample selected for closer analysis. One implication of this focus on groups most relevant to ACIAR is that the focus is on its geographic regions of interest and representatives from large sections of the agricultural extension world (e.g. that based in the U.S.) were not included. Purposive and snowball sampling was used to contact potential interviewees.

Fifty semi-structured interviews were conducted. Where possible these were done in person in a workplace or public space. Others were conducted via Skype or phone. The interviews ran for between 25 and 120 minutes and were taped and transcribed. Interviewees were guaranteed anonymity and confidentiality. Their transcripts were analysed thematically. The goal was to develop a high-level view of the main arguments, ideas and challenges characterising agricultural extension in the context of AR4D. An initial list of interviewees was purposively designed with ACIAR and used as the basis for further snowball sampling.

External Workshops

Three workshops were used to "road test" and enrich findings from the literature reviews and interviews. Three stakeholder workshops were held. These are described in the deliverables section below.

Internal Workshops

Three internal workshops with the research project team (Rickards, Alexandra, Jolley, Farhey and Frewer) were held at RMIT in Melbourne to develop the analytical frameworks, to collectively analyse the data, review interim findings and agree on conclusions and progress the writing tasks.

6 Achievement against activities and outputs/ milestones

6.1 Activities

A key activity scheduled to explore contemporary extension were the stakeholder workshops. These were intended to complement and test the findings from the interviews and literature reviews. An example of the workshop invite is provide at Appendix 1 and a copy of the discussion paper used to prime participants is provided at Appendix 2.

1. **Workshop 1: Reviewing the state of agricultural extension**
   This two-hour workshop with 21 ACIAR staff members and researchers in Canberra was designed to stimulate reflection and conversation about what extension is, its current manifestations and trajectories and how it relates to ACIAR work. Small group and whole group conversation was facilitated and stimulated by a presentation and prior discussion document based on the literature reviews. A particular focus was the difference and relationship between agricultural research and extension in Australia and in the low and medium income countries that ACIAR works in. The conversation on the day was recorded by a scribe and analysed for major themes afterwards.

2. **Workshop 2: Rethinking agricultural practices and agricultural extension**
   This one and half day workshop in Phnom Penh, Cambodia, drew together 31 participants from the Mekong region to discuss agricultural extension and its role and challenges in the region. Participants included ACIAR staff, researchers, stakeholders (including government representatives and members of relevant NGOs and networks such as GFRAS), as well as other key experts on extension. The workshop combined a series of presentations offering different perspectives on various aspects of contemporary extension challenges, as well as facilitated discussion and small group work. A particular focal topic in the workshop was the potential of thinking of agriculture and agricultural extension in terms of generic practices to help bring to the fore the cultural specificity of both as particular fields of work and think though how new approaches are introduced or could be introduced. A workshop dinner aided participant networking and conversation.

3. **Workshop 3: Rethinking agricultural "practice change"**
   This workshop was with 27 agricultural extension practitioners from Australia and neighbouring countries 'piggy backed' at the 2017 GFRAS-APEN conference in Townsville, Australia. A workshop discussion paper based on the literature review was provided to prime participants and to stimulate discussion on key dimensions.

4. **Seminar ACIAR staff Canberra**
   A seminar was held with ACIAR staff in Canberra in 2018 to explore the projects interim findings. In addition to informing those attending about the research, this seminar was structured so as to generate reflection that surfaces awareness about how personal positions influence decisions and priorities. Based on feedback, this workshop stimulated reflection about worldviews and embedded assumptions about the nature of extension and R&D.

6.2 Outputs and deliverables

The objectives of the project were refined (Table 3) in order to help focus the project, make explicit the historical, contextualised approach it was taking, and highlight particular issues of interest such as the "gender agenda". These refined objectives encompassed the original ones but helped provide more direction.

Table 4. Original and refined objectives

Original objectives	Refined objectives
To identify the assumptions, challenges, and practices of agricultural extension to date To identify needs and opportunities for improving the theory and practice of agricultural extension	To analyse the evolution of and debates about approaches to agricultural extension in the context of the agriculture and international development and the research/innovation sectors To identify the assumptions and challenges shaping agricultural extension including the issue of gender equity in agriculture and development To identify needs and opportunities for improving the conceptualization and practice of agricultural extension and its relationship to the AR4D sector.

In achieving these objectives, the project produced an adjusted list of outputs (Table 5). The fact sheet and blog were removed (following consultation with ACIAR) and the 'white paper' became a 'discussion paper'. A book was added to accommodate the large, interconnected ideas the project generated.

Table 5. Proposed and actual outputs delivered

Initial proposed deliverables	Outputs delivered
ix. Academic paper 1: Overview of agricultural extension x. Academic paper 2: Applying social practice theory to agricultural	i. Academic paper 1: Overview of agricultural extension ii. Academic paper 2: Genealogies of agricultural extension iii. Academic paper 3: Adapting

extension xi. Academic paper 3: Applying masculinity theory to agricultural extension xii. Final Report xiii. Fact sheet xiv. Blog xv. White paper published by ACIAR on agricultural extension xvi. Project presentation(s) to select ACIAR stakeholders, as appropriate	agricultural RDE to climate change: insights from practice theory iv. Academic paper 4: The gender agenda in agriculture v. Final report vi. Blog vii. Discussion paper 1: Background discussion paper to inform workshops viii. Discussion paper 2: Strategy oriented document for ACIAR ix. Book: Agricultural extension in the Anthropocene x. Project presentation to select ACIAR stakeholders

Each of the outputs is now described in turn.

Academic paper 1: Overview of agricultural extension

Title: Agricultural extension: its origins, evolution and future prospects
Journal: *Agriculture and Human Values*

Abstract

Agricultural policies are central in debates about the 'nexus' - the intersection of multiple related challenges of food, water, energy security and rural development. Despite broad acceptance that transformations of agriculture systems are critical to meeting sustainability, food security, climate adaptability and poverty reduction imperatives, intense contestation exists about the policy paradigms and pathways for delivering such change. A diversity of actors and agendas are involved in these contested knowledge politics with substantive questions regarding the modes and outcomes of research, development and extensions (RD&E). In this paper we provide a synoptic overview of the social apparatus of agricultural extension (AE) within the broader field of agricultural research for development (AR4D). To shed light on how AE is evolving we survey AE from its colonial origins to its current incarnations, finding significant continuities in its rationales of enhancing food security, reducing poverty and sustaining natural resources. These historic justifications of agricultural development policies endure despite three persistent critiques of AE - its colonial characteristics, the limited use of systems thinking, and questions of efficacy and performance. As a global professional network, AE has responded to these critiques, redefining its purpose as being less about transfer of technology (ToT) and more about enabling change by using methods that emphasise participatory approaches, social learning and innovation systems. Capacity to enhance the scaling up of innovations leading to climate resilient and sustainable agriculture are significant claims, and institutional capacities to facilitate large-scale change deserve attention due to their relevance to meeting wider sustainable development goals. However, development-oriented agronomy remains intensely contested, requiring greater effort to understand the nature of the ideological contests and their theoretical framings. The paper explores how the intensity of these debates reveals contests between fundamentally different political philosophies and theoretical perspectives that are attempting to territorialise agriculture's material and discursive domains.

