The case for retaining, redefining and reinvigorating extension in agricultural innovation systems

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Abstract. Agricultural extension has a proud international history in contributing to the success of agriculture, farmer incomes, food security, and more recently environmental sustainability. Extension has been changing a great deal in recent years, however, to the point that some have doubted its continuing relevance. Public sector provision has declined greatly, and private sector roles have increased and diversified. In developed countries, there has been discomfort with the term 'extension' being too closely associated with long-discredited transfer-of-technology approaches, but attempts to find substitute terms such as 'innovation' and 'knowledge-brokering' are yet to gain a clear identity. We argue there is a need to reinvigorate, redefine, and ultimately reinvent the conceptualisation and practice of agricultural extension, to meet changing contexts and needs. Opportunities lie in new issues and goals, involving broader sets of people, and reinvigoration of education, while continuing to build the participatory processes that lie at the heart of extension.

Keywords: agents of change, agroecology, change management, innovation, integration, natural resource management, skills

Introduction

We are facing the challenge of achieving a 60% increase in global food production by 2050, in a way that, at the very least, halts the decline in ecosystems and the services they provide (Williams 2014). This same period will see increasing costs of inputs to agriculture and an unprecedented need for adaptation as the impacts of climate change sharpen. If we are to succeed, we need inspiration, engagement and coordination of the people and institutions that are both part of the problem and, through innovation, can contribute to the solution. While this challenge is massive, it is important to recognise that we are starting from a strong base. Considerable knowledge and understanding already exists and current institutions are already responding, so that our innovation systems are in the process of adapting to the challenge. Our focus for this paper is to describe the evolving role of extension in innovation systems, to elucidate an up-to-date working definition, and to make the case for increased emphasis on extension-related public policy and training.

Extension encapsulates a number of definitions as it is a multi-faceted, multi-purpose, multi-scaled and multi-disciplinary field. While once narrowly defined as the process of dispersing technological innovations for increasing agricultural yields, the definition of extension has broadened considerably with the increased understanding of it as a 'person-focused' profession (Marsh & Pannell 2000; Vanclay 2004).

Extension has been defined and redefined in the following ways over the last 50 years:

- as farmers needing 'help':

  > assistance to farmers to help them identify and analyse their production problems and to become aware of opportunities for improvement (Adams, 1982; as cited in Leeuwis & Van den Ban 2004, p. 24)

- for inducing change:

  > to induce change in a voluntary behavior with a presumed public or collective utility (Röling, 1988; as cited in Leeuwis & Van den Ban 2004, p. 25)

- for empowerment and knowledge transfer:

  > …the process of enabling change in individuals, communities and industries involved with primary industries and natural resource management (NRM). Extension is concerned with building capacity for change through improved communication and information flow between industry, agency and community stakeholders. Extension seeks outcomes of capacity building and resilience in individuals and communities. Extension contributes to protecting, maintaining and enhancing the landscapes, livelihoods and lifestyles of all Australians. (State Extension Leaders Network, 2006; as cited in Jennings, Packham & Woodside 2011, p. 7)

- as an aspect of connectedness in complex socio-ecological systems;

  > an interactive process in which there is a large amount of co-evolution of scientific, technological and societal systems (Klerkx & Leeuwis 2008, p. 365).

Leeuwis and Van den Ban (2004, p. 25) argued that any definition of extension is limiting and should therefore be defined thus:

> Extension is everything that people who think of themselves as extensionists do as part of their professional practice.

While the latter definition could be criticized as being vague and indeterminate, it accommodates the burgeoning role of the modern extensionist and avoids specifying limitations on what extensionists should or should not do (Leeuwis & Van den Ban 2004). Attempting to crystallize the ever-changing role of extension into a definition is challenging and continues to cause debate (Jennings, Packham & Woodside 2011). Others have also attempted to inspire transition by redefining, reinvigorating and re-orientating extension theory and practice (Sulaiman & Hall 2002; Lambert & Elix 2003; Allahyari 2008; Rivera & Rasheed Sulaiman 2009; Klerkx, van Mierlo & Leeuwis 2012), however there remains disparity between the reality of extension and theoretical advances made in the field. Campbell & Mortlock (2000) claimed that when it comes to extension, we have amnesia; we fail to learn from past mistakes and continue to rationalize the profession using a top-down framework within a conventional adoption-diffusion paradigm. It is common for 'participatory', democratic approaches to be carried out within autocratic frameworks (Stringer et al. 2006).

