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Agricultural extension: A review and case study in the Tasmanian dairy farming sector.

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Abstract: *Agricultural extension aims to improve farmers' capability, capacity and adaptability so as to farm in a sustainable and profitable way in a world of constant change and ongoing challenges. Extension is adult education achieved through the organised exposure of adults voluntarily to the thoughts, ideas, concepts and practices both of their peers as well as of professionals with relevant knowledge and experience. Government funding of extension has been steadily reduced and funding for extension is increasingly sourced from farmer levies and other private funding agencies. Funders, including the public sector, have become more insistent that funded extension programs need to demonstrate their effectiveness, measured largely as on-farm practice change. The Pasture Plu\$ project was a three-year extension project (2005 – 2008) aimed at improving Tasmanian dairy farmers' business skills over a range of farm management areas. Its focus was a number of short workshops, one of which was coupled with a coaching component. Coutts and Coutts (2008) were contracted to evaluate the project against its objectives and, in summary, concluded that significant potential for practice change had been achieved. This paper explores the efficacy of the Pasture Plu\$ project from an educational perspective and argues that in terms of adult learning principles, the project content and delivery has equipped farmers with practical information enabling them to make practice changes to ensure ongoing viability and profitability for their farm businesses.*

Keywords: *education, adult learning, agricultural extension*

Introduction- a definition of agricultural extension

Agricultural extension is the function of providing need- and demand-based knowledge in agronomic techniques and skills to rural communities in a systematic, participatory manner, with the objective of improving their production, income and (by implication) quality of life

(Haug, 1999). Agricultural extension in today's commercial farming environment aims to improve farmers' capability, capacity and adaptability to farm in a sustainable and profitable way in a world of constant change and ongoing challenges (Jones & Garforth, 1997). In one sense extension is adult education but it is adult education achieved formally or informally through the organised exposure of adults voluntarily to the thoughts, ideas, concepts and practices both of their peers as well as of professionals with relevant knowledge and experience. Its aim is to bring about positive behavioural changes among farmers (Haug, 1999; Black, 2000).

Pretty and Chambers (1993) in their categorisation of extension theory suggest that extension in the period 1900-1975 was seen as a one way transfer of technology. Whilst it certainly encompasses this process, extension is more than this. As it stands this definition is too simplistic. The farming community is much more complex and farmers are more than vessels waiting to be filled and topped up with the latest research findings. Vanclay (2004) suggested that the "farming community is not homogeneous" (p. 213) and argued that those who are directly involved in extension education programs need to grasp the importance of social issues as well as the social nature of farming. This social aspect underlies the assertion that adoption of new farming practices has a social basis. The traditional belief that extension is a top down process, where scientific findings find their way through extension down to adoption of change in management practice by farmers, fails to understand why this adoption is not implemented (Vanclay & Lawrence, 1994). Vanclay and Lawrence suggested that there are a host of other factors influencing adoption of innovation, including conflicting information, associated costs and risks of implementation, farmer intellectual capacity, access to capital, incompatibility with farmer objectives, as well as social and perception issues. The suggestion that there are a complexity of factors influencing adoption is supported by Morse, Brown, and Warning (2006) who noted that there is a move away from the linear model towards extension methodologies that emphasise information flows, adult learning principles and participation by stakeholders. They suggested that farmers need to have more control over the information that they need or want, so that any extension programme is demand-driven.

Taking into account the complexity involved in the process of knowledge dissemination to change in farm practice, the authors of this paper suggest that it might be better to define extension as the encouraging exposure of farmers to information that will equip them to be in a more informed position to consider making changes to their farm business practice. Extension is no longer only a channel for dissemination of information from research to the farmer but takes the role of capacity building through education and developing knowledge partnerships with farmers.

Extension in agriculture – a brief history

By way of introduction, the quote from Jones and Garforth (1997) is useful.

Agricultural extension work has a venerable, albeit largely unrecorded, history. It is a significant social innovation, an important force in agricultural change, which has been created and recreated, adapted and developed over the centuries (p.1).