Academic paper 2: Genealogies of agriculture for development

Title: Genealogies of agriculture for development: eras, continuities and futures
Journal: *Journal of Rural Studies*

Abstract

This article examines the historical context of the agriculture for development discourse. The re-emergence of agriculture as a primary concern of major development institutions such as the World Bank has led to a proliferation of institutions, practitioners, donors, NGOs, scholars and networks who view agriculture as a key way of achieving development goals. The 'agriculture for development' discourse that is ubiquitous amongst the largest donors and institutions working in the agriculture sector including the World Bank, UNFAO, CGIAR, USAID, and within scholarly networks working on agriculture. Agriculture for development is generally considered a novel approach that has emerged in the last decade and which applies new approaches, techniques, strategies and concepts. This is encapsulated by claims to novelty including the rise of 'innovation' with its focus on entrepreneurship, technology and 'scaling up'; a renewed interest in smallholder farming; 'bottom up' approaches to development; and a focus on the capacities and needs of a range of subjects who have been marginalised from traditional state-led development efforts (women, indigenous people and other groups deemed 'vulnerable'). Although aspects of the agriculture for development discourse are indeed novel, this article examines how the longer-term biopolitical rationalities that emerged during the late nineteenth and early twentieth century continue to frame the overall discourse and underpin approaches to agriculture as a mode of development. This article focuses on relationships between agriculture, population health and security. It documents how these biopolitical concerns evolved alongside colonial agendas, US Cold War and modernising agendas, and the more contemporary rise of neoliberalism and resilience thinking. By taking a long view to the co-evolution of international development and international agricultural it becomes clear that not only is the agriculture-for-development discourse less novel than may first appear, but remains trapped within a rationality that seeks to govern over rural agriculturalists and their relations with the soil, food, malnutrition, the climate and global commodity markets. Agricultural networks involved in international development are diverse and multifaceted, forming an evolving assemblage of ideas and practices that have been inflected by different agendas and ideologies over time and space. However, this article demonstrates that a core biopolitical thread runs through agriculture-for-development discourses from the colonial era to the neoliberal era.

Academic paper 3: Adapting agricultural RDE to climate change

Title: Adapting agricultural RDE to climate change: insights from practice theory
Journal: *Sustainable Development*

Excerpt:

The need to reboot sustainable development and tackle climate change has refocused attention on agricultural research, development and extension (or what some now normatively refer to as agricultural innovation systems). The United Nations Sustainable Development Goals agenda (*Transforming our World: the 2030 Agenda for Sustainable Development*) features agriculture as both a cross-cutting theme and the focus of two Sustainable Development Goals (SDGs) (SDG 15: Life on Land and SDG 2: Zero Hunger). Under Target 2.A of Goal 2 End Hunger, it explicitly calls for increased investment and international cooperation around 'agricultural research and extension services'. It also calls for efforts to 'improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early

warning' (Target 13.3 of Goal 13 Climate Action). Knowledge-rich extension has long been the key tool used in agriculture for such tasks. Its role in helping agriculturalists respond to climate change is made explicit in the related Climate Smart Agriculture agenda of the FAO… Many other examples further illustrate how agricultural RDE is being positioned as a key enabler of climate change adaptation in the farming and broader rural arena.

What is frequently overlooked in such formulations, however, both in the agricultural sector and beyond, is that *RDE itself* needs to be adapted to climate change as part of the broad adaptation of development that is required. As (Payne and Shepardon, 2015) p.364 point out in this journal: 'Adaptation must occur, not only among users, but also among those supporting decision-making efforts, such as practitioners and academics'. While adaptation-relevant information and knowledge are among the most discussed enablers of adaptation (as the frequent emphasise on climate information services illustrates, for example), the processes, people and institutions involved in (formal) knowledge production are frequently obscured in adaptation discussions, silently positioned as enablers of (distant) others' adaptation rather than as targets of adaptation themselves. At the same time, this imagined separation of knowledge producers from the context they are discussing (behind the wall of the much-critiqued ivory tower) not only leads to complacence about the direct implications of climate change for RDE, but means that the knowledge actually produced is often of limited use for intended users (that is, those thought to be in need of assistance to adapt). As Payne and Shepardon continue, extending adaptation into the world of professional knowledge production necessitates a 'significant shift' from conventional

> …knowledge production strategies, which utilized unidirectional, top-down approaches producing technical, engineering solutions in the absence of local, traditional knowledge systems and practices. … [towards approaches that] include flexibility and learning, interactions between social and physical systems, local contexts, collaboration across individuals and scales, and societal values and interests (ibid).

What Payne and Shepardon stop short of saying is that, besides generating more relevant adaptation knowledge for others, this shift in approach is needed to expose how formal knowledge producers, including those in ag RDE, are necessarily objects as well as enablers of adaptation, and that this adaptation includes more than alterations to the knowledge they produce.

In the agricultural arena, calls to move from conventional linear knowledge production and dissemination practice to more systemic, participatory and bottom-up approaches is very familiar, with some people now eschewing the idea and terminology of extension and RDE as a result. But not only is this shift from RDE to alternative approaches incomplete within agriculture, and thus an area for ongoing effort under the climate change adaptation umbrella, it is an overly simplistic and naive formulation of what is required to tackle climate change and other concurrent sustainable development challenges.