In order to move towards true participation (Hayward, Simpson & Wood 2004) and sustainability, extensionists should be on the ground co-innovating and collaborating with the aim of influencing change in themselves, their partner communities, and the organisations in which they work. It is time to fully recognise the organizational constraints which have caused and continue to cause unsustainable relationships with the land. To address this, we build on the foundational work of Jennings, Packham and Woodside (2011) to make the case for redefining and retaining extension as a critical component of innovation, and to identify opportunities for reinvigorating extension to better address and resolve local-to-global challenges.

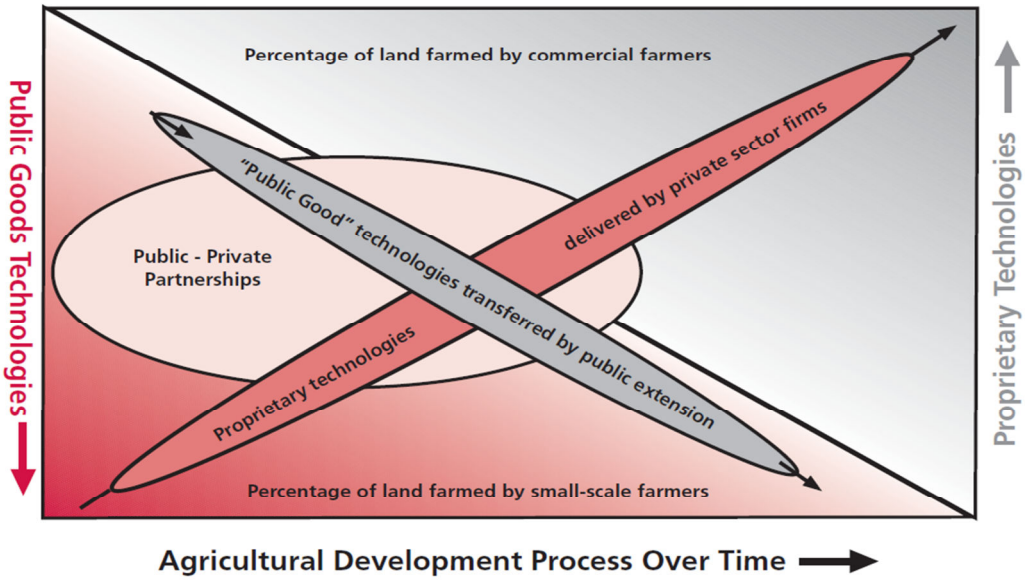
Extension then

The field of agricultural extension started out as a state sponsored vehicle for the adoption of technology to increase production. In Australia it was originally about feeding the troops in WW2 and earning export income (Hale & Ashton 2002). In the developing world it was one of the key activities of the Green Revolution, bringing the principles and practices of industrialized agriculture to small farmers (Rosegrant & Hazell 2000). The term 'extension' was used because the knowledge of the experts was extended to practitioners. This process involved more than just understanding technical information. It required different skills that involved translating technical knowledge into practical knowledge in order to make the innovation understandable to practitioners. This gave rise to a new profession, that of extension agent. The early research on adoption of technology was done in agriculture and the seminal work on diffusion of innovations (Rogers 1962) was a major influence on extension practice in Australian agriculture. The process was described as transfer of technology (TOT) and it remains influential in agricultural research, as exemplified by Rogers (2003) edition of the aforementioned work and the recent evaluation of the innovation system for grain production in Australia (Keogh & Julian 2013).