There are records of agricultural extension activity from several millennia ago: agricultural advice was being given to Chinese farmers as far back as 800 BC ("Agricultural extension," 2010). The Renaissance gave considerable impetus to agricultural education with the publication of educational literature, scientific findings and the evolution of agricultural clubs and societies. The modern extension movement is regarded as dating back to the Irish potato

crop failure in the middle of the 19th Century when the British Government organised for instructors to go to farmers and teach them how to grow other crops to ensure their economic survival (Jones & Garforth, 1997). This approach soon spread to the USA, Canada and Western Europe and from there to the various British colonies and Japan.

In many European countries where extension activity was achieving meaningful practice change, governments were committed to funding extension. By the late 1800s, many western European countries had developed state-funded extension services. This was emulated in the United Kingdom, the United States and Canada (Jones & Garforth, 1997). Governments were aware of the benefits to the national economy of a vibrant and adaptive agricultural sector and of extension's crucial role in maintaining competitiveness in primary production.

Extension work was soon evident along the coastal belts of southern and eastern Australia, with departments of agriculture established in the 1870s and 1880s. Agricultural colleges were established in Victoria, South Australia, New South Wales, and Queensland. Associated with this development was the official appointment in these states of the first itinerant agricultural instructors in the late 1880s. Although the impact of these early endeavours was probably slight, the basis had been laid for further development (Jones & Garforth, 1997).

The 1900s witnessed the development of extension services as managed organisations with hierarchical structures and reporting frameworks (Jones & Garforth, 1997). The 1970s and 1980s are regarded by many as the heyday of agricultural extension in developed countries. This could, in part, be due in part to the increasing rate of innovation and knowledge creation in the agricultural sector as well as the increased competence and competitiveness of farmers. This has led to a shift in public extension from one-on-one to group approaches (Coutts, Roberts, Frost, & Coutts, 2005) while the role of the extensionist has become increasingly that of a facilitator as much as an expert in the field of agricultural science (Coutts et al., 2005). Hunt and Coutts (2009) in a coordinated extension programme for wool producers showed that a suite of extension methodologies and techniques can be integrated to realise significant change and rural business benefit.

Agricultural extension in the Tasmanian dairy industry

In the early and mid 1900s, most dairy farmers in Tasmania had small herds producing home-separated cream for local cheese and butter factories and fed the bulk of the skimmed milk to pigs. Other dairy farmers had milk supply contracts. Local dairy officers' duties were focused on enforcing regulations to ensure quality of milk supply. There were Department of Agriculture technical publications but limited extension advisory services. However, initiatives to improve pasture production through fertiliser use and to address cell counts were introduced in this period (Tyson, 2009).

In the 1980s, the state government introduced a 'fee for service' for one-on-one advice but the 1980s also saw the development of geographical discussion groups. This form of extension service consisted of localised groups of dairy farmers meeting regularly under the facilitation by extension staff to discuss topical issues relating to their dairy businesses. The annual dairy farming business of the year award was introduced and regular surveys were undertaken to assess the level of farmers' skills and what should be done to improve efficiencies. The years 1982-1987 saw per cow milk production lift by over 30%. Members of discussion groups were typically increasing their production by up to 11% annually compared to around 7% for

non-members (Tyson, 2009). This should not be interpreted as simply as it reads. In any farming community there is considerable interaction between local farmers and the likelihood is that there would have been some diffusion of knowledge from group members to non-group members. In addition, rural professionals such as veterinarians would have regular contact with non members and be a source of information. Despite the apparent diffusion of information, the members still produced a 4% growth rate advantage.

Dairy farm numbers peaked in 1988 to approximately 1200 and have fallen since to less than 450 farms in 2009. However, herd sizes have increased and Tasmanian milk production has risen to its highest ever in the 2008/2009 season. Tasmania is currently the nation's third largest producer of milk at the farm gate.

As has happened worldwide, government support for extension services from a funding perspective has also declined in recent times and the numbers of extension staff serving the dairy industry has dropped. Currently, extension is offered under The Tasmanian Institute of Agricultural Research Dairy Centre Extension group with government support. New staff are employed on a contractual basis largely through specific project funding. Unfortunately, the considerable role that extension has played in the increase in productivity over time has not been quantified or analysed rigorously. Tasmanian dairy farmers have benefitted from public-funded extension for several decades that has arguably enabled them to improve their farming practices over time so as to remain competitive and profitable. More recently, however, public funding of extension has been steadily reduced and funding for extension is increasingly sourced from farmer levies and other private funding agencies. In addition funders, including the public sector, have become more insistent that funded extension programs need to demonstrate their effectiveness and this effectiveness is largely measured as on-farm practice change. Furthermore, it has become widely recognised that there is a marked lack of skilled farm staff available for the large herd farms and that farmers are facing an increasing need to manage people and to enter into employment relationships (Nettle, Paine, & Petheram, 2001). This has led to a new direction for extension services where training and education of farm managers and workers in farming management practices and in human resource management is increasingly important in the sphere of funded extension activities.