In this paper, I draw on a range of background research on agricultural RDE and climate change adaptation, including a strategic project for the Australian Council for International Agricultural Research, to map out some of the implications of the latter for the former. In doing so, I am informed by theoretical work in human geography and cognate disciplines that tries to escape the dead-end choice between top-down and bottom-up analytical frames (that is, between structures and agents) by focusing instead on practices as defined by social practice theories. Argued by some theorists to be the most fundamental analytical unit for understanding the world, practices are the repeated, purposeful interactions between people and other elements of the world that we all engage in in different ways in order to live. Placing to one side individuals and their purportedly independent decisions and behaviours, and challenging the notion of institutions and infrastructure as merely background and static features of the world, a practice lens focuses on

the continual reproduction (or disruption) of dynamic, physical, meaningful relations between entities. As (Feldman and Orlikowski, 2011) p.1241 put it, 'Practice theory argues that everyday actions are consequential in producing the structural contours of social life'. That is, practices highlight how actions (behaviours at the individual level, but all sorts of organisational processes) and social norms act back on and recursively make what is experienced as structures and order (Giddens, Schatzki). 'What makes … any … activity a practice is that the action of engaging in it is consequential for the development of the activity. ' (Feldman and Orlikowski, 2011) p.1242). In this emphasis on the idea that 'phenomena always exist in relation to each other, produced through a process of mutual constitution' (ibid), there is some alignment with systems thinking approaches. At the same time, a practice lens side-steps conventional hierarchical depictions of scale, and along with associated theories such as assemblage they (see (Gillard et al., 2016)) complements systems thinking by addressing the risk that what is being studied is uncritically presumed to be a functional (closed) system rather than recognised a far messier, complex set of processes. A practice theoretical lens also complements work in climate change adaptation that emphasises adaptation as a constant negotiation with shifting climatic, environmental and social conditions and ethnographic accounts of farming as a continuous performance and art (eg (Crane et al., 2011)). (Nettle et al., 2018) tentatively discuss extension practices using social practice theory, but in general it is yet to be applied to the agricultural RDE arena, despite one of the long-standing goals of agricultural extension being 'practice change' among farmers.

Academic paper 4: The gender agenda in agriculture

Title: The evolution of "the gender agenda" in agriculture for development
Journal: *World Development*

See Appendix 1

Gender is on the agenda in international development. So too is agriculture, meaning that questions of gender are increasingly interfacing with agriculture for development (A4D) discourse and praxis. In this paper we examine dominant and emerging approaches to women and gender within prominent A4D materials, and consider how the A4D field has, or has not, meaningfully incorporated longstanding feminist critiques of gendered approaches to development. We find that in spite of much feminist work in this space, prominent A4D organisations continue to reproduce problematic narratives which instrumentalize women as a panacea for various development ills, centralise the market as a solution to gender inequality, and leave untroubled structural constraints to gender equality. Yet, other more transformative discourses are emerging in the field, reflecting a deeper awareness of issues raised in gender studies scholarship. These begin to trouble some of the *drivers* of gender inequality and seek to locate responsibility for change beyond individual women. These steps towards a more comprehensive understanding of gender are vital to effective and just A4D because gender pervades not only the development landscape *in situ*, but development institutions and donor nations, and is inseparable from the production of, as well as responses to, global challenges in the A4D sector. To end, directions for further progressing the gender agenda in agriculture for development are suggested.

Final report
As found here

Blog
Title: Attending to agriculture

See Appendix 2

Excerpt:
For most urbanites – which is to say, most of the human population - agriculture is just there in the background, something that happens, but is of little interest or seeming relevance. Whether dismissed as a specialist area that others take care of, a minority rural issue, or something that only poor nations do now, agriculture is generally far from most urban citizen's everyday considerations. At least, that is how it has been until recently. Over the past few years, agriculture has had something of a renaissance. In international spheres, governmental departments, business arenas and local urban activities, agriculture is increasingly a familiar presence.

What has stimulated this revitalisation of interest in agriculture? Four reasons stand out, each representing one aspect of agriculture that appeals to or concerns particular groups. The overall result is a multidirectional convergence on agriculture as an object of concern. As discussed below, it is a shift that has far-reaching implications for those involved in the auxillary and especially backgrounded arena of agriculture extension.

Discussion Paper 1 – Background for workshops
Title: The Agricultural Extension Sector: past, present and future approaches

See Appendix 3

Excerpt:

This paper provides a broad-brush overview of the shifting world of agricultural extension (AE). It outlines some of the forces for change in the sector and the expansion of its mission. Four critiques of AE – challenging its overarching ethical basis, political economic character, use (or lack of) of systems thinking, and the efficacy and efficiency of its performance – are outlined. Three general, contemporary forms of AE - Extension 2.0, Shaping Change, and Personalised Advice – and the shift to private sector AE discussed.

Most discussion about AE is conducted among those involved with it. Nevertheless, what one means by extension usually needs explication. Some people adopt the narrow, traditional view of AE as the active or passive dissemination ("extension") of information about agricultural production to farmers. Others expand AE to mean rural capacity building in general. In between is a range of definitions that to varying degrees take a systemic view of agriculture, innovation and/or advisors. For example, the 2010 FAO report *Mobilising the Potential of Rural and Agricultural Extension* uses the language of systems but also reveals the implicit boundaries the FAO places on such systems by defining AE as:

> *systems that should facilitate the access of farmers, their organisations and other market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agri-business, and other relevant institutions; and assist them to develop their own technical, organisational and management skills and practices (Christoplos, 2010).*

Efforts to broaden thinking about AE by shifting the scale, elements and ideals in play are some of the many ways in which AE has changed and is continuing to change. In this paper we consider the shifting ground of AE in more detail before outlining four major critiques of it and the resultant rise of a more pluralistic and privatized sector with three cross-cutting forms. To end, some questions for discussion are posed.

Discussion Paper 2 – Strategic paper for ACIAR

Title: Enhancing positive impact in agricultural research for development: rethinking the role of "agricultural extension" and research.