In developing countries the limitations of this transfer of technology paradigm for extension became very evident. There was widespread recognition that the decision-making environment of farmers was complex, encompassing different economic, social and cultural contexts which meant that all innovations were not necessarily appropriate, and that there were often good reasons for farmers to choose not to adopt. Under TOT, the term 'laggard' was often used for those reluctant to adopt, which removed the need to understand why. This recognition of farmer perspectives and needs led to researchers and extension practitioners describing and advocating paradigm change including: farming systems research and extension; farmer first and last; social learning; farmers learning from farmers and others (Scoones & Thompson 1994; Chambers, Pacey & Thrupp 1989; Pretty 1995). These developments expanded the objectives of extension beyond transfer of technology to encompass the understanding and development of human and social capital. In the new millennium the rise of agri-environmentalism and agroecology brought a further broadening of extension objectives to encompass the concept of enhancing natural capital (Thomas & Kevan 1993; Altieri 2002; Warner 2008).

While this dynamic methodological and theoretical activity was occurring in extension circles in the developing world, public investment in extension services was being reduced in developed nations including Australia (Hunt et al. 2014). This phenomenon has been viewed as a logical consequence of economic development as illustrated in Figure 1, whereby public extension declines and is replaced by private or proprietary extension.

Figure 1. Transition from public to private technologies in the agricultural development process and the need for public–private partnerships to serve the agricultural community



Source: Swanson (2008, p. 21)

There was also research and commentary that questioned the logic of public investment enhancing the private benefit of pro-active farmers who were receiving a disproportionate share of the time of public extension agents (Anderson & Feder 2004). Another influence was neo-liberal economic policies that reduced the size of government especially in areas where it was contended that private enterprise could do the job.

As a consequence of these and other factors, there has been a steady erosion of public investment in agricultural extension aimed at increasing production, and this has been replaced to some extent by an increase in private and corporate extension agents. In all states except Victoria expenditure on departments of agriculture has declined and one-to-one service delivery has disappeared in favour of delivery to farmer groups and private extension agents (Keogh & Julian 2013). The impact of this on people employed in extension has been severe, according to anecdotal reports. The stress and disruption caused by frequent departmental restructures, and being shifted from one institution to another, has had an impact on morale, with many valued public extensionists taking on new roles in the private sector or ending their careers and connection with the communities they have served. Along with them, the public sector has lost significant knowledge and understanding and a focus on the public benefit aspects of their roles.

The corresponding rise in private and corporate extension agents has seen an increase in the promotion of private benefit practices rather than public benefit practices. For example, in the cropping area farmers who employ a crop advisor have access to advice on important production decisions. Crop advisors rated advice on pest and weed control and crop and fertilizers applications as highly important, and advice on human and financial performance and natural resource management as of below average importance (Keogh & Julian 2013). In contrast, we have also seen the emergence of consultants engaged in more holistic farmer training through organisations such as Holistic Resource Management (HRM) and Grazing for Profit (GfP). Participants in their programs look at values and develop a mission for their families that takes into account personal satisfaction, environmental and financial performance in a 'multiple bottom-line' strategy. The degree of influence of this approach has not been documented, but it has been credited as a key influence in the development of a community of practice of eco-innovators (Cross & Ampt forthcoming).

Perhaps as a direct consequence of the decline in public extension and erosion of employment, the academic field of extension research and teaching has also declined in Australian universities, despite Australian academics being an influential force in international extension research and practice. University departments of agricultural extension have disappeared and focus on the discipline has been reduced to optional units of study, often with a single offering and renamed 'stakeholder engagement' or 'communications'. At Australia's oldest agriculture faculty at Sydney University, there has not been an undergraduate unit in extension for

decades. The University of Queensland, the first university to establish teaching in agricultural extension, has always retained extension at undergraduate and masters level, though with some change to naming. At present, extension as a discipline has largely diminished or become invisible in tertiary institutions.