Extension as education

Agricultural extension is aimed at adults who are involved in the business of farming. As such it is a form of adult education and the key principles of adult education will form the framework in which extension activity operates.

The literature on adult education is extensive and there are a number of theories about how adults learn (Black, 2000). Knowles (1984, cited by Smith, 1996) suggested that adults are self-directed and expect to take responsibility for decisions. Who they are defines how they learn and adult learning programmes should accommodate that fundamental aspect. His arguments have, however, faced growing criticism, particularly in his distinguishing andragogy from pedagogy and some educational theorists argue that we need to see the adult as a whole in their lifelong development (Kidd, 1978). What appears to be of greater significance for extension is to understand the target audience at the point of the learning encounter. This is not a simple process, particularly for a typical group of farmers. The challenge of creating effective learning moments for a group of farmers is significant. Two

key adult learning principles and challenges that, amongst others, apply to the adult farming community as a learning community, are discussed below.

First, there is no stereotypic 'generic' adult learner (Long, 2004); a range of individual differences potentially impact on adults' learning experiences. There are not only the obvious gender and age differences but there are many others. There are likely to be sociological differences and psychological differences as well as prior learning level and experiences (not necessarily good). There will be different expectations and outcomes from the learning encounter and different drivers for why farmers attend learning sessions. If we accept that learning is a cognitive process then there are a number of factors that influence this process such as prior learning, literacy and numeracy skills, attitudes and beliefs of the adult learners, their state of mind and body, life experience, role in the farming business, relationship to others in a group and, for many education theorists, even personality (Long, 2004; Gonczi, 2004). Even physiological variables can influence the learning experience: issues such as vision and auditory defects can not only influence why farmers might or might not participate in extension activities but can influence how much they might learn in the activity. Health and energy levels are also significant factors. Extension programs and activities need to cater for this variation and it is argued that while not all persons can be equally satisfied in a learning encounter, the majority need to have most of their perceived needs met.

Second, motivation is a key element in participation in adult learning activities. Long (1985) argued that there is support for the premise that the desire for learning is a fundamental human characteristic, but that "the *focus* of learning ... is frequently based on some external circumstance or some social condition to which the individual responds" (Long, 2004, p. 26). It is interesting that extension has been seen from two different perspectives – paternalistic and participative. In communities where farmers have been socially and educationally at the lower end of the spectrum, much of government funded extension has been paternalistic and prescriptive in nature, looking to instruct farmers how to farm better. In the modern commercial environment, paternalistic and prescriptive approaches will be counter-productive. Modern extension needs to engage adults as willing participants in a non-prescriptive environment. Gonczi (2004) suggested that adult learning should be linked to the environment in which the learning takes place and the workplace provides much of the motivational environment to adult learners.

Studies in participation (Black, 2000; Long, 2004) have revealed a great number of reasons why adults choose to be part of an educational program. Long (2004) suggests that given such a wide range of motives, it is difficult to know for sure why any one adult has chosen to participate in a particular learning program. Long (2004), however, does argue for a common strand in the variety of motives, namely that of the need for a solution to a perceived 'problem'. Adults come to a point where they recognise that they don't know the answer to a particular line of inquiry, or are not sure that what they currently understand is sufficient to solve their problem. This 'doubt' drives them to find a solution. Experience in extension suggests that there is truth to this assertion. As an example, the authors of this paper recollect several occasions when there has been a particular challenge confronting farmers. On these occasions, many more farmers than expected attended extension events aimed at addressing the issues at hand. If farmers are 'problem' oriented, then the challenge for extension is to identify these 'problem' areas and to make available the best learning environment for farmers to find solutions.