See Appendix 4

Excerpt:
The aim of this paper is to help Agricultural Research for Development (AR4D) researchers and research organisations increase the positive impact of their research by thinking through some of the ways the research context is changing, how "agricultural extension" specifically has shifted, and what a rethink of agricultural extension suggests about and offers to agricultural research. The paper is informed by an extensive literature review, a series of workshops with ACIAR stakeholders, and 37 interviews with ACIAR researchers and experts in AR4D and extension. Five main sections make up the paper. Section 2 outlines the contemporary imperative for amplifying positive impacts from research in agriculture and the underpinning need to consider *how* impact is to be generated and amplified. Section 3 turns to the conventional tool for the application and diffusion of research in practice – agricultural extension (AE) – and outlines how its dominant linear approaches, and extension overall, has been discredited, dismantled and diversified over the last few decades in response to a suite of convergent pressures and substantive critiques. In response an Agricultural Innovation Systems lens is increasingly dominant. Section 4 highlights the implications of these same pressures for professional agricultural researchers, including many researchers' conventional reliance on now discredited, dissemination-based extension, broader challenges to institutionalised expertise and the radical democratisation of "research" that an Innovation Systems lens implies. Section 5 looks in more detail at how AE is being reconfigured and contested, including the revitalisation of some linear dissemination models and increasing awareness of the need for context-specific approaches to and impact evaluation of AE itself. It outlines how agricultural researchers might therefore think of and engage with AE, given their historic reliance on older forms of it in efforts to achieve research impact. Section 6 presents conclusions, arguing that - whatever it is called and whoever it is practiced by - AE remains an important concept, consideration and community for agricultural researchers striving to improve the impact of their work in the world. In particular, it argues that is crucial to understand that the forces transforming agricultural extension are also at work in agricultural research, even if less manifest to date. Examining AE thus points to the need for a larger conversation about challenges to the role, legitimacy and agility of formal agricultural research.

Book: Agricultural extension in the Anthropocene

Arising from the ACIAR project is the manuscript for a book that is in an well formed but early draft of 127 pages.

Publisher – Palgrave Macmillan (TBC)

Excerpt:
In policy agendas, media headlines and academic discourse, agriculture features simultaneously as a saviour, victim and villain. Diverse in not only form but also meaning, agriculture is discussed simultaneously as:

- The fundamental basis for human existence and wellbeing, including as a source of food, income, ecological services and cultural and community resilience;
- A highly risky enterprise for those involved, especially given climate change; and
- The source of socio-environmental impacts of such magnitude that it is implicated in all of the proposed starting dates for the Anthropocene epoch.

The Anthropocene is the name for the contemporary planetary condition in which the Earth has tipped into a human-dominated and life-threatening operating state. The current unsustainable trajectory has been driven by human ingenuity, technology and innovation capacities. Pursued reflexively, an amplification of these traits, even as a response to the Anthropocene, could threaten to worsen rather than alleviate the situation, particularly for those millions of people structurally disadvantaged by the mistakes of the past.

This book takes up the Anthropocene challenges examining the roles and prospects of Agricultural Research for Development (AR4D). It aims to help researchers and development organisations increase the positive impact by highlighting salient aspects of the historical, socio-political, institutional and intellectual context in which they work, and by introducing insights from a range of valuable theoretical perspectives. It uses these to highlight the challenges and opportunities that AR4D sector faces in contributing to positive transformative change for sustainable development. It focused attention on the role of the paradigms, logics and rationales that shape how the world is understood and engaged with including issues arising from gender bias and inequities.

The book consists of five main sections. The first three provide high level guides to the three main pillars of AR4D: agriculture; research and innovation; and international development. Understanding the major agendas, ideas and logics at work in these fields, and how they have arisen and inter-relate is crucial to understanding contemporary concerns and the push for transformational change. Cutting across these areas are questions of gender. The fourth substantive section provides an overview of gender issues in A4D, broadening the scope to examine gendering as a modernist value frame that helps explain fundamental tensions in agriculture's status. The final section turns to the question of agricultural extension. It maps the evolution of extension and helps explain its controversies and changes in terms of broader shifts in agriculture, development and modernisation.

7 Key results and discussion

7.1 Overview

This key results section provides a brief overview the main results about agricultural extension. More detailed results and wider topics are discussed in associated publications.

At base, this project is about the 'problematisation' of agricultural extension, both as a method – problematising or thinking reflexively this thing called agricultural extension – and as an empirical object – attending to how agricultural extension has been repeatedly problematised from various angles over time, and how these critiques and responses reflect deeper problematisations of agriculture, international development and research/innovation (Figure 1). The main outcomes of this process – the results indicate – are three main, often overlapping, approaches to the question of extension: ongoing linear or Transfer of Technology style extension (updated with new mechanisms such as ICT); more systems based approaches to agricultural innovation (including agricultural innovation systems) in which extension is often muted; and participatory approaches to agricultural innovation and extension. The first two represent first order reflexive modernisation in that they amplify existing approaches in order to address newly recognised or emerged problems. The second two represent second order reflexive modernisation in that they not only tackle newly recognised or emerged problems, but also adopt new ways of doing so. Systems based approaches feature in both (as could participatory approaches to some degree) because systems thinking encompasses, on the one hand, conventional systems approaches based on closed, mechanistic systems and, on the other hand, more transformative approaches based on open, organismic systems. While newer approaches are not necessarily better – and indeed, challenging such an innovation bias is part of the new approach needed - the reflexive modernisation frame brings to the fore the improvement intent that both reflexivity and modernisation imply.

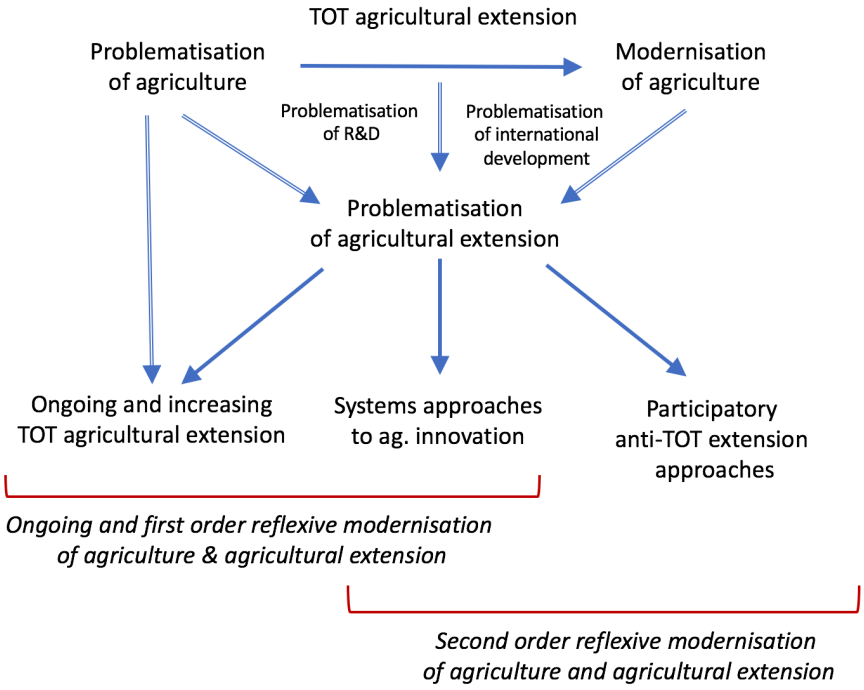


Figure 2. Schematic overview of the iterative processes of problematisation and reflexive modernisation that have produced and reshaped agricultural extension

