# Extension Farming Systems Journal

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Foreword

Welcome to Volume 6, Number 1 of the Extension Farming Systems Journal. This is a first for the journal in that all papers were submitted to the Australasia-Pacific Extension Network’s 5th International Conference, “Shaping Change in Communities: Dimensions of Excellence”, held at the Abbey Beach Resort, Busselton, Western Australia on 9-12 November 2009. The first two issues were published last year in Volume 5 Numbers 1 and 2 and this issue contains the remainder of the papers submitted for the conference.

However, the journal remains essentially the same, with both Research Forum and Industry Forum Sections. The former, for publishing outcomes of research in extension contains papers which have been subject to a blind reviewing process by two independent reviewers. The latter is a forum for publishing papers on extension practice, case-studies and stories. I will remain an on-line journal, although it will be possible to purchase hard copies.

The large number of papers to be reviewed and edited required help from additional reviewers other than the Editorial Board Members. They are listed on the previous page below the Editorial Board members and I would like to thank them for their contribution. In particular, I would like to thank Kate Ambrose for organising the editing of the Industry Forum papers.

Roy Murray-Prior
Editor
The character of the Extension Farming Systems Journal

The Extension Farming Systems Journal is jointly published by the Australasian Farm Business Management Network (AFBMN) and the Australasia-Pacific Extension Network (APEN) with free online access to AFBMN and APEN members and others. A printed version is available to interested individuals and organisations by paid subscription. The journal is registered as with DEST as satisfying the refereeing requirements for the Higher Education Research Data Collection.

Extension Farming Systems Journal is an innovative extension publication of the AFBM Network and APEN. This journal covers extension aspects of agribusiness systems. Extension Farming Systems Journal is for farmers, farmer groups, corporate agribusiness managers, professional farm business consultants, extension and development officers, academics, researchers and postgraduate students who want to help extend the available knowledge about the efficient and effective operations of farming systems in Australia. There are two formats for publication:

   Extension Farming Systems Research Forum
   Extension Farming Systems Industry Forum

Extension has many definitions but to provide guidance we will adopt that found on the Australasia Pacific Extension Network website (http://www.apen.org.au).

Extension Farming Systems Research Forum

The Research Forum section of the journal will publish research into agricultural extension issues that follow a recognised disciplinary research methodology. It is targeted at professional extension practitioners and will be reviewed by the Editors and members of the Editorial Board. Two Editors are appointed and Editorial Board members are nominated by the AFBM network and APEN. The Editorial Board manages the Research Forum and the Editorial Board members have advisory, mentoring and refereeing roles. The Executive Editor manages the printing of the Journal.

Extension Farming Systems Industry Forum

The Industry Forum section of the journal - mainly targeted to professional farmers, agribusiness managers, farm business consultants and extension practitioners - will be reviewed by an industry panel to evaluate scholarship, readability, relevance to industry and capacity to enable change. The Industry Forum section of the Extension Farming Systems Journal will publish papers on farm business and farming systems technology highlights (typically with an extension character), outstanding farm and agribusiness case-studies and leading farmers’ stories.

Who can access the Extension Farming Systems Journal?

EFS Journal is published online free of charge for AFBM Network and APEN members and a wider audience. A subscription for printed copies of the journal can be ordered by contacting the Secretariat. Hard-copy issues have a cost of A$25 (+GST) per issue.

Who can publish in Extension Farming Systems Journal?

Extension Farming Systems Journal is for members of the AFBM Network and APEN. Anyone intending to publish a paper in Extension Farming Systems Journal who is not a member of either organisation should initially apply for membership of the AFBM Network or APEN by contacting the Administrative Assistant of AFBMNetwork at afbmnetworkexecutive@listserv.csu.edu.au or the APEN Secretariat at info@apen.org.au

Initially the Journal Editors will decide whether a paper and author meets the criteria for acceptance into the reviewing process for either the Industry or Research Forum sections. The criteria for assessing suitability will vary according to the details outlined under the Industry and Research Forum sections of the Journal.

If accepted for the Research Forum it will be sent to two members of the editorial board for review. The Editors will then decide whether to publish a paper after receiving reports from the referees. If accepted for the Industry Forum it may be sent to reviewers from the Industry Forum panel for consideration and then published if their comments are favourable.

To submit a paper for publication please send an electronic copy of your paper, edited as per Instructions to the Editors.
Milking their health for all its worth? Improving the health of farming families through facilitated learning

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Abstract: The Victorian Dairy Industry has an annual turnover of $5,125 million and produces over two thirds of the nation’s fresh milk and cheese, but what do we know about the health of the dairy men and women who drive this industry, and how can health professionals and industry assist them to focus on the health of the people involved in the farm business? The Sustainable Dairy Farm Families (SDFF) program undertook research exploring the health, wellbeing and safety of Victorian Dairy farming families across eleven locations. The program involved physical assessments, reviewed health conditions and health behaviours and provided education relating to common health conditions. Risk factors were identified for chronic and lifestyle diseases such as cardiovascular disease, diabetes and cancer. Participants were referred to health professionals as required and reassessed over three years concluding in 2007. The program has influenced participants’ decisions about their health and improved some clinical indicators. A cross-sectoral intervention appears to be an effective method for improving health, wellbeing and safety in farm men and women and their families.

Keywords: farming, learning, health, dairy, safety

Introduction
The Australian dairy industry is Australia's largest processed food industry, and ranks in the top four of the nation's rural industries. At the farm gate the Australian dairy industry was valued at $3.2 billion in 2006/07 and according to the Australian Bureau of Agricultural and Resource Economics (ABARE) report dairy provides an estimated regional economic multiplier effect of 2.5 (ABARE 2008). Australia also exports over $3 billion worth of milk and related products making it one of the world’s leading exporters of dairy products. The dairy industry is one of Australia’s leading rural industries in terms of adding value through further processing, with much of this processing occurring close to farming areas, and generating significant economic activity and employment in country regions.

The recent global financial crisis has affected Australian dairy industry exports and this reduced demand and the relative strength of the Australian dollar has halved the price per litre paid to dairy farmers. With the dairy industry operating in a highly competitive world market, precise management and coordination undertaken by all dairy businesses is vital in order to survive. When we assess this industry we see farming families make decisions, plans and choices that optimise profit and production for the benefit of the family business. However, there is limited acknowledgement about the effects of health of the dairy farmer on the production and profitability of the dairy farm. Important questions emerge in this context: Do dairy farmers consider their health and its impact on their business? Does the health of dairy farmers have differences and similarities with other agricultural industries such as broadacre farmers?

The Sustainable Farm Families (SFF) and the Sustainable Dairy Farm Families (SDFF) projects are initiatives developed by Western District Health Service in Hamilton, Victoria through a unique process of intersectoral collaboration involving health services, university, agricultural agencies, training bodies and farming communities. This combination of industry partners work together to address the health, wellbeing and safety of farming families across Australia and in particular the Victorian Dairy Industry. A successful application was made to the Geoffrey Gardiner Foundation for funding to research the Victorian Dairy industry using the SFF framework, education and assessment process.

The SFF program provided participants with information on personal health, wellbeing and safety whilst exploring attitudes to personal health. The program also provided opportunities for learning ways to improve the health and safety of people working on dairy farms. The positive outcomes from interventions in both industry groups (broadacre and dairy) have been recognised through publications and reports associated with both research projects (see Brumby et al. 2008; Brumby et al. 2009). It is important to use these new learnings to compare the two industry groups and make recommendations in relation to key findings to policy makers in both the health and agricultural industries.

This paper reports on the outcomes from the SDFF project undertaken in the Victorian dairy industry from 2004-07. We also provide information on the key similarities and differences between two agricultural sectors; dairy and broadacre. Using the research data and
interventions from both industry groups, we discuss and explore the similarities and differences. We also offer an hypothesis to explain what these clinical indicators tell us about the nature of farming businesses in these two sectors and the resultant health and well being of the people farming in these industries.

**Theoretical framework**

The SFF and SDFF programs were developed by drawing on both the adult learning and health promotion frameworks. Evidence from health promotion informed us that different teaching approaches can either stifle or encourage the attainment of health knowledge by population groups (Wass 2000). Wenger advised that in communities of practice people who share a concern or a passion for something they do will learn how to do it better as they interact regularly (2005). In addition Keen et al. (2005, p. 6), suggest that ‘our social and ecological sustainability depend on our capacity to learn together and respond to changing circumstances’ and that many of our current approaches to learning and responding to change occur within traditional institutional arrangement and values. Azjen and Fishbein’s (1980), theory of “reasoned action and planned behaviour” focuses on the belief that behaviour change occurs when individuals and groups:

- Share values and beliefs
- Share a common commitment to their new found knowledge
- Discuss with peers how best to respond to the information delivered in their daily lives, and
- Share an understanding of the possible negative effects of poor health behaviours within their business.

In the SDFF and SFF program the farming business is both the traditional institutional arrangement as described by Keen et al. (2005) and the shared concern or passion as described by Wenger (2005). The understanding of the individual impact of health, well being and safety on the farming business is the additional learning and knowledge that the participant gains through this learning model. That is, health, wellbeing and safety while initially viewed as a separate domain from the farming business is recognised as pivotal to both the emotional and economic success of the family farm business.

To assist participants in applying these learning’s and taking action both at an individual and the farm family business level we draw on Kolb’s adult learning model. While Kolb is focussed on individual learning, the lessons from this work are that designing suitable adult learning experiences requires a process to support objective understanding and concrete action. In our case, it is based on objective measures of health and providing suitable reflection on what this means through focus groups and individual counselling. The process also provides opportunities for future action through a joint action plan between farmer and health professional. The SDFF process reflects a supported learning model based on Kolb’s contribution to our thinking about individual learning, rather than a style of “teaching”.

Using Kolb’s (1984) learning model we were able to engage effectively with participants to assist them to learn key concepts about health and wellbeing and farm safety by using their own experiences. Kolb’s model allows participants to become active members of the learning process by experiencing the concept, reflecting in the learning, comprehending and then planning to use this new information within their farming life. Working with participants in small group formats has assisted in this learning process, as they are able to learn from others with similar agricultural interests and share the new information and conceptualise how the new health information can be used in their own business.