In conclusion, the many and varied factors that influence the learning encounter need to be explicit in the thinking of extensionists planning extension activities if there is to be some degree of achieving a successful outcome. As much as these variables can contribute to a rich experience of learning so they can also be a minefield of potential disaster and either way a challenge to manage.

Extensionists as educators

Educational practitioners have noted that many ‘teachers’ in adult education have the technical expertise required to deliver content but lack preparation in the art and science of teaching (Galbraith, 2004). The primary and secondary education sectors in developed countries require some teaching qualification in addition to qualifications in the relevant fields. The tertiary education sector is generally not as proactive and, in particular, extensionists often have little formal exposure to teaching methods and practice. Irani, Place, and Mott (2003) found in a survey of sixty United States county extensionists that whilst the majority regarded themselves as effective adult educators, there was also the recognition that they had a “*substantial* need for training in adult education” (p. 164). Astroth and Robbins (1987) acknowledged that whilst extension agents in the United States have been rigorously trained in many aspects of extension activity, they have not been trained to teach and suggested that it was time to strengthen their expertise as professional educators. In the opinion of the authors of this paper, developing extensionists as professional educators should also apply to extension in Australia.

Pasture Plu\$: a case study in extension

The Pasture Plu\$ project

The Pasture Plu\$ project was a three-year extension project (2005 – 2008) aimed at improving Tasmanian dairy farmers’ business skills over a range of farm management areas. Its focus was a number of short workshops coupled with a coaching component in the case of pasture management. The project learning outcomes were supported by a monitor farm (a commercial demonstration farm) program aimed at demonstrating the increased profitability of farm businesses that implement best management practice. The remainder of this paper explores the efficacy of the Pasture Plu\$ project from an educational perspective and argues that the project content and delivery were designed in a way likely to equip farmers with practical information and increase their capacity for informed decisions, enabling them to make practice changes to ensure ongoing viability and profitability for their farm businesses.

Recently, much of the Tasmanian extension activity has been on a project basis and in 2006 the Pasture Plu\$ project was rolled out. This project ran for just under three years. The Pasture Plu\$ project continued a pasture management program that had been offered in a previous project (the 20.12 project), but added other farm management programs consisting of one- and two-day workshops covering soil and fertilisers, animal nutrition, water-use efficiency, and business management. These workshops were supported by a monitor farm program where the implementation of best management practice in a number of key areas was encouraged across three farms. This program was intended to demonstrate to dairy farmers the financial benefits of best practice. In addition a monthly newsletter was made available to

every dairy business to disseminate information which could reinforce the learning given in the program as well as other relevant information.

Evaluating the impact of the Pasture Plu\$ project

The overarching long term aim of the project was ‘to encourage dairy farmers to take on a business culture’ and to achieve this through the setting of goals consisting of a number of short and medium term outcomes. Between 30 and 40 farmers attended each of the workshops on offer. The issue of accountability to funders has been raised above and mention was made that ultimately, on-farm practice change was the measure of the effectiveness of any extension activity. It should be immediately obvious that to measure on-farm practice change over a short time frame is not reflective of the effectiveness of extension. From what has been discussed above about the complexity of the farming community and the many factors influencing educational outcomes in adult education environments, it cannot be automatically assumed that extension activity will result in immediate practice change. It should go without saying that the desire and expectation of extensionists is practice change; extension professionals committed to their message are not satisfied with anything less. However, the time to respond and the extent of response is varied. The timely implementation of a recommended practice may not occur because of the host of physical, psychosocial and economic reasons presented above. Therefore, it is proposed that the outcome of an effective extension program is that farmers are better equipped to make practice changes if and when other barriers to adoption have been overcome, rather than that immediate changes to practice occur. It is further argued that, in the short-term, an assessment of the extent to which extension activities meet the criteria for effective learning experiences provides a valuable assessment of the effectiveness of the extension program.