As outlined in the previous section agricultural extension is a clear case co-production where, science and academic research more generally are coproducing society, reproducing ordered regimes of knowledge and practice. There are a wide range of factors and forces shaping the way these regimes evolved that are deeply connected with wider social and political trends. For example, in agriculture, international development and the A4D sectors, we find strong influences from:

1. Neoliberalisation, privatisation, corporatisation, productionism, competition for land, new commodities, more intensive
2. Politicisation, rage, dissent, rise of social movements
3. The rise of importance in systemic issues, and calls for systems approach (nexus thinking), and sustainability transitions based on eco-modernist (resource flow reading of sustainability), transformation (systemic, functional integrity reading of sustainability)

These are aligned with and complemented by trends in research and innovation that involve:

1. Scientific globalism
2. Neoliberalisation, commercialisation and industry relevance with the rise of scientific nationalism. Impact, log frames, scaling
3. Mode 2 - Rise of coproduction of knowledge and social innovation – different inflections, subversive, NGOs, scaling
4. Systems thinking for example innovation systems – mechanistic and imposed/orchestrated structures, or emergent.

7.2 The problematisation of research and innovation

Partly as a result of the problematisation of the limited positive and/or negative impacts that science has had via AE and the related knowledge arrangements, agricultural extension can be seen as a window onto how society has produced science/research. AR4D-AE has been critiqued as part of the linear modernist mentality and widespread demands for more systemic understanding and inclusive responses in terms of generating knowledge (using transdisciplinary knowledge systems approaches). At same time, one reason for this shift from linear to systems approaches is that modern ag has contributed to the Earth's move into the Anthropocene and towards planetary boundaries and tipping points, including but not limited to climate change. Rapidly amending this Earth trajectory towards a more sustainable, habitable, socially just future, and addressing the grave problems it has already generated in many contexts, for certain groups (including smallholders) especially, requires rapid transformational change of the sort called for by the UN Agenda 2030. This in turn is adding to pressure on the research sector to forego arcane ivory tower debates and contribute more directly to generating real world change as part of a global effort to make sustainable development more systemic and genuinely sustainable. Adding to the challenge and complexity is that the general turn towards innovation that this represents is being significantly intensified by neoliberal agendas in research and beyond that, in their ultimate prioritisation of capitalist markets and economic growth, are arguably generating on-ground outcomes of an opposite (i.e. un-sustainable) kind. This tension is evident in the predominant AR4D response to the twin calls to replace linear with systemic approaches, and to replace pure research with innovation: agricultural innovation systems (Figure 3).

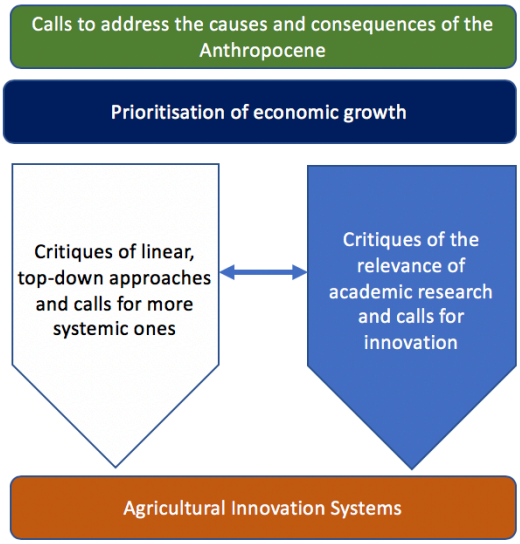


Figure 3. Different inflections of AIS – some mechanistic

The rise of agricultural innovation systems is indicative of a framing based on the coproduction of knowledge but these in themselves do not negate linear diffusion or scaling out processes. The key issues are not whether there are some linearity – causal relationships – but whether there are later feedbacks (thus systemic) at multiple scales of multiple types that rely on iterative interactional coproduction. These can still recognise expertise, division of labour, situatedness and specialisation.

The rise of AIS can be understood as an outcome of progressive critiques of AE over past decades, discussed in section 7.3 below. First, we briefly review the problematisation of international development that ACIAR innovation efforts are positioned within.

7.3 The problematisation of international development

Any initiative in the international development space necessarily has to contend with the fact that the latter is highly contested. While the UN's Agenda 2030 is helpfully revitalising and reframing international development, it cannot erase the fraught history of the latter and resultant cynicism about its own role. Historical amnesia of the sort that (Murray Li, 2009) identifies in the World Bank's A4D vision, and that is exemplified by new players' recent uncritical adoption of transfer of technology approaches to AR4D (discussed below), simply papers over cracks in the very intellectual and social basis of development. As such, it represents a major threat to the ability of the latter to deliver public good outcomes. As (Kramer, 2016) argues, to understand 'the development paradigm's impact upon agricultural development' we need to appreciate that it is 'not unbiased, non-political, nor non-ideological', and which paradigm dominates 'greatly impacts local ecologies, hunger, and poverty' (p.30). Although there is growing recognition that 'realizing inclusive and sustainable agricultural development' is clearly 'a political question, not merely technical one' (Isgren, 2018) unpaginated, much research on agriculture remains largely depoliticised, focusing instead on operationalising urgent agendas (Taylor, 2018). Yet there is a need for research that not only addresses specific problems, but helps maintain a critically reflexive outlook on the trajectory of the whole development endeavour it is part of.