**The education process**

The process allowed us to work with a population that we now recognise represented a high change challenge, in that their health status was poorer than their metropolitan cousins (AIHW 2007). The SDFF program consists of a structured two-day workshop in year one and a one-day workshop in year two and three. Participants were recruited from the dairy industry directly (word of mouth) and via collaborative industry partners (e.g. WestVic Dairy) for each of the programs. The broadacre and dairy programs were delivered using the same education format over three years of intervention. A total of 128 broadacre and 210 dairy farmers were sampled over the three year period. Topic delivery and format was similar for both industry groups. The sequence of intended outcomes, as set out in Figure 1, shows how the workshop process facilitated individual behaviour change. For example, increased awareness and understanding led to specific behaviour change which impacted on clinical indicators leading to improved health and wellbeing.
Focus group information was gathered from participants at the start of the first workshop to gain an insight into their views about the current health issues relating to the farming industry. Questions was asked about their farming unit, reason for attendance and the current value of health in their farming entity. The focus group information was essential in determining the evaluative framework associated with each industry. Key areas of concern gathered were health information, access to services and issues affecting the industry.

The topics in the workshop were chosen to reflect the current health issues affecting rural populations. While data on the health and well being of farming families could not be separated from data for rural populations, farmers were typically surprised to learn that the health status of rural people was poorer than in metropolitan areas. Just how farmers compared to rural populations was the basis of much discussion early on in the workshop. Key topics included:

- The state of rural health
- Cardiovascular disease
- Cancer including bowel and skin
- Farm health and safety
- Stress and stress management
- Diet and Nutrition – supermarket tour
- Gender related topics delivered in separate groups e.g. prostate cancer, impotence, women’s health and breast cancer

Two health professionals with expertise in rural health, men’s and women’s health and farming experience facilitated sessions. The third party evaluation (Boymal et al. 2007) of the Sustainable Farm Families workshop program identified that one of the key successes of the education, assessment and review processes was that the two original health professionals continued to assess the same participants with the same equipment at a similar time of year over the three years. This made the data gathering more reliable and created the opportunity to develop strong linkages with participants and effective sharing of information about the causes of poor health and appropriate remedies. Conducting the workshops at the same time each year reduced the risk of seasonal workload influences affecting the clinical results.

Hip circumference was measured after removing folds of clothing and was measured with a tape measure to the nearest 0.5 cm. Weight was measured in kilograms to the nearest 0.1 kg. Height was measured in centimetres to the nearest of 0.5 cm on a portable stadiometer. Body Mass Index (BMI) was calculated using the formula BMI = weight (kg)/height (m)^2. A BMI of 30 or greater was considered as obese while other measurements were ranked based on WHO definitions (Balkau 2002)

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**Figure 1. The SFF Model of Change.**

<table>
<thead>
<tr>
<th>Participation in SDFF project</th>
<th>Behaviour changes</th>
<th>Changes in clinical indicators</th>
<th>Changes in morbidity &amp; mortality</th>
<th>Benefits of these changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance all 3 years</td>
<td>Self-report</td>
<td>Measured after 1 year &amp; after 2 years</td>
<td>Projected changes</td>
<td>Estimated benefits</td>
</tr>
</tbody>
</table>

- Increased awareness of individual health status & specific health risks
- Increased understanding of links between behaviour & health outcomes
- Awareness of value of monitoring health & seeking early intervention

- Eating healthier food
- Drinking less alcohol
- More exercise
- Safer farming work practices
- Health follow up checks
- Reducing stress

- Obesity-related indicators:
  - Waist circumference
  - Body mass index
  - Waist-hip ratio
  - Percentage of fat in body mass
  - Blood glucose level
  - Blood pressure
    - Systolic
    - Diastolic
  - Cholesterol level
  - Pulse rate

- Reduced risk of:
  - Cardio-vascular event
  - Death due to cardio-vascular event
  - Diabetes
  - In addition, given the content of the sessions, there are likely to be reductions in:
    - Farming accidents
    - Cancer
    - Anxiety & Depression

- Increased Quality Adjusted Life Years
- Downstream cost savings

Source: Boymal, Rogers, Brumby & Willder (2007)
Physical assessment

A success of the program was the one-on-one physical assessment process that all participants were offered each year as part of their participation in the program. The 30 minute physical assessment also involved the collection of information related to the current state of health of each of the farming family members. The process was structured to undertake initial screening on arrival of participants following a minimum of 10 hours of fasting to aid in accuracy of the testing procedures. Initial screening followed a 3-5 minute initial assessment including the following privately recorded tests:

- Fasting total cholesterol and blood glucose
- Weight and height measurement
- Body mass index
- Body fat percentage
- Blood pressure and pulse
- Waist and hip measurement

A comprehensive one-on-one private assessment followed the initial assessment taking up to 30 minutes and included the gathering of information covering:

- Evaluation and discussion of initial physical assessment results
- Allergies and current medications
- Familial history and incidence of disease
- Neurological assessment
- Skin and integumentary assessment
- Cardiovascular assessment including heart sound assessment
- Respiratory assessment and auscultation
- Gastrointestinal assessment and risk for upper and lower GI disorders
- Urological assessment for relevant risk and disorders
- Sexual history and assessment for disorders
- Social history

Ethics approval was granted from the South West Health Care Ethics committee on the undertaking of specific objectives. The committee made several recommendations including the need to refer participants with fasting cholesterol or blood glucose levels greater than or equal to 5.5 mmols to their General Practitioner and to use the Heart Foundation’s (2002) minimal requirements for exercise.

Results

The average baseline characteristics of the SFF and SDFF participants are presented in Table 1. The mean baseline for body mass index in both the dairy (28.14) and broadacre (26.06) programs were above the healthy range threshold of 25. Dairy participants recorded higher BMI, waist circumference, blood glucose and blood pressure levels than broadacre farmers. Only baseline total cholesterol levels were lower for dairy farmers, which appears counter intuitive to public perceptions of dairy farmers producing and consuming products high in saturated fats and cholesterol. These results are also reflected in the percentage of participants at risk in terms of clinical indicators.

Table 2 below highlights the number of people at risk with four key clinical indicators being body mass index, cholesterol, blood pressure and blood glucose and highlights the higher rate of clinic issues in the dairy population.

The gender of the participants at risk in terms of clinical indicators, perception of health and behaviours is shown in Table 3. Higher percentages of dairy women farmers did not undertake adequate physical activity, had higher waist measurements and not surprisingly this was reflected in raised blood glucose levels. The dairy women also received the highest amount of referral for further follow up with 73 percent of participants being referred. Thirty-four per cent of dairy women indicated that their health interfered with the quality of their life. Conversely, more men noted moderate to severe pain and also higher consumption of alcohol at high risk levels.

What is noticeable in Table 2 and 3 is that the clinical indicators in a number of dairy participants suggest that a large number were at a higher risk for preventable lifestyle conditions such as CVD and diabetes and also experienced higher levels of body pain. The exceptions were total cholesterol level and alcohol consumption being lower than broad acre farmers.
Table 1. Baseline characteristics of SDFF and Broad acre participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>SDFF Number of participants (n = 210)</th>
<th>Percentage of participants</th>
<th>SFF Broad acre program Number of participants (n = 128)</th>
<th>Percentage of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>109</td>
<td>52%</td>
<td>69</td>
<td>54%</td>
</tr>
<tr>
<td>Female</td>
<td>101</td>
<td>48%</td>
<td>59</td>
<td>46%</td>
</tr>
<tr>
<td>Born in Australia</td>
<td>195</td>
<td>93%</td>
<td>121</td>
<td>95%</td>
</tr>
<tr>
<td>Current smoker</td>
<td>15</td>
<td>7%</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Previous smoker</td>
<td>41</td>
<td>20%</td>
<td>28</td>
<td>22%</td>
</tr>
</tbody>
</table>

Variable                  | Mean | Standard deviation | Mean | Standard deviation |
<table>
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<tr>
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<tbody>
<tr>
<td>Age</td>
<td>49</td>
<td>10.98</td>
<td>47</td>
<td>8.79</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>28.14</td>
<td>4.75</td>
<td>26.06</td>
<td>3.44</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>4.98</td>
<td>0.97</td>
<td>5.49</td>
<td>1.10</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>95.7</td>
<td>13.15</td>
<td>91.18</td>
<td>10.79</td>
</tr>
<tr>
<td>Blood sugar level (mmol/L)</td>
<td>5.07</td>
<td>0.82</td>
<td>4.88</td>
<td>0.63</td>
</tr>
<tr>
<td>Blood pressure (systolic) (mm Hg)</td>
<td>131.25</td>
<td>16.26</td>
<td>126.28</td>
<td>15.13</td>
</tr>
<tr>
<td>Blood pressure (diastolic) (mm Hg)</td>
<td>82.57</td>
<td>9.58</td>
<td>79.34</td>
<td>9.08</td>
</tr>
<tr>
<td>Pulse rate</td>
<td>75</td>
<td>8.55</td>
<td>72.89</td>
<td>9.26</td>
</tr>
</tbody>
</table>

Table 2. Number of participants at risk in base year for specific clinical indicators

<table>
<thead>
<tr>
<th>Clinical Indicator</th>
<th>SDFF Percent of participants (dairy)</th>
<th>SFF Percent of participants (broad acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index ≥ 25</td>
<td>78</td>
<td>52</td>
</tr>
<tr>
<td>Total cholesterol level ≥ 5.5 mmol/L</td>
<td>29</td>
<td>35</td>
</tr>
<tr>
<td>Blood pressure (systolic) (mm Hg) ≥140</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Total blood sugar level ≥ 5.5 mmol/L</td>
<td>17.6(16.6)*</td>
<td>10</td>
</tr>
</tbody>
</table>

* people with diabetes, even when their diabetes is well managed are likely to have a high early morning fasting blood sugar level. Of the 5 dairy farmers with a pre-existing diagnosis of diabetes, 3 had blood glucose levels above 5.5 mmol/L. If participants with a pre-existing diagnosis of diabetes were excluded from the analysis then 16.6% of dairy farmers would have been at risk in the base year.

Discussion broad acre

Workshops were conducted across Victoria, New South Wales and South Australia in 2003-2006. The majority of agricultural operations included, mixed grazing, cattle and sheep, viticulture, and cropping. The farming groups were keen to discuss the issues effecting modern day farming operations and ways in which farming has changed in the recent years. Some interest was directed at the dry weather conditions and early indications of ongoing water shortages. There was limited to nil discussion relating to climate change rather drought.

These farmers rated themselves as having a high level of physical activity and good to very good health. Their idea of physical activity was usually associated with work on the farm and felt this was ample to maintain good cardiovascular fitness.