Educational effectiveness of the workshops – an internal assessment

One difficulty with informal adult education is the objective measurement of how well participants have increased their learning as a result of the course or workshop undertaken. There are no oral or written assessments and so other more subjective evaluation methods are required to gauge the effectiveness of the educational aspects of extension activities. However, it is argued that a well-designed and delivered program will increase the likelihood that farmers will acquire new information and be equipped to make later practice change(s) where and when appropriate and motivated to do so. Therefore, the first element of the evaluation presented here is a consideration of the structure and implementation of the program. The authors were part of the teaching team delivering the program and had the opportunity to observe selected workshops and to speak to participants. In addition, the authors were involved in the development of the workshop program and designed both manual and teaching aid contents to best suit the target audience. In discussions after the program delivery the authors reflected, individually and together, on the design and delivery of the Pasture Plu\$ program. From this process, a number of aspects of the program were identified as reflecting the broader challenges of adult educational design, as discussed previously. These aspects are discussed below, with a consideration of the approach taken with the Pasture Plu\$ program.

Willing participation as a reflection of motivation

We have noted above that programs orientated toward perceived ‘problems’ are more likely to arouse farmer interest and participation. When extension is a ‘demand’ driven activity then it is more likely to be effective for change. The workshops were offered to the dairy farming

community for voluntary participation. The assumption can be made that those farmers who gave up their valuable time to attend the workshops did so to gain a better understanding of what the workshops were designed to give. It is argued that there is a high likelihood of motivated participants implementing practice change following participation in extension.

Farmer involvement in activities

Paternalistic and prescriptive programs are not likely to achieve change in today's commercial, competitive and more advanced farming enterprises. Farmers need to be involved in the programs as co-contributors. Whilst a detailed manual was made available for the participants, the content delivery was designed to be practical and relevant to farmers. Farmers were encouraged to contribute and practical exercises were designed to reinforce learning outcomes. This supports the contention by Coutts et al. (2005) that this approach meets several adult learning principles, in particular, that of encouragement of producer "ownership" of both problems and solutions.

Catering for farmer diversity

One of the strengths of those who delivered the content was familiarity with the farming community. This allowed the presenters to target their delivery accordingly. It is acknowledged that the presenters (from TIAR RD&E and industry) were, in the main, not trained in adult education and could no doubt improve their effectiveness as adult educators. However, the empathy factor is an important one. The ability to gauge the level at which to pitch delivery caters to some extent for the diversity among the participants. There was a good degree of creativity in the presentations and interest levels were maintained throughout the two days. This is to some degree a subjective assessment and there is no doubt room for improvement in the nature of the delivery.

Relevancy of the content

Courses that have a greater likelihood of meeting farmers' needs have to be relevant to their farming businesses and although the manuals give detailed information to those who would be keen to develop their understanding to greater depths, the delivered content was designed to be of value for immediate on-farm application. Of the workshops on offer, the business management workshop might in our opinion have been presented in a more practical manner.

Trust in the presenters

The majority of the presenters were well known to the dairy farming community. Familiarity can present its own problems and may well be a factor affecting effectiveness of learning but the levels of trust are high and the genuineness and integrity of those who presented would not likely be questioned. This raises the important factor of the level of expertise of the presenters. Farmers are more likely to respond to and engage with presenters who they regard as knowledgeable in their relevant fields and presenters were chosen who were known to have both experience and expertise.

Reinforcement of learning

The pasture management workshops offered participants the opportunity to be part of a small group of farmers in a follow up coaching program. Monthly meetings of participants were held on their farms for up to eight sessions. These days were designed to take farmers through the application of the key pasture management principles delivered in the workshops under the direction and encouragement of a trained coach. The coaches consisted of leading farmers who had the respect of the community, consultants, milk factory staff and TIAR staff. The success of this approach in the preceding 20.12 project has been noted (Doonan, 2007), and this continued to be the case in this project. It must be said that pasture management is one

aspect of the farm business that farmers readily identify with in terms of its relevance to production. It is their daily activity and they related well to the content of both the workshops and coaching program. In the other areas of management, farmers tend to rely on consultants and industry service provision staff and attempts at arranging further interaction was not successful with the business and animal nutrition workshops. This might be due to a lack of preparation by extension staff and it is our opinion that farmers would benefit from a coaching program in all areas of management. A lack of information on these possibilities was apparently one weakness of the Pasture Plu\$ project.

Based on the above examination of the program, we argue that we can make the reasonable assumption that those farmers who attended the workshops gained further insight and understanding in different aspects of their farm business and that they would have been better informed to consider making practice changes with increased confidence.