"Development" is now such a normalised concept that it is easy to forget that it is historically and culturally specific. Yet it has been fiercely critiqued and contested over the past fifty years. Some locate the origins of the concept in the colonial era. (Simon, 2006) for example, follows (Cowen and Shenton, 2003) in identifying the colonial idea of trusteeship – the 'self-interested, but also moral and altruistic, intention to develop' as the foundation of contemporary 'official development discourse and policy' (p.16). Others locate the birth of development in the post-war period of deliberate reconstruction, high modernism and globalisation, notably the Bretton Woods agreement (e.g. (Blaikie, 2000). Either way, the concept is premised on two basic beliefs core to Western culture. The first is the "natural" process of what (Cowen and Shenton, 2003) call 'immanent development': the modernist idea that some things – whether forests, people, or nations – change over time in a spontaneous but non-random, teleological direction. Core to Western narratives about human uniqueness and modernity, and what (Murray Li, 2007) calls 'the will to improve' in international development, this is the common sense meaning of development as progress, as improvement. It is a logic that underpins both scientific nationalism and globalism, being fundamental to ideas of nation-building, economic growth and the advancement of human knowledge. It is exemplified by Rowstow's (1979) 'stages of growth' model that depicts five stages that societies must progress through to become developed, the first of which – notably - is traditional agricultural society. Such thinking has been institutionalised in the formal ranking of nations according to economic wealth measures, which habitually conflate GDP with "development". Yet the significance of this logic is not simply that evolution from an agricultural base to a post-industrial one, or increases in economic growth, are interpreted as positive. The point is that in development thinking such a trajectory is believed to have a natural, even unstoppable force; that it grows 'out of the nature of things' so that improvements are 'not something to be explained' but are 'natural phenomena, like the precession of the equinoxes' (Young, 1928)(p.528).

In addition to being considered natural in some ways, development is also premised on a belief that *not all* elements and groups in society are (a) at an equally advanced stage or (b) even equally capable of advancement. In this light, some groups are interpreted as behind or stuck and therefore in need of special assistance. A sense of the unevenness of development outcomes and capabilities, combined with a pervasive Darwinist reading of development as a competition, leads to the second basic principle underpinning the specific phenomenon of cross-border "international development" (e.g. financial aid). This is the idea that some development can be and needs to be *intentional.* Importantly, 'intentional development' is believed to be necessary not just because of an observed discrepancy in outcomes, or desire to "get ahead", but because immanent development *itself* continually creates certain pressures that vulnerable groups and elements of society are ill-placed to deal with (Cowen and Shenton, 2003). That is, while immanent development or modernity is understood to be, by definition, progressive for society as a whole, it is understood as inevitably, naturally necessitating certain trade-offs, or at least as sometimes having been "implemented poorly", leading to certain unfortunate problems (e.g. due to an overconfidence in a population's "capacity to benefit" from a given development process). Thus intentional development is not just about catching up, it is also *ameliorative* and *continual.* The uneven circumstances underlying this need for targeted assistance implicitly distinguishes between those groups who are marginalised prior to and because of immanent development, and those who benefit from it, and will likely always benefit *more* from it. Acknowledgement and naturalisation of this hierarchy has led to a sense that the beneficiaries have a moral obligation, as well as capacity and practical incentive, to assuage the accidental or known side-effects of immanent development on the most vulnerable with directed, intentional interventions.

International development is a deeply biopolitical and governmental project. It is biopolitical in that it is intentional intervention clearly 'concerned with matters of life and death, with birth and propagation, with health and illness, both physical and mental, and with the process that sustain *or retard* the optimization of the life of a population' ((Dean, 2010) italics added). It is

governmental in that it is focused on populations and their characteristics and is animated by a clear political rationality: progressing humanity by ameliorating the problems that some encounter on the road to modernisation. The governmental technologies and practices used to render the amorphous notion of development actually governable, or to render populations and territories governable for development outcomes, are numerous and contested. Besides the widespread use of statistics and rankings, some governmental technologies are institutional, legal and economic, such as those implemented at the inter-national scale in agreements about which certain "developed" countries will assist which "developing" countries, why and how. Others operate at the national scale where, for example, the provision of certain vital infrastructure is determined, or redistributive, protective welfare measures are used to assist those considered relatively "undevelopable" or facing urgent humanitarian crises (refs). Perhaps the most common class of governmental technologies for development are the apt-named capacity development initiatives which, besides being used for the population as a whole, are also especially aimed at equipping the marginalised to better deal with and benefit from modernity's progression.
It is pertinent to note that, as indicated in Section 2, agriculture is both a target for developmental practices – via agricultural extension among other things - and is itself a governmental technology. As the latter - that is, a vehicle via which populations and land are governed – it helps government (or its private sector or civil sector delegates) to reach the large and special proportion of the (national and global) population who practice farming, and to exert some influence over the large land mass, resource and waste flows and environmental assets that these farmers (and indirectly the government) are responsible for. Similarly, agricultural extension is both a governmental technology and is itself a target for such technologies. The latter operate in various ways, including administrative evaluations and restructuring (e.g. within national governments, many of which have largely abolished agricultural extension via such processes), guidance and advice designed to build capabilities in new extension mechanisms and rationalities (e.g. via networks such as APEN or GFRAS), or other techniques (see Section 5).

The basic tension in international development between an acceptance of the dominant change trajectory and a desire to intervene in it are evident within the A4D agenda. The latter is based on a 'hybrid' approach, which is focused, on the one hand, upon 'innovation', entrepreneurship, technology, markets and 'scaling up', and on the other hand, upon smallholder farming and 'bottom up' development with marginalised subjects (Oya, 2009). Fundamentally eclectic, the A4D agenda has stimulated a range of responses that vacillate uneasily between different political rationalities and practice regimes, notably large, top-down technocratic governmental programs of rural reform, on the one hand, and small-scale, bottom up projects aiming to enhance community capacities, on the other. As such, A4D reflects 'the ongoing tension in international development between pressures for 'economic freedom' and the imperatives of welfare arising from their destructive tendencies' ((Hart, 2004) p.95). Varied assemblages of actors and agendas pull in different directions, some towards growth, some towards protection (Li, 2010). As a result, A4D is characterised by the 'gradual accumulation of multiple, overlapping and contradictory agendas' (Oya, 2009) p.231 including a plethora of criticisms of the classic model of international development. Consequently, there is now a range of intentional development rationalities or paradigms, which intermix in complex ways in actual development projects. Three main rationalities are evident, each of which represents a spectrum of milder to stronger critiques. These are: neoliberal development; sustainable development; and neopopulist development. All involved major attacks on AE, which we now turn to.

7.4 The problematisation of agricultural extension

The project identified and analysed the major persistent critiques of AE and explores the way agencies and professionals have responded to these. At the intersection of agriculture, international development and research, AE has been the subject of robust criticisms that have

contributed to its changing practices. However, with the proliferation of AE type activities (often with new and different names) there is risk that the lesson of this evolution are ignored or forgotten.