Key discoveries

Broadacre farming families were found to have significant issues that directly influenced their health. Through focus group discussion and physical assessment processes participants were able to communicate many of the issues specific to their industry.

Work ethic

Broadacre farming families felt their workplace was different from other farming industries in that they were required to manage risk related to seasonal indicators more than farmers in other sectors were. This was evident in the preparation of crops and the resultant harvesting process through the year. Twenty-hour days were not uncommon during harvesting and isolation and poor sleeping habits were a regular occurrence at that time. In contrast, these farming families reported periods of time when the work demands were reduced and minimal work was required to keep the farm operational at other times of the season. Participants often worked off farm to provide additional financial support and the shared role of husband and wife on the farm was complicated by managing farm, work and family.
Table 3. Gender and health indicators of SDFF and SFF participants

<table>
<thead>
<tr>
<th>Factor</th>
<th>SFF Men n=69</th>
<th>SDFF Men n=109</th>
<th>SFF Women n=59</th>
<th>SDFF Women n=101</th>
</tr>
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<tbody>
<tr>
<td><strong>Health Demographic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian born (%)</td>
<td>97</td>
<td>93</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>Spoke English at home (%)</td>
<td>100</td>
<td>98.2</td>
<td>100</td>
<td>97</td>
</tr>
<tr>
<td>Average Age (years) Range</td>
<td>48 (20-74)</td>
<td>49 (23-76)</td>
<td>46 (28-63)</td>
<td>47 (22–71)</td>
</tr>
<tr>
<td>Drink alcohol once per week (%)</td>
<td>86</td>
<td>67</td>
<td>67</td>
<td>54.5</td>
</tr>
<tr>
<td>Drink high-risk levels* at least once a month (%)</td>
<td>54</td>
<td>44</td>
<td>22</td>
<td>12</td>
</tr>
<tr>
<td><strong>Perceptions of Health</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical activity 30 min per day most days (%)</td>
<td>75</td>
<td>85</td>
<td>73</td>
<td>72</td>
</tr>
<tr>
<td>Report health as good, very good to excellent (%)</td>
<td>90</td>
<td>93</td>
<td>94</td>
<td>92</td>
</tr>
<tr>
<td>Suffer moderate –very severe bodily pain (%)</td>
<td>30</td>
<td>27</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Health interfered with activities of daily life</td>
<td>30</td>
<td>40</td>
<td>29</td>
<td>34</td>
</tr>
<tr>
<td><strong>Health Indicators</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist size above recommended level c</td>
<td>26%</td>
<td>37.6</td>
<td>38%</td>
<td>56%</td>
</tr>
<tr>
<td>Elevated Body Mass Index d</td>
<td>70%</td>
<td><strong>73.4%</strong></td>
<td>21%</td>
<td>47%</td>
</tr>
<tr>
<td>Elevated fasting cholesterol e</td>
<td>43%</td>
<td>38.5%</td>
<td>38%</td>
<td>18%</td>
</tr>
<tr>
<td>Elevated fasting blood glucose f</td>
<td>13%</td>
<td>15.6%</td>
<td>8.6%</td>
<td><strong>17%</strong></td>
</tr>
<tr>
<td>Urinary problems g</td>
<td>43%</td>
<td>41.2%</td>
<td>61%</td>
<td>55%</td>
</tr>
<tr>
<td>Suffering from muscle, joint pain, back pain</td>
<td>68.6%</td>
<td>72.5%</td>
<td>41%</td>
<td>59%</td>
</tr>
<tr>
<td>Participants referred for further follow up (% with actual numbers in brackets)</td>
<td>60% (42)</td>
<td>63% (69)</td>
<td>71% (41)</td>
<td>73% (74)</td>
</tr>
<tr>
<td>Total number of referrals written – GPs, dietetics, clinics and counsellors</td>
<td>45</td>
<td>70</td>
<td>53</td>
<td>93</td>
</tr>
</tbody>
</table>

Source: Brumby SA, Willder SJ, Martin J. 2009

* More than 6 standard drinks in any one day for men and four standard drinks for women (National Health and Medical Research Council 2001).

b Physical Activity for 30 minutes on most days of the week (Heart Foundation 2002)

¢ Waist circumference greater than 88cm in women and 102 cm in men associated with greater risk of diabetes (International Diabetes Institute 2001)


e Fasting screening cholesterol over 5.5mmol referred to General Practitioners for further follow up (Southwest Ethics Committee 2003)

f Fasting blood glucose over 5.5mmol referred to General Practitioners for further follow up (Southwest Ethics Committee 2003)

g Dribbling of urine when lifting, cough or sneeze, getting up more than once through the night, difficulty controlling flow (Continence Foundation of Australia 2002)

Food and lifestyle During the overlap of both the SFF and SDFF program, it was noticed that the broadacre farmers as a group had significantly higher levels of fasting cholesterol than dairy farming families. This prompted the researchers to ask the question about meat consumption and the slaughtering of their own farm grown meat for personal family consumption. This question was not asked until year three of the broadacre program. Of the original 128, 112 participants responded to this question with 62.5 percent indicating that they slaughtered their own meat; 96% killing sheep (lamb, mutton, two tooth) and 27 percent also slaughtering beef. Pork, rabbit and duck were also mentioned. This may have some clinical indication in the level of fasting cholesterol, which was higher than the dairy farming families who had informed us that very few dairy farmers slaughtered lamb for their personal consumption. Through pre-workshop survey questions it was clear that diet and nutrition knowledge was poor. While the recommended meat serving sizes of 120 grams was met with hilarity in the workshop, the clinical indicators showed that the broadacre workshop participants had reduced their consumption of cholesterol over the three years of the program.

Health indicators A summary of the health assessment results were reported back to each workshop at the end of the first year. Key health indicators revealed significant health issues relating to potential diseases and increased mortality and morbidity, which became the motivation, both individually and collectively for change and also peer support – as most knew several other farming families participating in each program. In the elevated sample there was a greater improvement in clinical indicators over the life of the program, indicating that increased understanding between diet, exercise had impacted on clinical indicators. As outlined by Blackburn et al. 2009, high risk participants in the SFF Program reduced their risk for lifestyle disease such as cardiovascular disease and diabetes.

Alcohol consumption for both men and women was higher amongst broadacre farmers than dairy farmers. Both men and women in the broadacre groups rated their health as good, very
good or excellent. However, the need for referral for further follow up in both broadacre and dairy groups was approximately 70% for females and 60% for males.

**General findings**

There were many trends that were relevant to their industry as listed below:

- Rashes, skin conditions and suspicious skin spots were common amongst the group and revealed prolonged skin exposure issues and constant rashes involving heat, fungal infections and dermatitis.
- Sexual dysfunction including erectile dysfunction and impotence was noted in the male sample yet below what was detected in the dairy participants.
- Physical activity was minimal in males and females (although self-reported as adequate) and many noted social isolation, seasonal pressures and distance to services as key reasons for this.
- Farm health and safety issues were prominent including lack of helmet use due to heat and discomfort and the belief that they were ‘safe riders’. Parents said they encouraged children to wear helmets.
- Safe use of equipment and plant was often stated to be dependent on money to maintain this to a safe level.

**Discussion dairy industry**

The dairy industry group had 210 participants selected from the 10 dairy industry regions across Victoria (and an eleventh workshop held in Melbourne for dairy industry leaders from across the State). The farming enterprises focused primarily on dairy with a few involved in beef farming. The sample was similar in demographics to the broad acre group with mean age, nationality and self-reporting of health status. While it was more difficult to recruit dairy farmers (who worked morning and night and attendance at day-long workshops was problematic for some) the workshops were well attended and retention rates over the three years were high. The SDFF program was adapted to facilitate their attendance by starting later and finishing earlier to allow for milking requirements.

Group participants were happy with their level of health and self rated this as very good to excellent at the same rate as the broad acre groups. Participants felt that working with bodily pain was the norm and this was highlighted with up to a quarter of men and women experiencing bodily pain on a regular basis.

**Work Ethic**

The work ethic within the dairy industry was different to the broad acre families with both husband and wife being the key farming unit driving production and operations within the business. The restriction of the dairy enterprise was evident with minimal time available to travel, holiday and even support community activities. Farmers also noted the difficulties in accessing additional labour to support the operation of the farm and the lack of confidence exhibited by many dairy farmers to entrust others to look after their farm. Many stated that holidays have been non-existent for years due to the workload demands of the farm. This demand limited the families’ ability to get off the farm and socialise as well as limiting other activities including physical exercise, participating in groups, sporting or social opportunities for children and more general community engagement. The increased risk of burnout and the challenge of work life balance has also been recognised by the dairy industry (Ison 2007) There was limited reporting of off dairy farm work with husbands and wives having equal responsibilities on the farm. Roles and responsibilities were in most cases equally shared and each understood and respected the role of the partnership in this type of farming enterprise.

**Food and lifestyle**

Many highlighted that they do not access the vat for their source of milk for consumption. Dairy farms were located in more closely settled rural regions and closer access to towns with larger supermarkets and choices available, than the broadacre farmers. This also included purchasing milk – particularly low fat brands. The dairy farmers were asked in the second year if they slaughtered their own meat for personal consumption with 61% indicating they did. Only 32% reported killing sheep but 93% (n=107) reported killing beef and also pork and poultry. Food consumption patterns were more regular with breakfast, morning tea, lunch and other meals consumed together. Access to physical activity was limited and they believed the completion of activities associated with farming was sufficient enough for positive health benefits; as was noted by broad acre farmers. Dietary knowledge was similar to the broad acre group with minimal knowledge relating to food composition, daily requirements and label reading principles.

The level of elevated blood glucose results within the dairy industry was concerning and over the three years this continued to remain a significant indicator. Results for the dairy industry
revealed over 17% of females and 15% of males had fasting blood glucose readings elevated above 5.5 mmols. This was higher than the broad acre group.

*Health Indicators* A common theme noted within the dairy sample was the high level of fasting blood glucose levels, high body mass index and waist hip ratios outside the recommended ratios. Weight issues were common and significantly higher in the females when compared to the female broadacre farmers. Women in particular have a relatively sudden increase in their level of risk at menopause as the protective effects of oestrogen on cardiovascular risks diminish. Many women also experience metabolic changes that result in weight gain and a subsequently higher risk of both cardiovascular disease and diabetes. Bodily pain was common with moderate to severe pain a daily occurrence and referral levels were marginally higher than the broadacre farmers.