Educational effectiveness of the workshops – confirmation from an external evaluation

Coutts and Coutts (2008) were contracted to undertake an evaluation of the project. The approach adopted included a random survey of participants and non-participants, phone interviews with informed persons, case studies, analysis of available secondary data and a debrief workshop involving key industry players (Coutts & Coutts, 2008, p. 3). This paper is concerned with the evaluation findings that point to the effectiveness of the workshops as educational activities.

Coutts and Coutts (2008) reported that overall the project demonstrated a strong direct impact on at least 20% of the industry and added “value to other initiatives by providing unique relevant training events...” (p. 2). In the survey, participants were asked to rate the value of the workshops. The value encompassed the participants’ perception of their learning uptake and their self assessment of their improvement in understanding best management practices demonstrated at the workshops. The score was out of 10 and Figure 1 illustrates the overall ratings given by participants. These findings suggest that the participants found the workshops in general to be of value and we would argue that this confirms that, as delivery of educational experiences, they were successful.

Coutts and Coutts (2008) also reported that many participants had made changes to their farm management practices within the lifetime of the Pasture Plu\$ project. Figure 2 summarises the response of both participating farmers and non-participants to the survey question relating to practice change. In the areas of fertiliser and water use efficiency it can be argued that the project played a key role in helping farmers make these changes.

When farmers make practice changes as a result of extension activity, this is very encouraging. Apart from quantitative surveys documenting practice change, all anecdotal evidence affirms that extension has been an integral and essential ingredient in the steady improvement witnessed in farming practice over time.

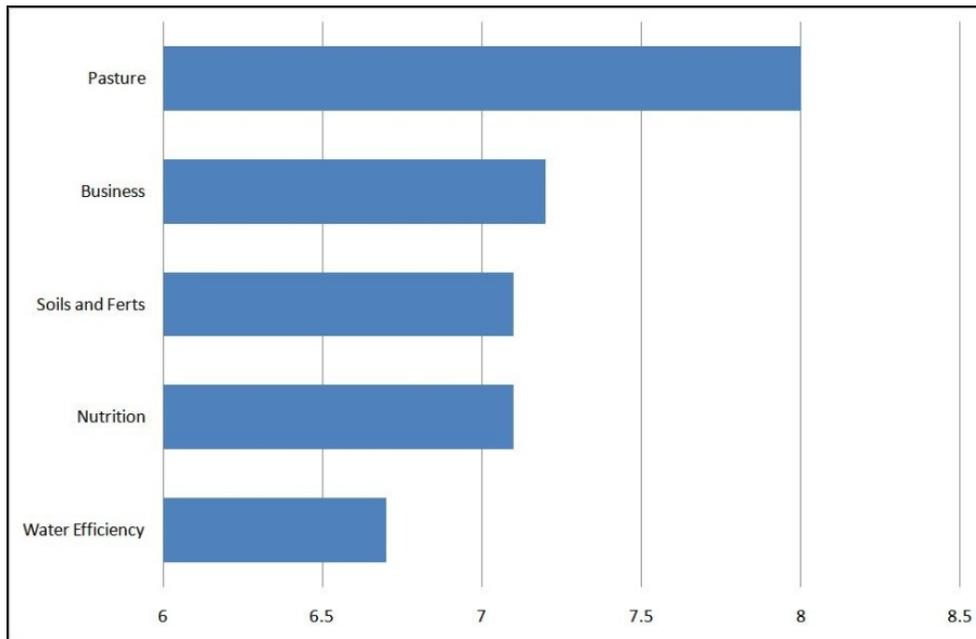


Figure 1: Pasture Plu\$ workshops – participants' ratings. Scores out of 10. (after Coutts & Coutts, 2008)