Three persistent, overlapping critiques are summarised in Table 1 below. Many stem from the late 1970's and 1980s, resulting from reactions to the Green Revolution and associated international development efforts, when critics questioned the purpose of AE, its means of delivery and its impacts. However, these broad lines of questioning resonate today, with the global rise of food security discourses and the renewed emphasis on agricultural development policies.

Table 1. Three major critiques of agricultural extension

Main thrust of critique	**Questions**	**Focus**	**Timing**	**Emphasis on** multiplicity of…
Ethics and justice of AE and related A4D	Can we justify top-down extension? Exactly whose purposes does extension serve? Why and how are some agendas and groups served and others neglected?	The outcomes of extension – why is it done and to what effect?	1970s on	Values, interests and agendas
The need for systems thinking (variously defined) about ag and AE	What and who is included in the extension viewpoint? What system components (including farmers and their understanding and values) need to be included to render AE more effective?	The means of extension – how is it done?	1980s on and revitalised recently	Actors, knowledges and scales. Types of farmers, and advisors
Efficacy and cost effectiveness of AE	Why is extension underperforming? Can it be more cost effective and efficient? How can AE harness new methods, technologies and capabilities? Is public support justified? - What outcomes and impacts are achieved?	Means of extension	1980s on and revitalised recently	Justifications and expenditure

Critique 1: The ethics and justice of AE

The most far-reaching critique focuses on AE as a tool of colonialism and post-colonial economic development in which local knowledge and ways of life were sometimes willingly and other times violently replaced. Programs promoting monocultures of "improved" varieties, grown with chemical and technology intensive methods, became symbols of this disruption.
Pointing to its value-laden and power-inflected nature, this critique questions whether conventional extension – notably the dissemination of knowledge and technologies assumed to be superior – can be uncritically justified. This critique aligns with many feminist critiques about disembodied science, emphasising the situated character of exported extension expertise, and the complexity, appropriateness, resilience and rich diversity of locally developed knowledge and practices.

Sharing the focus on politics of expertise, and critically questioning AE's mission, a more targeted critique contests the political-economic characteristics of top-down AE. This critique points to the dominance of powerful interests and their agendas asking: who's AE and for whose benefit? Traditional forms of AE are seen from this perspective as part of a science-industry-complex or socio-technological regime that, from international institutions down, systematically favours environmentally and socially destructive modes of agriculture, while ignoring more diverse, agro-

ecological and locally appropriate forms. This critique calls out the tendency for agricultural development efforts to result in institutional and/or socio-technological lock-in.

Critique 2: The lack of systems thinking in AE

The second main critique stems from the rise of systems thinking in agricultural research. Systems thinking modes require the articulation of system boundaries, calling attention to the implicit intellectual externalization (and therefore neglect) of many important influences upon farming. These factors include recognition of families, rural communities and social networks; local, unofficial or tacit sources of knowledge; the influence of property rights, governance and institutional dimensions; and powerful intangible factors such as cultural and normative ideals about what constitutes a good farmer.

This critique calls for greater reflexivity, raising questions about who defines 'the system', and determines what is counted as in or out. It asks questions about how systems are defined, how change occurs, and whether changes are imposed, accepted or resisted. These are fundamentally questions about who or what controls the system and whose knowledge is used to define it.

Systemic thinking finds limited utility in "technology transfer" and "diffusion of innovation" models based on simplistic conceptualizations of change. Advocates of systems perspectives perceive "adoption" of innovations as dynamic processes. They reject ideas that non-adopters are "laggards". Taking this idea further is the view that many local or peasant systems are highly evolved, nuanced to local conditions and worthy of recognition as sources of innovation and adaptive capacity.

Agricultural systems thinking models (and their proponents) can be characterised as bifurcating into two major types – those emphasising techno-scientific innovation (eg Klerkx et al., 2012) and the agro-ecological systems models emphasising ecological and social justice (eg Rosset and Martínez-Torres 2012).

Critique 3: The performance of AE

Numerous dissatisfactions have been voiced about the impacts, outcomes and value that AE generates, with calls for it to become - like its clients - more productive and adaptive, more efficient and cost effective whilst also managing increasingly complex economic, social and environmental trade-offs.

These critiques reflect questions about the performance of AE, and question how it can be enhanced, at a time when renewed visions of large-scale, coordinated change in agriculture are being promoted by organisation like the World Bank who are seeking to enhance food and economic security. These critiques focus on improving how AE is organized, implemented and conducted in order for it to become a more cost effective and seek to increase returns on public investments.

AE is seen as a means to enhance the impact of R&D. With pressure to demonstrate short-term impact of R&D there is enthusiasm for collaborative, interdisciplinary, networked knowledge brokering that enhances economic and human development. In this are strong echoes of AE in its original colonial form. But the lessons from that time and contemporary challenges now demand a transformed approach to AE practices.

8 Impacts

As a comprehensive and critical review of agricultural extension and its roles in relation to A4D this project may have far reaching impacts and implications for how organisation conceive of engage with and practice extension type activities, but this uptake will depend on a range of other factors, beyond the life of this project

The implications for ACIAR of this research is that at the organisational, program and project level there is significant scope for greater use and application of social science research that informs

i. Understanding of the broad context of Ag4D in which it works,
ii. Progressive, critical self-reflexion to improve knowledge production, adoption and adaptation
iii. Adoption of specific techniques and tools – eg use of analytic methods as diagnostic tools to target research
iv. R&D projects designed to have embedded extension via co-production techniques.

8.1 Scientific impacts now and in 5 years

The project has achieved impacts – through interviews and workshops – with numerous comments from participants suggesting their involvement stimulated new thinking and deeper reflection on the shifting context, opportunities and new models of agricultural extension. This included amongst ACIAR staff and researchers and agricultural extension practitioners via APEN.

The anticipated impacts are that other scholars will become more engaged in the spectrum of activities that involve agricultural extension and AR4D. The research outputs will stimulate further exploration by social scientists – contribute to debates about AR4D and AIS and develop work across fields – eg gender and ag, AE and AR4D, science and social science

8.2 Capacity impacts now and in 5 years

Anticipated impacts are that this work will contribute to the development of some new tools, frameworks and techniques such as best practice guides and training manuals for use by researchers who are interested in increasing the impact of their work via a better understanding and appreciation of AE.