*General findings*

The dairy industry prompted us to question the influencing factors that exist amongst different farming enterprises and how these contribute to the health status of farmers in these industries. Of interest was the level of sexual dysfunction reported by men and the level of concern revealed by the females. The female participants would often state that the level of intimacy and sexual contact was low and expressed that they would hope that their partners would discuss this during their physical assessment. The men when asked about their sexual function discussed many factors including tiredness, lack of interest, difficulty and the need for supportive intervention such as PDE5 inhibitor use (Phosphodiesterase inhibitors e.g. Viagara) and contacting clinics for review. Our discussions with participants (one-on-one) often centred around the level of sleep participants had and the time constraints experienced on the dairy farm as contributing factors for this health and well being issue. To date we have not had this level of concern about a sexual health issue reported by participants from other agricultural industries (the SFF program has been undertaken in sugar and cotton in addition to broad acre and dairy).

Other health issues included:

- A high level of self reported skin and noted issues which mainly affected the hands, through calluses, cuts and affected by dermatitis.
- High level of self reported bodily pain including arthritis, back and joint pain.
- Increased levels of psychological distress were noted within the sample, which was demonstrated with the Kessler 10 psychological assessment scores.
- Men and women had poor knowledge relating to gender specific health issues including prostate, continence, breast screen and cancer screening.

*Action Planning*

Following the year one program, participants were asked to identify areas where they could improve their health, wellbeing or safety.

In both the SFF and SDFF program these activities was successful with men and women from the same farm setting different personal goals, adopting different actions and achieving different outcomes. Participants indicated two – three actions that often linked with their clinical indicators, suggesting that the participants’ were aware of areas they needed to address. This method of participation and engagement was very popular among SFF participants with 325 participants forwarding their action plan (96% response from the baseline year) and over 930 actions documented reflecting the enthusiasm for addressing their own priorities.

More dairy farmer participants chose to focus on stress management rather than increase their physical activity or reduce their weight and this is reflected in their clinical outcomes in Table 4. The rate of change and improvement in the dairy farmer clinical indicators is less than the broad acre farmers who focussed more on diet and exercise in their action plans. Since 2006, much more publicity around type two diabetes and the risks for people with higher body mass index and waist circumference has increased awareness in the general population of this relationship. Whereas previously most people knew about the causes of cardiovascular disease and heart attacks and took steps to reduce their consumption of cholesterol, much less was known in the general community about being overweight and the increased likelihood of type two diabetes.
Table 4. Mean change in clinical parameters from baseline to year 3 for those at risk in base year, dairy and broad acre.

<table>
<thead>
<tr>
<th>Clinical Indicator</th>
<th>Dairy Mean (±Standard Error)</th>
<th>Broad acre Mean (±Standard Error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index ≥ 25</td>
<td>-0.17 (0.12)</td>
<td>-0.44 (0.16)**</td>
</tr>
<tr>
<td>Total cholesterol level ≥ 5.5 mmol/L</td>
<td>-0.48 (0.14)***</td>
<td>-1.26 (0.12)***</td>
</tr>
<tr>
<td>Total Blood sugar level ≥ 5.5 mmol/L</td>
<td>0.18 (0.17)</td>
<td>-0.56 (0.15)**</td>
</tr>
<tr>
<td>Waist Circumference - Women &gt;88cms</td>
<td>-1.10 (0.85)</td>
<td>-3.17 (0.69)***</td>
</tr>
<tr>
<td>Waist circumference - Men &gt; 102 cm</td>
<td>-2.42 (0.67)***</td>
<td>-3.25 (1.498)</td>
</tr>
<tr>
<td>Blood pressure (systolic) (mm Hg) ≥140</td>
<td>-10.68 (1.71)***</td>
<td>-12.5 (1.91)***</td>
</tr>
<tr>
<td>Blood pressure (diastolic (mm Hg) ≥90</td>
<td>-10.10(0.96)***</td>
<td>-5.00(1.40)***</td>
</tr>
</tbody>
</table>

P≤0.05*, P≤0.01**, P≤0.001***

Conclusion

The SDFF and SFF programs are continuing to provide Australia’s health industry with important information relating to the health of our farming families. This research has revealed that there are both similarities and differences related to key health indicators and psychosocial aspects of the broadacre and dairy industry groups. Both industries have different work patterns, daily and seasonally, and this affects farmers health, wellbeing and safety in different ways. As people age, health risks generally increase and the number of people with clinical indicators that put them at risk increase over time. While the mean ages of the dairy and broad acre farmers were not significantly different the distribution of ages did vary between the 2 groups. There were a higher proportion of dairy farmers aged over 50 as compared to broad acre farmers. The proportion of women aged over 55 was also significantly higher in the dairy farming group.

The SFF and SDFF program has influenced participants’ decisions regarding diet and nutrition, exercise, behaviourial (safety) and lifestyle factors through increasing knowledge, objective measurement of health indicators (see Table 4) and subsequent changes through documented action plans (see Figure 2). Participation in this SFF program is associated with an improvement in some clinical indicators and participants have reported changes in their knowledge and behaviour undertaking actions across a range of personal, family and farm related areas (Brumby et al. 2008). It is the only program that attempts to address this public health issue in the Australian farming community. The newly established National Centre for Farmer Health at Deakin University, in partnership with the Western District Health Service, recognise that more research needs to be undertaken with farmers to find the relationship and balance between life as a farmer and the health indicators. We continue to focus on reducing the number of people who increase their clinical risk factors during the program, as well as on reducing the risk levels for those who are at risk at the start of the program.

The finding through the SFF projects has informed us of the health status of farm families and their capacity for change through increasing their knowledge, addressing their health indicators and empowering behaviour change. These findings suggest that cross-sectoral intervention (health, industry, research, farmer groups, service delivery) is an effective method for improving health, wellbeing and safety in farm men and women and their families. The success of this program is a combination of several key factors: it addresses primary health concerns of family families and it locates the discussion of improved health and wellbeing within the context of the family farming business. It does this by working with other family families in a participatory workshop format. It engages industry, health services and universities in a purposeful process of enquiry that aims to enhance the health, wellbeing and safety of Australian farming families.
Figure 2. Action planning choices following year 1 workshop

Acknowledgements

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Water security: how can extension work with farming worldviews?

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Abstract. Water for irrigated agriculture is increasingly contested, and policy approaches are increasingly turning to water markets and new technologies to achieve water resource management goals. Public sector extension services are often in the “front-line” for brokering on-farm change and policy outcomes. This paper outlines the variation in farmer worldviews identified from an action research study involving social researchers and extension based on case study farms in both the Northern Victorian and Macalister Irrigation Districts of Victoria. Seven different water worldviews were distinguished by the research team from qualitative analysis of water management decisions on 12 case study farms. The descriptive titles assigned were: Utilitarian; Pragmatic; Eco-social; Custodian; Agri-centric; Cornucopian; and Autonomous worldviews. These worldviews are influencing decisions concerning water use, the perceptions of policy changes, the perceptions of opportunities available and therefore the options considered possible or feasible for farms. It is concluded that because the public extension role in irrigation management is expected to support improved irrigation practices that reduce environmental impacts, increase water savings and/or enhance profitability, extension and policy need to engage with the water worldviews of irrigators, and this research provides insight to some ways in which this is feasible.

Keywords: Water worldviews, irrigated farming systems, reflective practice, extension

Introduction

Dairying is one of Australia’s top three rural industries with a farm gate production value of AUD$3.2 billion and it is the fifth most important industry in terms of agricultural exports (AUD$2.5 billion). There are 7,000 Australian dairy farms with an average herd size of 232 cows run predominantly as owner-operated farms (Dairy Australia 2009). The Australian dairy industry uses 25% of the surface irrigation water in Australia, and has 57% of its farms fully or partly dependent on irrigation to maintain the productivity of their farms (Dairying for Tomorrow 2006). For dairy farm businesses, reliable and affordable irrigation water has been a central platform to farm viability and profitability. However, this is changing. Recent low water allocations, climate change concerns and high water prices have meant a re-think for farmers about the place of water in their business. Farmers are actively looking for alternatives for viable and profitable production and, for the dairy industry, understanding, anticipating and adapting to change in the new operating environment for water is a necessary part of industry strategy. Yet how much emphasis do industry and policy place on understanding the adaptation challenge of changes in irrigation water allocation and pricing at a farm level? What is the role and issues for extension as a professional practice engaged to support on-farm preparedness and adaptation in the face of policy and environmental change?

This paper provides an overview of research into farmer decision making and the role of extension, with particular emphasis on the influence of water worldviews on practice, and the role of extension in challenging worldviews. The research results are described in two parts: The first part describes seven different water worldviews emerging from qualitative analysis of 12 case study farms and the implications for extension. The second part describes and critiques the development and use of an extension tool to aid in the identification of water worldviews by extension and in positioning extension practice.

Viewing water security from a farmer’s perspective

For irrigated dairy farmers, water security includes the allocation policies of governments and water authorities, the types of entitlement or ownership through which they have access to water for irrigation, the efficiency of their individual farming systems in producing pastures and forage, and the irrigation practice they employ. A farmer’s actual water security can extend to include the equity they have in their business and their capacity to purchase additional water rights or water on an annual basis, as well as the annual cost of water right deliveries. Farmers can also suffer a loss of water security through an unmanageable increase in labour demands during periods of reduced water allocations. For the dairy industry as a whole, water security can be threatened through restrictions placed on the discharge of nutrient and salt-rich waters from dairy farms into regional watercourses and lakes, or through the redirection of water from agricultural to environmental uses through government policy. Whether or not changes in
Victorian water allocation policies associated with the conversion of sales water into a lower-reliability water share actually gives irrigators greater water security depends to a large extent on the perspective taken to such issues - is an unsecured but regularly bestowed benefit better or worse than a benefit guaranteed but reduced? (Gomez-Limon and Riesgo 2004).

It follows then, that in order to understand “water security” it is necessary to understand how farmers make sense of water in their business. The information being sought, the meaning ascribed and the action taken by farmers concerning water become the entry point for understanding how they cope with interruptions and is something that a physical analysis of a farm’s technical water use efficiency (Armstrong, 2004) and water situation will not do. Weick’s Sensemaking framework (Weick 1995, p. 17) includes seven properties of “making sense”:

- grounded in identity construction (the orientation to situations that maintain esteem and consistency of self-conception)
- retrospective (reflective and interpretive of past actions)
- produced through action in context (producing the environments we act in)
- social (contingent on others)
- ongoing (not starting or ending)
- focused on and by extracted cues (simple, familiar structures or points of reference)
- driven by plausibility rather than accuracy (enough certainty to act again).