While this decline in extension activity was taking place, Australian federal NRM policies reflecting the shift to agroecological approaches were developed with the rise of Landcare, then the regionalization of NRM through the Natural Heritage Trust period (Curtis et al. 2014). This public investment in people to work with landholders was against the declining trend. As a result a new breed of extension agent emerged in the regional NRM bodies with responsibility for encouraging better management of land, water and biodiversity resources through knowledge sharing, capacity building and design and administration of publicly funded projects focused on better environmental stewardship by farmers. To a large extent, these new extension practitioners operated without the benefit of the development of thinking and practice that had taken place in agricultural extension (Pannell et al. 2006).

The early years of publicly supported NRM in Australia were extensively researched with a plethora of published articles chronicling, evaluating and critiquing the decade of Landcare (Lockie & Vanclay 1997; Toyne & Farley 2000; Curtis 2003). In the next phase there was increased Australian Government support but much less extension research, so that when the Natural Heritage Trust 1&2 and the National Action Plan for Salinity and Water Quality programs and NRM regionalization were reviewed, there was little tangible evidence of return on investment (Morrison et al. 2010; Robins & Kanowski 2011; Curtis et al. 2014). A promising 'monitoring, evaluation, review and improvement' (MERI) process was introduced for the subsequent program (Caring for Our Country), but we would argue that the influence of well trained and experienced extension researchers was lacking.

Despite their central role, extensionists in NRM have had little career structure or security of tenure. Landcare facilitators in the decade of Landcare had, at best, 12 month contracts. Since then Landcare networks have struggled to keep on key coordinators. Those employed in regional NRM bodies have been subject to frequent restructures with their accompanying disruptions and redundancies. This has also occurred in state bureaucracies, where extensionists in NRM and agricultural production have been moved between different departments and endured numerous re-organisations. In NSW for example, there were seven restructures in the 'environment' department and five in the 'agriculture' department between 1990 and 2011. As a result of redundancy programs and lack of consistent commitment and purpose, a generation of highly knowledgeable and dedicated extension specialists in both agriculture and NRM has moved on or become disillusioned and disempowered. Private and corporate extension services have benefitted from these redundancies, but without a vibrant public extension profession, that source of skilled and experienced staff will diminish.

Extension now

The continued long-term decline in agricultural extension is reflected in a pronounced step-wise reduction in both agricultural and environmental extension in most states. In NSW the introduction of a new agency, Local Land Services (LLS), aimed to integrate delivery of agricultural advice, NRM, biosecurity and emergency services in rural areas. While further analysis is needed, preliminary investigations suggest that NRM staff numbers have dropped by 40% and agricultural advisory staff by 60%. It is difficult to see how the lofty aims of LLS, for integrated delivery across very different needs, can be achieved with such a severe reduction in capacity. There are indications that additional job cuts and lack of planning will further impact on-ground effectiveness (Jones 2014). Some continued government support for Landcare has made a contribution to the maintenance of local networks via part-time facilitators, however, on the whole, there has been a decline in the number of participants and groups with remaining groups surviving on goodwill, private funds and minor government grants (Tennent & Lockie 2013).

With decreases in public extension provision there has been some corresponding increase in private and corporate extension delivery, with many former state and federal extension agents moving to extension roles in the private sector. There is a spectrum of roles in the private sector ranging from: people who provide advice on the use of specific products and are paid bonuses according to sales; those employed by input suppliers to provide a full range of advice; through to fully independent advisors. In some quarters there has been longstanding disquiet about advisory services that are supplied by companies with the primary aim of generating profit from sales. There are many effective private advisors and trainers who strongly argue that they are not focussed on product sales, but they do seek fee for service and therefore have a commercial focus. The key issue is the perceived lack of independent advice where

commercial realities demand a measurable financial outcome at the expense of a public benefit outcome. While farmers are unlikely to accept advice that is too narrowly focused on input sales, the local and broader impacts of this significant shift from public to private extension is not fully understood. It is unlikely that this sector will be strongly engaged in, or focused on public benefit activities unless they are paid for it.