8.3 Community impacts now and in 5 years

Anticipated impacts – higher awareness amongst researchers and AE practitioners of new approaches and gradual emergence of new approaches to AR4D and AE

8.4 Communication and dissemination activities

Publications, seminars and workshops as outlined above.

An abstract has been submitted and paper is being prepared for the Climate Smart Agriculture conference in Bali in October 2018.

A paper is planned for the APEN Conference Sept 2019 in Darwin – key themes of this conference include international extension, sustainable ag and climate resilience

9 Conclusions and recommendations

9.1 Conclusions

This project undertook a broad-brush overview of the past, present and possible future trajectories of AE. It involved tracing AE from its origins, through the 20th century's programs of international development when the social infrastructure of agricultural RD&E expanded rapidly. Since then, AE has evolved in the context of wider change, including the escalating policy attention being given to food, agriculture and natural resources within the SDGs. This points to re-endorsements of AE's importance as a key component of policy interventions aimed at transforming agriculture. It matters little whether activities are referred to as AE or not. The need for appropriate scaling and adoption mechanisms are increasingly recognised as important.

The project found that the ways in which practices and systems are conceptualised limits change through reinforcing dominant views and approaches. The project critical analysis found the need for more reflexive and theoretically informed examination of AE if it is evolved into a repertoire of social techniques that support transformative future making.

The context for AE continues to evolve. AE itself is changing with new technologies, circumstances and imperatives. Yet AE remains fluid, flexible and difficult to define, because institutionally and socially it is conceived of as being primarily forms of communication practice and linkage mechanisms. Also there are major variations in how it is enacted and in what it is understood to be. This position means that it serves as a boundary object with diverse methods, prospects and priorities that reflect and refract societal concerns and what to do about them. Some see its very existence as value-laden, while others see it as a neutral (but somewhat instrumental) policy mechanism for delivering various outcomes. AE is expected to serve diverse agendas and has a tendency to incorporate odd amalgamations of discourses, jargons, approaches and agendas. While this messiness often defined as "pluralistic" this label means many can overlook the significant contestations that surround agricultural development, and the diversity of paradigms, modes and models with their conflicting logics, rationalities and ideals.

AE is something done to, with and by those who practice farming usually by intermediaries - acting on behalf of funders (governments and others) to change practices and beliefs. In effect, AE sets out to change both the material and abstracted (discursive) domains of agriculture, using informative and educational policy instruments. It usually seeks to achieve a particular set of goals, outcomes or agendas: productivity, stability, commercial goals, conservation, or climate adaption. Thus AE is essentially an intervention to assist in changing the practices (and beliefs) of those who farm by those who don't (but may still have a legitimate right to participate in questions of how farming is undertaken).

As a communicative and linkage mechanism AE is reflective of societies' changing interests and communication technologies, inevitably expressing norms, values, discourses and their deeper logics. For example, the broad pivot to greater farmer participation and legitimisation of their positions and perspectives can be seen as reflective of the broad social shift from the dominance of positivist (modernist) problem solving towards post modernists (constructivism) yet with all participation strategies critical question of power and control remain: whose system, whose definitions, whose innovations? Whose change and who stands to benefit? Whose system and whose decisions about how it changes? These are questions of power and agency, of resistance or acceptance, not of people being passive recipients of information. These are about who decides,

and therefore involve issues of domination and resistance, dependence and independence that depend on structural and institutional factors that span from the paddock to the planet and back. Across these numerous scales and networks, there are deep divisions and contestations about the trajectories of agriculture and the means and ends for the transformation of agricultural systems. These contestations reveal fundamental power struggles about who get to determine the material and discursive domains of agriculture. AE is deeply and inevitably immersed in these contestations.

From this perspective, we advocate further use of open ended, relationally oriented approaches, so that AE's future can be linked to broader socio-technical transitions that are about collective, social experiments oriented to social learning and coproduction. These can be conceived of as practices that enable transformative actions in a world of transformation. As part of this there is a need to critically revise and renegotiate relationships between science and society including through sponsoring more innovative Mode 2 and 3 science that embeds AE as part of the project design in ways that enable coproduction of results. Such approaches would help to target RD&E interventions in ways that are respectful of the highly evolved cultural and material assemblages that are agriculture systems with their interlinked cultural and biological diversity.

9.2 Recommendations

That ACIAR build on its history of providing learning opportunities for Australian and international researchers and others by generating opportunities for such groups to learn about both:

- the particular insights this project has produced about changes and debates in the agriculture, international development and research arenas, notably extension; and
- critical social science methods and theoretical lenses and concepts, the utility of which this that the project has demonstrated.

That a discrete project is funded based on the analysis undertaken in this work that develops and refines a crash course in social science as a training module for agricultural researchers.

That ACIAR expands its program of social science research to engage in international conversations about and incorporate more research into:

- the shifting context of agricultural transformations and the identification of transformative techniques for scaling innovations and adoption;
- critical reviews of innovation systems and other new RDE models for agriculture, informed by theoretical work that pushes existing innovation and research scholarship to better appreciate how innovation and research processes are embedded within and co-constituted by social-ecological systems, including climate;
- agriculture's multiple roles in socially just sustainability transitions, given its unique characteristics, pressures and diversity;
- lessons from Landcare-based participatory extension models for other innovation initiatives, including identification of its key positive elements, the potential of the concept of care and regeneration, its resonance with multiple social movements, and ways of building on these feature to engender wider transformational change; and
- long-term case studies of regionally-based innovation processes and social experimentation directed at exploring pathways for sustainability transitions and multiple sustainable development benefits.

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10.1 List of publications produced by project

- Academic paper 1: Overview of agricultural extension
- Academic paper 2: Genealogies of agricultural extension
- Academic paper 3: Adapting agricultural RDE to climate change: insights from practice theory
- Academic paper 4: The gender agenda in agriculture
- Discussion paper 1: Background discussion paper to inform workshops
- Discussion paper 2: Strategy oriented document for ACIAR
- Book: Agricultural extension in the Anthropocene

[i] These quotes are from the Transformative Innovation Policy Consortium Research Brief 2018-01, available http://tipconsortium.net Clark (2018) refers to a speech on ‘Transforming societies: people, planet and prosperity’ by Helen Clark, former director of UNDP at the Global Transformation Forum, and UNRISD refers to a report ‘Policy Innovations for Transformative Change’ by the UN Research Institute for Sustainable Development.