This framework emphasises the importance of the every-day actions of individuals or groups that underpin competence and how action evolves as successful responses to uncertainties. Decision-making is therefore viewed as a product (rather than a precursor) of actions (Weick 1995) and an evaluative process for actions as responses to uncertainty (Choi 1993; McCown 2002). The focus for intervention then becomes one of facilitating new action, rather than supporting decision-making per se. This shift in perspective is contrary to what may be described as the prevailing “theory-in-use” (after Argyris and Schon 1987) in which information processing is the predominant view of human cognition. Locating information provision becomes the central issue for change-agents (e.g., Fountas et al. 2006) despite contrary evidence suggesting the social and practical dimensions of action are the source of change (McCown 2002).

**Worldviews**

Worldview is a widely used term with many interpretations. Worldview (derived from the German term Weltanschauung), is the overall perspective from which one sees and interprets the world and the collection of beliefs about the world held by an individual or group (Churchman, 1971). It is a high-level concept, one that pervades every aspect of thinking and doing, influencing the way problems are solved, goals are pursued and practice performed. Because people view the world differently, ‘reality’ is filtered and shaped by past experiences, personal beliefs and values and this makes-up one’s ‘view of the world’. The need to understand and incorporate different worldviews of people in the definition of a problem situation and the definition of action to improve a situation is a central concept in soft systems thinking and soft systems methodologies (SSM) (Churchman 1971; Ackoff 1979; Checkland 1981;; Checkland and Scholes,1990). An individual’s worldview will be unique to them but there will be common elements and ideas that will be evident in what individuals do and the opinion they express. Worldview then becomes something that can be looked for by observers to help understand a social situation (Checkland and Davies 1986). For the purpose of this research we were particularly interested in exploring worldviews that concern the taken-as-given assumptions that farmers use to guide their action in water management and the challenges and problems they face in water security. We argue that an appreciation of worldviews and their influence on practice is essential for understanding the nature of support to change.

**Extension and worldview**

In their study of intentional learning of dairy farmers, Kenny (2002) and Paine and Kenny (2002) identified three attributes of extension practice when working with farmers: extension focuses on farmer action; on farmer intentions; and it appreciates the worldviews of both themselves and farmers, when engaged in learning relationships. That is, extension is looking at how the farmer explores options, appraises feasibility and conducts reality checks – all the ‘non-reflective’ activities making up farming practice. Extension also gains insight into the intentions of farmers (the planning that is anticipating future results from certain actions: the goals, objectives and perception of barriers associated with their farm practices). However intention and action is affected by some form of criteria embodied by individuals that influence how they appropriate action strategies – the criteria or frame through which intention and action is assessed is how extension uses the concept of “worldview”. Worldviews can affect the reflective
process by setting the criteria by which actions are examined relative to the intentions of the farmer. Advisers can explore the farmers and their own worldview and its impact on performance and can provide challenging worldviews using stimulating questions based on assessments of current performance relative to the adviser's knowledge of the farmers' intentions. This discussion will ground the role of extension in a learning relationship.

Many farmers may have a worldview that does not include a need to change or improve their performance – particularly according to the 'rules' that extension, policy or research organisations may view as underpinning competent performance. In these situations the learning relationship can become 'tension filled' as different practices seek to influence the others way of making sense of the situation. Regardless of the contrasting worldviews in a relationship, practitioners can still engage in a conversations based on practice – what people are doing and why.

How might this be applied to the issue of water?

Can the worldview of farmers in relation to water be impacting on the way opportunities from water markets or environmental flows are perceived? How can extension work with the worldviews of farmers in change? The following research questions emerged from this questioning of the degree to which an understanding of the farm perspective was having in the practice of extension in an irrigation context.

1. How are farmers adapting and making sense of the need for different farming systems with respect to water?
2. What options are being considered and why? What is informing choices concerning farming systems?
3. What forms of support relationships (extension/advisory, policy) for farmers are required to effectively manage through water resource changes?

Research approach

The research examined the water resource management decisions of 12 case study farms in the Northern Irrigation Region and the Macalister Irrigation Districts of Victoria over the period 2002-2005. The case studies were then used in an action research process with different extension agents in these regions to reflect and theorise about current approaches to water resource intervention and the planning and testing of new approaches, as "reflective practitioners" (after Schon 1983, 1987). The research findings were drawn from the experience, decisions and issues faced by the 12 farmers, the extension officers supporting the change and a social researcher (see Nettle et al. 2006). The research reported here focuses specifically on the analysis of differing worldviews of the farmers and implications for extension practice.

The research team (extension and irrigation officers and innovation researchers) chose farms as case studies using specific criteria developed for each region and the extension interest. The aim was to choose cases that would offer variation in: current capacity to improve water resource management and manage through changes in water allocation rules and policy; on-farm roles and responsibilities; beliefs about the need to change; the particular water issue for the farm and the availability and use of information and advisory services in the region.

In the Northern Irrigation area, farmers attending an irrigation course run by the Department of Primary Industry were chosen. The selection criterion for these farms was the perceived different level of preparedness that farmers had for water security changes at entry to the course and different levels of information seeking behaviour. In the Macalister Irrigation District (MID) farmers were selected based on their involvement (or non involvement) in an irrigation course run by the Department of Primary Industries local irrigation officer, their use of whole farm planning (or not) and use of new irrigation technologies.

Semi-structured interviews with the twelve case study farmers were undertaken by rural innovation researchers and, in the MID, an irrigation extension officer. The interviews were conducted in July and August, 2005 and explored:

1. What farmers were doing in relation to water management on their farm and why.
2. How farmers were going about implementing changes on their farm regarding water use.
3. How farmers learnt about and managed water on their farm.
4. How farmers sought and used information and advice regarding water management in their business.

All interviews were audio-taped and transcribed. The transcripts provided the data for the production of case study descriptions and analysis. The case studies were assigned a
Identifying worldviews from the case studies involved a form of discourse analysis (Potter and Wetherall 2004) whereby verbal ‘cues’ from the farmers about their attitudes and beliefs about water and farming were explored. This involved interrogating the text using the questions: “what attitudes, beliefs and/or values seem to underpin their position or action regarding water management?: Is this influencing practices or changes on this farm? How and why? (i.e. what is considered ‘in’ or ‘out’ in terms of options?). Then a descriptive title was chosen for the particular worldview to reflect the main underpinning attitudes, beliefs and values impacting on water management. Following this, the extension agents in the research team considered the potential extension strategies that might support changes on the farms based on worldviews. This covered issues such as: what extension options might be aligned or otherwise with particular worldviews, ways to work with the worldview; the conditions under which they might be able to challenge the farmers worldview; reflecting on their own worldview with respect to farming and water-use and whether their own worldviews were consistent or counter to these farms worldviews? The analysis method described is consistent with an action research framework within the realm of research for professional practice (Argyris and Schon 1996). The results below are presented to reflect this process by outlining the water worldviews defined by the research team, providing an illustration of the verbal cues identified by the research team that led to the definition and then outlining the extension officers reflections on the implications of this worldview on their practice. Before the results are presented, the context for water management practices on the case study farms is provided through a summary of the water allocation arrangements in the Northern Victorian irrigation area and the Macalister irrigation district.

The Victorian Northern Irrigation Region (NIR) is situated along a 500km stretch of the Murray River basin, between Cobram and the Victorian-South Australian border. The region has extensive areas of irrigated pastures for dairy farming, and irrigated horticulture and cropping. Approximately 20% of Australia’s milk production comes from this combined northern Victoria and Riverina dairy region (Dairy Australia, 2009). Irrigators, including dairy farmers, on both sides of the Murray River share a semi-regulated water market that currently allows for trade in annual (temporary) water, and permanent trading of water right (since unbundling in July 2006). The volume of water irrigators can access each annual irrigation season is determined by the amount of water right owned by them, measured in megalitres, and the water right allocations made available by Goulburn Murray Water for that season.

The Macalister Irrigation District (MID) Water for the MID is primarily diverted from the local river and stored in Lake Glenmaggie, which receives annual inflows of over 500,000ML, well above its storage capacity of 190,000ML. In the legally gazetted boundary of the MID, the irrigators, including approximately 500 dairy farmers, hold an entitlement to water right (or a 15-year licensed volume) for a certain amount of water, measured in megalitres. The spill-and-fill storages of Lake Glenmaggie enable a policy of water right allocation that is unique. Under this system, water that irrigators take from the start of the irrigation season in August, while the lake is filling, draws down their water right allocations. Once the lake fills and then spills (typically around mid-September) the water that irrigators have already taken becomes ‘off-quota’ or ‘spill entitlements’ and is no longer counted against their water right allocation. This off-quota water is charged to farmers on a per megalitre basis at the same price as water right for that year. Unbundling of water right from land occurred in July 2008.

Results

The results are divided into two parts. The first part describes seven different water worldviews emerging from qualitative analysis of 12 case study farms and the reflections of the extension officers involved in the research team. The second part describes and critiques the development and use of an extension tool developed from the case study analysis to aid in the identification of water worldviews and to position extension practice.

Part 1: Appreciating differences in water worldviews and implications for extension

Seven of the case study farms have been grouped under a descriptive title chosen to reflect the key aspect of the water worldview emerging from the analysis. For a full description of each of the case study farms, see Nettle et al, (2006). For closer analysis of the actions and practices of two of the case study farms and the implications for advisory practice and policy making, see Nettle and Paine (2009).
A "utilitarian" water worldview

Adam is 40 years old and is married with young children, he has owned the farm (located on the Goulbourn irrigation system) for about 16 years. Adam’s key water decisions (2002-2005) were: Sell permanent water; buy temporary water; change to a fully flexible dairy production system (adjusting herd size and production on the basis of milk, water and feed prices in a given year).

Verbal cues to a "utilitarian" water worldview: Adam manages water on his farm opportunistically. He views water as a tradeable, functional resource rather than a long-term asset for achieving business goals and recently sold his permanent water right: 

“...while I owed money on that water right, I had to make money every year to pay the interests. Now, I’m buying temporary water; if I want to shut up shop and close the production system right down and slow it right back, I can do it.”

Adam views water as a factor of production rather than an asset and this utilitarian view of water affects how he views options for his business:

"It's a lot more flexible, ...while we had a heap of debt hanging over our head and paying interest, effectively on the water right, we had to answer to someone else all the time”.