There has also been a parallel shift in the system for funding research and development from predominantly public funding to co-funding with industry. This has been achieved through Australia's industry-based R&D Corporations (RDCs) and Cooperative Research Centres (CRCs). It has been fruitful in generating industry-driven research including some extension-focused programs. Most, if not all, funded projects have required a dissemination strategy, which have tended towards dissemination through mass communications to some extent assisted by the rise of internet accessibility and use. It is not clear whether thoroughly designed extension processes have guided these dissemination strategies, and short term projects with staff employed on project funding have become the norm. With the decline in public extension, professional linkages and continuity of research effort have become more difficult.

These factors suggest the need for different approaches for all engaged in innovation systems. The term 'innovation platform' has been coined to express the need for actors to come together to better integrate actions that facilitate innovation. In the Dairy industry, for example, a recent review (Murphy, Nettle & Paine 2013, p. 917) has called for:

> (1) a professional development strategy that incorporates (i) an understanding of the new professional situations extension works within, (ii) leadership in cross-industry and cross-sector coordination concerning the nature of the changing client in research, development, extension and education system and (iii) clear priorities for extension; (2) a professional development plan that incorporates a workplace-learning approach; and (Missios 2004) for extension specialists to be engaged in defining research priorities, the agenda for change and suitable pathways for change alongside other professional groups, including farming.

In NRM, we rely heavily on the ongoing legacy of Landcare and the continuity provided by local communities to provide the social capital needed to sustain the NRM effort. Continued withdrawal of public investment and lack of career structure and a stable institutional environment for NRM-focused extensionists is taking us closer to a tipping point.

Extension Reinvigorated

Extension is the part of innovation systems concerned with the recognition, co-development, adaptation and spread of innovation. It recognizes that that there are many sources of innovation from bottom-up to top-down, and that stakeholder engagement is a key part of the development and adoption of innovation. Extension research and practice therefore remains a rich source of knowledge, understanding and skills for ecologically sustainable development and related challenges. Agriculture has a major advantage over other science-based activities in having developed extension as a conduit for the application of its findings. Through strong and continual interface between agriculture and the social sciences, especially communications, extension has transformed into a two-way or multi-way process of facilitating innovation, and for transformation in agricultural systems. In many fields, such as Participatory Action Research, extension has led the social sciences. This is a marked contrast to some other sciences that struggle with their 'science-policy interface' or how to communicate and gain application of their results which has led to an increasing emphasis on 'translational' research (Wamae et al. 2011; Valdivia et al. 2014; Assefa, Alemneh & Rorissa 2015).

The reinvention of extension we advocate involves the recognition that innovations can originate from anywhere and usually require adaptation regardless of their degree of development. This means that the research becomes more participatory, and extension facilitates and communicates linkages between practitioners and researchers in both directions. Extension also becomes about recognizing and utilizing opportunities based on understanding the perspectives from both researchers and practitioners. We strongly endorse the approach of Klerkx et al. (2012) which calls for increased research 'push' and 'pull', in other words, two-way informing and learning whereby the top-down influences the bottom-up, and the bottom-up influences the top-down. This positions extensionists as conduits or connectors of information, knowledge and people in both vertical and lateral networks. The innovation systems approach transforms extensionists and farmers into 'engagement practitioners' (Ampt 2013), 'innovation brokers' or 'knowledge brokers' (Klerkx et al. 2012a), 'agents of change' (Cerf, Guillot & Olry 2011) and 'co-innovators' (Klerkx & Leeuwis 2008). These roles in theory offer a new direction, but in practice can become lost in translation, allowing old ways of thinking to prevail in new clothes. While this review has focused on Australia, this challenge affects developed and developing countries alike.

The required transformation captures every current buzz word in agricultural and environmental systems thinking, for example dealing with 'wicked problems' that require 'capacity building' and 'resilience building' via 'adaptive management' and 'adaptive learning' for the manifestation of 'sustainable' and 'holistic' land and resource management. Whilst the productivity of agricultural systems remains important, the key challenge is in their sustainability. Quality rather than quantity in the food growing process will be a prerequisite for triggering a major transition towards sustainable land-use management (Nettle & Santhanam-Martin 2014). As a result it is essential that extension facilitates the integration of production and environment, and as a result the training of extension agents must incorporate the development of understanding and skills in integration. Integration extends beyond the marriage of conservation and production, requiring extensionists to work for public and private benefit simultaneously. Reinventing extension so that agroecology plays an even greater role in this profession is key to up-skilling practitioners.