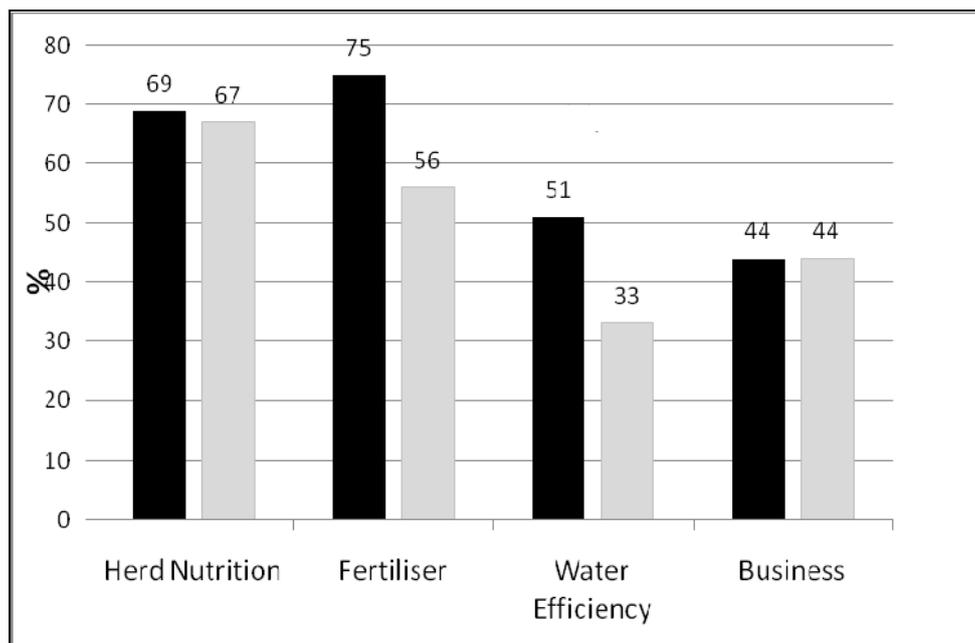


Figure 2: Percentage of farmers making practice changes 2006 - 2008 (after Coutts & Coutts, 2008). Extension participants are represented by black columns; non-participants in light grey.

Discussion

The outcome of good extension is that farm practices change for the good. Extension activities are designed to realise that end. However, there are many other factors that impinge upon adoption of practice change as mentioned in the introduction. Furthermore, in the opinion of the authors, deregulated market driven economies present farmers with uncertain financial returns and environmental regulations place additional financial burdens on farmers. These factors can influence the adoption of change. Whilst it is disappointing when adoption is delayed or is not what was intended, extensionists should be encouraged when they offer

quality programs that expose farmers to relevant information. Where the educational content and delivery satisfy key adult learning principles then extension agents can make a reasonable assumption that farmers have assimilated information that will be an important part of practice change decision making at some point in the future.

Adult education methodologies in ‘creative’ assessment of learning uptake have been developed and should be practised to show more rigour in evaluation of learning uptake. (Black, 2000) has suggested that these need to be trialled in future research in extension methodologies. The ideal method of providing measurable evidence of adoption of innovation is to monitor farm practices of the participants in the extension program for at least two seasons following completion of the programme. However, extension project funding usually does not allow a budget for this activity so that this evidence cannot be produced. Validation can be found in industry statistics relating to farm production, such as changes in production of milk solids per hectare as well as of those farmers participating in the extension program compared with those who have not. However, because this can only be evidenced after a period of two years or more it has to be done retrospectively and cannot be reliably associated with learning uptakes from the extension program alone after that period of time.

Research into the barriers to adoption of innovation has produced some indication why farmers don’t make practice changes as hoped for and expected by extension. There is no doubt that educational programs need to realise these barriers and seek ways to assist farmers to overcome these barriers if possible, or to accept that some barriers are perfectly valid reasons for non-adoption and involve research into adaptation of management practices which accommodate those barriers. Traditional extension activity needs to adapt to remain relevant as agents for change. We agree with those who call for more scholarship in the field of extension (Astroth & Robbins, 1987; Jones & Garforth, 1997; Vanclay, 2004) and for inspiring leadership to chart the way forward to best meet farmer needs in the future (Black, 2000; Davis, 2002). To abandon extension is to rob the farming community of a service that can support change in the face of new challenges.

Conclusion

Notwithstanding the constraints placed on the resources available to current extension programs, the evaluation of the Pasture Plu\$ project indicated that the use of adult learning principles in the delivery of the extension program and focussed, practical information that addressed farmer-driven management practice issues, achieved capacity building in participants. This led to an improvement in informed decision making and further, led to a marked improvement in adoption of innovation in the fields of fertiliser use, water use efficiency and pasture management principles. It is recommended that the rigour in evaluation of extension outcomes can be improved through development of innovative extension education methodology and assessment.

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