Adam values flexibility, control and profit – and decisions regarding water are based on achieving production and profit control.

Extension reflections on the implications of a "utilitarian" water worldview for practice: Adam’s practices lie outside the traditional bounds of dairy farm extension. Extension identifies many risks for Adam from these beliefs including: the casual water use fee as a factored cost in decision making and the uncertain implications (for production and profit) from reliance on purchased, temporary water. Although Adam’s utilitarian worldview may align with market-based water policy, extension officers believe Adam will need highly accurate information on casual use fees and delivery share, and a high degree of management competence to manage more annuals and summer crops. Further, the long-term implications from a financial and investment perspective of Adam’s strategies would need to be thought through.

A "pragmatic" water worldview

Bruce is 50 with teenage children and farms on the Murray Irrigation system. Bruce’s key water decisions (2002-2005) were: purchased temporary water for the first time; increasing intensity of production on smaller areas of the farm to improve irrigation efficiency; changed calving pattern; changed forage base to more annuals; considered automatic irrigation; considering water purchase (via farm purchase).

Verbal cues to a "pragmatic" water worldview: Bruce tries to match the water he uses to the needs of his current production system on a seasonal basis, but also regards his water “right” as something of value to his farming future. Bruce’s normal water management had been challenged through recent seasons because of the ongoing drought and reduction in allocations and this had prompted new practices concerning purchasing temporary water and increasing irrigation efficiency:

“I grew a lot of grass, and the production I’ve been doing this year (2004–05) has been better than I’ve ever done. I got the returns from it, but I think I can do it more efficiently next year”...“We’ve looked at buying the block next door, because that’s got a little bit of water right with it, that’s still for sale but we haven’t been able to negotiate a price we’ve been happy with. We’ve looked into buying water rights...it’s not a viable option at this stage, we’re better off buying temporary water than we are buying water rights.”

Bruce indicates a reliance on his water right as a long-term asset that he believes will increase in value and provide a level of security to the farm business in the long-term. Water is a “family” asset to be preserved. Other farmers, south of Kyabram on the Goulbourn irrigation system, (Fred and his son-in-law Greg) appeared to hold similar attitudes: Fred and Greg’s key water decisions (2002-2005) were: purchased more land for the water; install automatic irrigation system; laser grading.

More verbal cues to a "pragmatic" water worldview: Fred and Greg view water as an asset for their business with a key priority being to source more water for their business in the short term. They position water policies as a direct threat to their business and the industry.
'Well on 100% [water allocation] we’re pretty well right, but ...I sort of feel that if we had another 50–100 megs [ML] of water it would put us in a pretty secure position (Greg) ...It [water right] is money in the bank, really, especially these days (Fred) ... The way it is now, we’ve got to look after every drop, we are sort of borderline (Greg)...But if they (government) want a dairy industry they’ve got to allow us to make a profit, otherwise we’re wasting our time being there (Greg)

Extension reflections on implications of a “pragmatic” water worldview for practice: Bruce and Fred and Greg are all production-focused with beliefs that water is central to the productivity of their farms. Therefore, water is something that ‘just has to be sourced profitably’. This pragmatic water worldview aligns well with irrigation extension in terms of aligning water use with the achievement of farm business goals like profit. However, the variation in farms from the perspective of assessing needs, suggesting suitable technologies, identifying opportunities and looking for ways to support the achievement of long-term goals mean a “one-size fits all” approach on the basis of worldview is not appropriate either. However, a learning relationship established with these farms with aligned worldviews mean extension is well placed for conversations about future policy changes that may affect ground-water into the longer term or future climate change policies for instance.

An "eco-social" water worldview

Cliff and Donna are a young farming couple working towards the establishment of a successful, medium-sized farm business, with sustainable land management in the Goulbourn irrigation area. They began lease-purchasing their dairy farm in September 2004. Cliff and Donna’s key water decisions (2002-2005) were: change calving pattern; purchase temporary water; change pasture mix; build herd size (as part of farm business development); active participation in environment and irrigation development groups.

Verbal cues to an "eco-social" water worldview: Cliff and Donna have one eye on their business and another on their business in society and how it is perceived. Their personal preferences take a back-seat to the farms physical characteristics in defining the farms production system.

We looked at ... how much water is here, how much land is actually laid out for irrigation, how much is irrigatable properly – as in efficient irrigation – and also we looked at how many cows did we want to milk, from a lifestyle balance. So we ... came up with figures around 300 [cows] in about two-and-a-half seasons, that’s what we’re ...aiming for...you’ve got to have goals...to be efficient. (Donna)

Water is basically our turning point. And we looked at our farm system at the moment and being spring calvers ... this soil type is ...a lot heavier – so we looked at ...split calving, or stay at spring calving, or majority of autumn calving? So now our decisions have changed to go to autumn calving, purely because of the soil type. And the soil type here, you maximise your water usage with sub pastures, so basically your annuals (Donna).

Donna identifies herself as an irrigator rather than a dairy farmer:

Somehow we have got to put that positive message out about irrigators, and that we are prepared to listen to what consumers are saying. Because they’re a very powerful lobbyist, but also we’ve still got to run our business and so we have to be sustainable. It’s an education process for consumers too, and politicians, on what we are doing. ...Possibly down the track to be allocated water you’re going to have to meet criteria... we comply with regulation whatever they’re going to be...(Donna).

Cliff and Donna reflect a form of eco-centricism where their personal preferences or opportunity to modify the farm characteristics are secondary to what fits the farm. Water is more than a production input or an asset to them – it is a pathway to environmental sustainability of their farming businesses - and other dairy farmers.

Extension reflections on the implications from an "eco-social" water worldview on practice: Extension can identify a number of risks to Cliff and Donna’s achievement of their goals including the risks from debt from farm development priorities and water prices. However, in working with them on a prioritised action plan for the large number of water-use efficiency issues that make a difference to their profit whilst supporting their non-production goals may offer extension an opportunity to learn about the way eco-social and business goals can intersect – this is triple-bottom-line farming in practice.
A "custodian" water worldview

Julie and Kev (farm manager) farm on the Murray Irrigation system near Nathalia and milk between 100-130 cows. Julie works off-farm. Julie and Kev’s key water decisions (2002-2005) were: Julie is thinking of selling the farm; feed purchase rather than water purchase through the drought; modified calving pattern; some purchase of temporary water; improved irrigation system, laser grading; introduce oats and lucerne into the forage base, pasture renovation.

Verbal cues to a "custodian" worldview: Julie and Kev believe water is a right for their business – a right that is being taken away:

“The costs are just... when you haven’t got water, the feed costs are up. So whichever way you do it, it’s either because of lack of water allocation, you’re in this cost squeeze. You’ve got to buy too much fodder, or you’ve got to buy the water. (Julie) We’re going to have to sell because we can’t physically keep going much more than twelve months (Julie).

The old politicians set it up [the irrigation system] years ago to try and make the country profitable. Now they’re doing everything they can to break it, to kill it… The main thing behind it is that someone is going to make heaps of money selling water to people who are desperate for it. (Kev).

Julie and Kev believe they have no ability to compete for water resources. The ability to source water to meet production needs is constrained by their cash-flow, business structure and future goals of the business. The changes to water rules reinforce in their mind the sense that there are no options for them. The commitment to try and improve and make the most of their situation despite an apparent “hopelessness” in a viable future conveys a strong sense of resilience on the part of Julie and Kev and also a commitment to the profession and practices of farming.

Extension reflection on the implications of a "custodian" water worldview for practice: This water worldview is confronting to extension and its role. Julie and Kev require a good exit plan and motivation and support. Extension officers perceive a risk from their commitment to farming is that they will continue to spend money on the farm that may not give a return at sale.

An "agri-centric" water worldview

Harold bought the farm in 2002 after many years leasing and sharefarming. His farm is on the Murray Irrigation system at Katunga. Harold’s key water decisions (2002-2005) were: shift to annual pastures; building herd size after reduction through drought; change to split calving; purchase temporary water rather than permanent; production system working around a 148% water right in the medium term.

Verbal cues to an "agri-centric" water worldview: Harold perceives water as a production input whose cost and use is to be minimised. He also views previous water allocations as a form of enduring private entitlement in which changes in allocation and pricing represent a threat to the security of farming:

‘...we are down in that battler’s class, we’ve been able to get over the hurdle and get our first farm – but I think...we’re going to look at playing in the temporary [water] market at this stage. We’re not in the financial position or established enough to be buying permanent water”.

“They [policy makers] see the price of the temporary water but certainly as a business operation you can’t afford to pay that for the total lot of your water, that’s your marginal water, it’s a bit different to have to pay that for the whole lot of your water, ... you’re starting to certainly hit a ceiling as to what you can feasibly afford to pay”.

Extension reflections on the implications of an "agri-centric" water worldview for practice: This worldview can create a challenge for extension acting in a policy implementation role, particularly if it leads to farms “tuning out” of the policy implications for their business. Extension saw a large role in providing quality and timely information concerning water price and feed-options; building confidence in water trading; discussion of the unbundling implications for the business and assessing the longer term business implications of water changes such as the importance of succession planning in relation to water. The risk of not challenging or working in the constraints of their worldview is one of lost opportunities.
A “Cornucopia” worldview

Lyn and Geoff farm in the Macalister irrigation district and would like to retire in the next 10 years. Lyn and Geoff’s key water decisions (2002-2005) were: laser grading; re-use system; consider whole farm plan; and high flow flood irrigation.

Verbal cues to a “cornucopia” water worldview: Lyn and Geoff appear to be driven by a “pragmatic” water worldview or even an “agri-centric” worldview:

“...because of the threat that we’re going to lose our ground water...we want to be able to irrigate and maintain our herd size and to do that we need to be looking seriously at water savings...we service a substantial loan, ...I wouldn’t say water specifically but it’s my chore to keep the business profitable...We’ll just milk as many cows as what we’ve got water to grow the grass to feed them (Lyn).”

“...they are not only robbing us of the water, to the environment, they’re going to rob the district of the water that goes to the subsurface that goes into the shallow aquifer, that goes into the drains, ...it’s the fear of compliance...”

Although they struggle with how they might maintain the productivity of their land with less water, their actions are underpinned by the belief in the longer-term benefit to them of their water resource providing wealth and prosperity:

“...we are very excited because we see water as our liquid gold investment in the future...What we’re talking about, moving out of dairy not actually moving off the farm “.