The reinvention of extension will also require further development and reaffirmation of the profession as a 'people-based' approach. While 'participatory approaches', 'engagement', 'education' and ''social learning' are well-established additions to agricultural extension, they have not yet led to fundamental change in the innovation system. Reduced investment and support in public extension limits the current capacity of extensionists to build the networks and innovation platforms required to share knowledge and trigger sustainable transitions; arguably the key purpose of the extension practitioner. Without the agency to develop long-term relationships with landholders based on trust, partnerships and discovery, public extensionists will continue to deliver short-term projects that are largely non-participatory and ineffectual due to time and budget constraints (Allan 2012).

We argue that as food production is increasingly conceptualized in terms of food security, food sovereignty and food justice, empowerment and adaptive management capacity are central extension outcomes (Allahyari 2008). We need to rethink extension in light of changes in the conceptualization of agriculture, including attention to supply (value) chains, where extension principles and processes can contribute well to the enhancement of distribution systems. There are opportunities to contribute in emerging international challenges such as climate change, food and water security, the food-water-energy nexus, and One Health (the interfaces between human, animal and ecosystem health). All of these arenas need, and offer new potential for, the principles and practices evolved in agricultural extension.

A deeper understanding of change as a very personal, emotional process is required to truly legitimate local knowledge and to integrate local experience, culture and philosophy into the framework of extension practice and theory. As Ison (2010) argued, 'in doing what we do [extension] we are also constrained by the institutionalization of an intellectual apartheid in which appreciation and understanding of the emotions is cut off from practical action and daily discourse'. Therefore, extensionists need to embrace irrationality, intuition, perception and creativity to break down barriers of miscommunication and become catalysts for change.

In addition, we argue that the fundamental skill-base of current extensionists needs updating. Comprehensive training in social science methodologies to better assess and navigate innovation networks and platforms, reflexivity for evaluative and professional development purposes, and refinement of inter-personal skills are central to our proposal. A review of Australian tertiary extension education, conducted by the APEN Extension, Education and Accreditation (ETA) sub-committee has concluded that there is an increase, albeit slow, in units of study that focus on embedding people-based change management skills in agricultural degrees (APEN 2014).

As a representative organisation for the extension profession, APEN is in a good position to make a strong statement about what extension is in 2015, and make the case for its important role in achieving ecologically sustainable development in rural areas. This paper is an attempt to capture some of the wisdom of the APEN ETA subcommittee for wider discussion by the network.

Conclusion

The withdrawal of public resources from the public benefit components of the RD&E system has been relentless and is not widely recognised. We argue that it is approaching a tipping point. We need to bring to the surface the degree to which governments have withdrawn from extension in both agriculture and NRM, and from the integration of production and conservation. Equally we need to emphasise the opportunities and requirements for extension skills that are emerging with new global concerns and agendas.

The private components of the innovation system remain heavily reliant on public investment in knowledge and skills. The earlier public investment in extension for land and water conservation, in Landcare and in successive natural resource management programs (Curtis et al. 2014) continues to have a beneficial legacy effect, but without enabling policies and continued, coordinated and consistent support and investment in professionally trained people with a career structure we risk losing what we have now. A major challenge is to meet the gaps left from the relative withdrawal of public investment from both agricultural and environmental extension. We can do this through lobbying to generate a new professional public service skilled in integrative extension activities, re-orientation of public agencies to help support networking and coordination, and through policy levers to encourage, facilitate and support private extension agents to be more integrative of public benefit components of NRM.

Extensionists retain the skills to address emerging challenges, but investment to develop and use these skills is necessary. There is high potential for extension to contribute more in its traditional domains of agriculture and NRM, and for the field to continue to evolve in addressing contemporary and future global and local challenges.

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