Extension reflections on the implications of a “cornucopia” water worldview for practice: This water worldview can create a challenge for extension in understanding and challenging the water efficiency and wealth possibilities from water management.

An “Autonomous” water worldview

Paul and Abby farm in the Macalister irrigation district have returned to their “roots” following careers outside farming. Paul and Abby’s key water decision was to install lateral spray irrigation on a section of the farm.

Verbal cues to an “autonomous” water worldview: Paul and Abby are looking to maintain their independence, preferring to have a farm that they could work and manage as a couple/family, rather than a larger farm:

“...we didn’t want 350 cows and employing people - we wanted to kick back - do it yourself.” (Abby)

We ensure we use our water right – we used sales only twice...we get it and we often don’t use it or sell it. We use 150-180ML out of the bore...we don’t sell it – I know that’s not good, but if it gets to the end of the season and if I have water then I can get through – but if I’ve sold it I don’t have that security. (Paul)

They also see water as being part of a wider collective good:

“We’re of the belief that if everyone’s doing tough and for us to use it its $40/ML and why sell it for a profit when someone else needs it – why should farmers shaft other farmers?” (Abby) “

Extension reflections on the implications of an “autonomous” water worldview for practice: Extension struggles with how to position their engagement to challenge the cost versus profit focus of the farm, the pressure on water entitlement and their self-sufficiency focus as a limitation to opportunities. For instance although water trading may offer possibilities for the achievement of farm goals, this presents a direct challenge to their worldview and must be weighed against other ways to support change.

In summary

The case studies have reflected a large variation in the “worldviews” farmers hold towards water in their business, their region and more broadly in society. These “worldviews” are influencing decisions concerning water use. This variation influences the perceptions of policy changes, the perceptions of opportunities available (e.g. “hold on to water at all costs” versus “increase farm profitability through opportunistic water sale”) and therefore the options considered possible or feasible for farms. Therefore, to understand a farm’s water issues (and options for addressing them) requires an appreciation of their water “worldview” and not just (for instance) a technical analysis of their farms water use efficiency. Also, an extension or support person needs to recognise their own “water worldview” in supporting change. Ignoring differing “worldviews” or avoiding conflict or tension between worldviews and policy is likely to result in poorly conceived
options for farmers, or "inertia" in industry or policy implementation. Although time-consuming, difficult to achieve and requiring the development of trust and partnerships, advisory relationships may offer a sound platform in which water "worldviews" are negotiated, and foundations for effective change made. A summary of the worldviews defined and cues for extension is provided in Table 1.

Table 1: Defining water worldviews and the implications for extension*

<table>
<thead>
<tr>
<th>Defined worldviews</th>
<th>Main verbal cues used in defining the worldview</th>
<th>Implications noted by extension</th>
<th>Extension strategies for this worldview.</th>
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</thead>
<tbody>
<tr>
<td>1. Utilitarian</td>
<td>Decisions &amp; practices based on attitudes that water is just another input to farm production that can be replaced, traded or used. Market conditions were the sole arbiter of this use. Decisions appeared business rather than production focussed.</td>
<td>Radical farm practices emerging that challenge ‘standard practice’. Current information services &amp; management capacity may not be high enough to support these level of decisions. Long-term implications are unclear. Margin of error lower.</td>
<td>Increase the level of accuracy &amp; improve timing of market information to farmers (water, livestock &amp; feed markets). Explore risk management options for different systems. Analyse longer-term business implications of utilitarian practice.</td>
</tr>
<tr>
<td>2. Pragmatic</td>
<td>Decisions &amp; practices based on beliefs that because water is becoming a more scarce, expensive resource, production decisions involving water needed to be reviewed. Production &amp; exploring ways to ensure profitable production was central.</td>
<td>Highly responsive to productivity extension</td>
<td>Strong alignment with productivity focused extension.</td>
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<tr>
<td>3. Eco-social</td>
<td>Decisions &amp; practices were based on attitudes that water is a societal resource in which farm production &amp; use of water needs to be aligned with the local environment, personal goals &amp; societal expectations (represented in regulation &amp; laws).</td>
<td>Strong alignment with policy worldview Triple-bottom line in reality.</td>
<td>Learning opportunity for extension.</td>
</tr>
<tr>
<td>4. Custodian</td>
<td>Decisions &amp; practices are based on attitudes that water is a personal right &amp; farmers use water responsibly as ‘stewards’. Strong beliefs that adverse market forces (water prices, commodity prices) represent an attack on this responsibility &amp; undermine it.</td>
<td>Potential conflict with policy, extension worldviews</td>
<td>Reliant on connections with other organisations.</td>
</tr>
<tr>
<td>5. Agri-centric</td>
<td>Decisions &amp; practices are based on attitudes that water is agricultures right in return for national wealth. Attitudes &amp; beliefs are strongly aligned with a pragmatic worldview, but however</td>
<td>Alignment with productivity extension but potential conflict with policy worldview</td>
<td>Extension as a broker between policy &amp; productivity.</td>
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<tr>
<td>6. Cornucopian</td>
<td>Decisions &amp; practices are based on attitudes that water is such a valuable asset for the future, that it represents a considerable back-up plan for future wealth, irrespective of day to day productive uses.</td>
<td>Worldview is limiting Challenging</td>
<td>Develop ways to analyse implications of reliance on long-term strategy.</td>
</tr>
<tr>
<td>7. Autonomous</td>
<td>Decisions &amp; practices are based on attitudes that water is a personal entitlement that is managed individually rather than collectively. Cost minimisation more important than profit maximisation</td>
<td>Worldview is limiting opportunities seen by extension.</td>
<td>Maintain relationship &amp; offer new options.</td>
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</tbody>
</table>

* In providing this table, the authors recommend that it is the process used in the development of the classification that is most relevant for providing a feasible way for extension to become more sensitized to the role of worldview in farm practice, why farmers respond or not to extension ‘offers’ and for generating ideas for different extension strategies, rather than the classification of water worldviews per se.
**Part 2 – Recognising and working with worldview**

This part introduces the development and use of an extension tool to aid in the identification of water worldviews and positioning irrigation officer extension practice. This tool was developed in the context of the Macalister irrigation district (MID)-.

*The development of WaterMAP (Water Management Action Plan): On-farm change from the right support at the right time*: WaterMAP was developed from the learning’s about farmer water resource management and water worldviews outlined previously. It is a social and technical analysis for extension to gain an insight into farmers’ water and irrigation related needs. This insight then directs the type of extension effort required, the role of different expertise in achieving change, and can be used to report on outcomes from extension efforts to policy and stakeholders. The WaterMAP process is summarised in Table 2. WaterMAP is a questioning tool an adviser uses with a farmer which is based on:

1. Social and technical analysis of the presenting issue in water at the farm business level (including a short, medium and long term implications of the issue)
2. Technical/physical analysis of irrigation and water use performance (including an assessment of the decision-level involved)
3. Identification of opportunities for change and an analysis of what is required for these opportunities to be realised
4. Adviser “flags” for questioning and documenting the adviser “role” (or other roles) in realising opportunities
5. Documentation of the outcomes from intervention for the farmer and extension programs.

<table>
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<tr>
<th>Table 2: WaterMAP process between adviser and farmer</th>
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<tr>
<td>1. Perceptions of water in the farm business (what is/is not a significant water issue for the farm and why does the farmer see it this way).</td>
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<tr>
<td>2. How the farmer is changing or modifying their water situation (what they are seeing as possible solutions).</td>
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<tr>
<td>3. A physical assessment of their farm water situation (through to water use/ML/ha/irrigation/bay) Does this reveal impacts on the environment or productivity or both?</td>
</tr>
<tr>
<td>4. Farmers understanding and reaction to the physical assessment.</td>
</tr>
<tr>
<td>5. Presentation of possibilities seen by extension.</td>
</tr>
<tr>
<td>6. Assessment of capacity to capture opportunities (financial, farming horizon, skills, information, services, length of farming career, all decision makers can be engaged?).</td>
</tr>
<tr>
<td>7. A discussion of what needs to happen to improve (business is interested in change or can identify opportunities?).</td>
</tr>
<tr>
<td>8. An adviser assessment of the contribution to policy and program goals of working with this farm (high or low return to extension), whether the farms could be advocates for other farmers for change; is there a learning benefit for extension?</td>
</tr>
<tr>
<td>9. An assessment of the outcomes from working together for the farmer, policy or others (e.g. dairy industry).</td>
</tr>
<tr>
<td>10. Action plan for farmer and extension developed and followed through.</td>
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</table>

*Testing the tool*

For the purposes of this research, the tool was trialled with 2 farms in the MID. After each visit, the extent to which the tool helped position the farm and the necessary extension response was tested against evaluation questions. WaterMAP was seen to be able to effectively position the farm and extension response required when:

1. The farm visit and the results are documented. The document is a good record of the farm water issues and of the thinking, intentions and plans of farmers and extension.
2. Other areas of the farm business (other than water) are explored in context.
3. There is a second and/or subsequent visits to the farm that builds on the understanding from the WaterMAP appraisal (i.e. match the intent of the farmer with their records and gather more intelligence on their sources of information and who is trusted).
4. It is actively used as a feedback tool/loop between farmer needs (farm business and water use issues) and extension needs (program goals).
5. It is used to refer to others in the industry once issues outside specific program goals of the extension officer are reached.
6. There is a commitment to accuracy in the water use issue – if early visits indicate a high return from continuing interaction between extension and farming.
Further development of the tool is recommended to improve its usability by a population of service providers.

Conclusion

Regardless of the contrasting worldviews in a relationship, farmers and extension practitioners can still engage in conversations based on activities. The adjustment of extension practice in coping with the farming position is based on a commitment to reflective practice (Schon, 1983; 1987). Being sensitized to worldview is important for extension in effectively positioning their response. Schon and Rein (1994) call this “Frame reflection” where professionals move beyond the safe ground of existing cultural frames and engage with alternative ‘views of the world’ in concrete acts of ‘co-design’. Frame reflection appears critical for achieving societal expectations regarding water use in irrigated agriculture.

Key learnings

1. Water “worldviews” is an important concept for the improvement of learning processes between farmers and extension regarding irrigation practice.
2. Extension can explore the farmer’s worldview, and based on assessments of the drivers of current irrigation performance relative to the adviser’s knowledge of the farmers’ intentions, use stimulating questions to support change.
3. Effective questioning around farming worldviews may also help in the targeting of extension interactions, particularly with respect to water policy changes.

References

Agricultural and fisheries extension in Indonesia – origins, transitions and current challenges

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Abstract. In recent decades, changes to Indonesia’s government extension systems have been driven primarily by shifts in agricultural development policies, albeit with a continuing focus on rice self-sufficiency, by the ‘autonomy’ process and by budgetary constraints. Under these changes, the T&V system was abandoned, despite being considered effective by extension workers and farmers. Current extension systems, variously applied by autonomous provincial and district governments, are often poorly resourced and undervalued, leading to poor service provision and dissatisfaction amongst both extensionists and farmers. In this context, Indonesian governments recognise the potential of the fisheries sector, particularly shrimp farming, to contribute substantially to both the domestic and lucrative export markets. Two cases of ongoing ACIAR research projects indicate that better management practice (BMP) programs can improve productivity and profitability for traditional shrimp farmers using a group approach. However, effective extension systems are extremely limited to support the shrimp farmer groups in committing to adopt these relatively complex programs and in scaling out beyond demonstration sites.

Keyword: Indonesia, extension system, agriculture, fisheries, historic review, BMP.

Introduction

Agriculture continues to play an important role in Indonesia’s economic development as a contributor to food security and as a generator of income, employment and foreign exchange. Rice is the main agricultural commodity and is the staple food for about 97% of the population; at a national level rice provides 60% of the total calories consumed, 44% of total protein intake and 55% of total consumer expenditure (Suryana and Erwidodo 1996; Setiawan, 2006). However, estate crops such as rubber, palm oil, coffee and tea, together with fisheries products, such as shrimp and tuna are the main primary export commodities.

Indonesia has a coastline of about 81,000 km, of which only about 10%, 40% and 0.01% of potential freshwater, brackish water and marine areas, respectively, are in use (Nurdjana 2008). Consequently, aquaculture is seen as having considerable potential for further expansion in response to growing domestic and export market demands. Currently, farmed shrimp ranks highest amongst brackish water aquaculture commodities, comprising 80% of the total sector value; most of the shrimp crop is exported. In addition, mariculture products, such as finfish, and seaweed, obtain good prices on export markets in East Asia, Europe and the United States.

In most cases, Indonesian smallholders, including brackish water farmers, do not have ready access to financial support for farm development. Nor do they have ready access to information on appropriate innovations, primarily because of the very limited government extension services currently available under the decentralization policies of the past decade. Historically, agricultural extension services in Indonesia have been driven by the central government’s Ministry of Agriculture and have focused on food crops, estate crops (e.g. palm oil, tea, coffee, sugar) and livestock, with the aim of improving production and reducing reliance on imports, particularly of rice. Notably, until 1999, the fisheries and aquaculture sectors received relatively little support from the extension services. However, with Presidential Decree No 355 Year 1999, the Ministry of Marine Exploration was established as an agency separate from Agriculture, with responsibility for managing the marine and fisheries sector. Subsequently, Presidential Decree No 94 Year 2006 established the Ministry of Marine Affairs and Fisheries, within which the Agency for Marine and Fisheries Human Resources Development was given responsibility for development of human resources in fisheries extension only; delivering fisheries extension services remained the responsibility of Provincial and District governments.

This paper describes three related aspects of agricultural extension provision and system development in Indonesia. Its purpose is to improve understanding of the system and its focus on food crops and fisheries. The paper is organized into sections as follows: (1) origins and historic review of agricultural extension systems in Indonesia; (2) transition in Indonesian agricultural extension from training and visit (T&V), to Farmer Field Schools, to Decentralized
Agricultural Extension; and (3) the current initiatives and processes being used in selected projects, funded by Australian Centre for International Agricultural Research (ACIAR) and aimed at assisting aquaculture development in Indonesia.

Method
In this paper, a mixed model design with both qualitative and quantitative methods (Payne and Payne 2005) was used. In the first and second sections, we used a documentation review method. For the third section, we applied a quantitative field survey with focus on socioeconomic issues using questionnaire-based interviews as part of an ACIAR-funded aquaculture project, i.e., FIS2005/169 ‘Improving productivity and profitability for smallholder shrimp farmers and related enterprises in Indonesia’. This work was done at a study sites in Central Java province via collaborative research between University of Sydney, Main Centre for Brackishwater Aquaculture Development (BBPBAP-Jepara) and the Universitas Gadjah Mada Yogyakarta. Specifically, two villages, each supporting its own shrimp farmer group, in Demak district were selected as a research area where the demonstration ponds for better management practice (BMP) programs were located. There were 120 shrimp farmer respondents. We interviewed 60 respondents from each village, each comprising 30 members and 30 non-members of the shrimp farmer group. Adoption and its determinant factors was analysed with a logistic regression method (Herianto, 2004)

Origins and historic review of Indonesian agricultural extension systems
Rice, coconut, nutmeg and cloves were important commercial crops in the Indonesian archipelago even before the colonial era. These crops, cultivated by various indigenous groups, represented important economic activity for the Indonesian economy. However, between 1830 to 1870, farmers were forced to produce compulsory export crops such as indigo, tobacco and sugarcane under the Dutch East Indies colonial government’s Cultuurstelsel system, which was administered by a single institution - an indigenous civil service (Pangreh Praja) (Purwanto 2002).

After the gradual abolition of the Cultuurstelsel system, the first attempt to develop an agricultural extension system was the establishment of an agricultural school at Buitenzorg, near the Botanical Garden in Bogor, West Java. The botanical garden included various collections of local rice varieties and other commercial crops; it became a famous research centre where demonstration plots were used as focal points for the agricultural extension services (Boomgard 1987). However, the production gap between the demonstration plots and those operated by farmers was still noted. In order to bridge the gap, in 1905 the colonial government united the services from the Botanical Garden and other research institutions into the Agriculture Department. However, some constraints in disseminating technologies via extension services throughout the country still remained. In response to these problems, in 1911, this Department was restructured to become the Agriculture, Industry and Trade Department incorporating the Landbouw Voorlichtings Dients- LVD or the Agricultural Extension Service as a new branch with specific tasks in disseminating research results to the farmers (Sumintareja 2001).

The extension service’s task was to suggest, but not compel, improvement of agricultural practice, particularly for estate crops destined for export, by encouraging farmers to adopt innovations developed by the Algemeene Proefsation voor den Landbouw – APL (= Agricultural Research Centre). APL was supported by LVD and conducted many experimental plots at outstations, mainly in Java, where landholder farmers and tenant farmers could directly observe agricultural innovations under the olie vlek system, and voluntarily adopt appropriate innovations. This agricultural extension system was propagated to local or provincial governments throughout Indonesia under a decentralization policy in agricultural development up to the 1940s. This could be considered a model era of “voluntary and participatory” agricultural extension approach, in that farmers adopted the innovations with no compulsion from the government (Reksohadiprojo 1963 cit Sumintareja 2001).

In the 1940’s, the agricultural development policy shifted its focus from export crops to food crops, especially for rice. During the period of Japanese occupation (1942-1945) and in the two decades following Indonesian independence in 1945, the agricultural extension system returned to a compulsory system. In this period, officers of the Agricultural Civil Service (Mantri Tani) and some post-independence graduates of Wageningen Agricultural School, were directed to implement a policy whereby rice crops were compulsorily acquired and distributed by the government in order to promote food security. With this approach, eventually the agricultural civil service became a dominant apparatus, with farmers locked into its ineffective process of disseminating agricultural innovations.
Recent transitions in Indonesian agricultural extension systems

In the early 1960s, a completely new approach was applied. Using the limited human resources of the agricultural extension services, students at Bogor Agricultural Institute and Universitas Gadjah Mada conducted demonstration plots promoting "green revolution" technology. They introduced a five production inputs program (Panca Usaha) for rice to farmer groups using demonstration plots in targeted areas. With this system, rice productivity doubled in the demonstration area. Subsequently, between 1964 and 1966, the agricultural extension service promoted adoption of rice production technology innovation using a mass demonstration approach, termed the DEMAS system.

From 1966 onwards, under Soeharto’s New Order (ca. 1966 – 1998), an agricultural extension program, designated 'Improvement and Strengthening of Agriculture Extension Activities' was developed under the system of five years development plans, Rencana Pembangunan Lima Tahun (REPELITA). The program emphasized qualitative and quantitative improvement of the extension services. This involved adoption of various approaches to extension methods and materials, as well as expanded interaction with target groups, mainly male, female and youth-based farmer groups. As well, increased numbers of field extension workers were recruited and the Rural Extension Centres (REC or Balai Penyuluhan Pertanian) at local levels were rehabilitated (Sumintareja 2001).

During the New Order period, the Ministry of Agriculture comprised four technical Directorates General (Food Crops, Livestock, Estate Crops and Fisheries), each having its own extension section. However, extension service resources were generally commodity-focused (with most resources devoted to rice) rather than farm-focused (Ameur 1994). With its focus on rice intensification and improving farmers’ incomes, the extension service implemented a Bimbingan Massal – BIMAS (Mass Guidance) program. To support this social engineering approach (Nuraini 1977), the Ministry of Agriculture created several enabling agencies, including the Agency for Mass Guidance (Badan Pengendali Bimbingan Masal-BP Bimas), responsible for human resource management, the Agency for Agricultural Research and Development (AARD), responsible for generating research information and the Agency for Agricultural Education and Training, together with its Agricultural Information Centre (AIC or Balai Informasi Pertanian) primarily for education and training of extension personnel and production of extension material.

In this context, the BIMAS program implemented a number of significant changes in agricultural extension services in Indonesia. In order to achieve rice self-sufficiency, extension services were delivered through a LAKU (Latihan dan Kunjungan) or Training and Visit (T&V) system, introduced with World Bank sponsorship as part of the green revolution technology campaign in the early 1970s. There were three components to the system, i.e. capacity building programs for extensionists, programs of visits to motivate farmers to adopt new technologies for rice or other commodities, and programs in assessing extensionists’ work performance and farmers’ adoption levels. Within the system, Field Extension Workers (FEW, penyuluhan pertanian lapangan, PPL) were responsible for field visitation and technology dissemination tasks; middle level Senior Extension Workers (SEW, penyuluhan pertanian madya, PPM) for devising and supervising field extension programs; and graduate subject-matter extension specialists (SES, penyuluhan pertanian spesialis, PPS) for periodically training the FEW and SEW on innovations arising from AARD. At local levels, FEW and SEW extensionists worked in the REC area. A single REC area, designated REC working area (Wilayah Kerja BPP, WKPP), covered about 10 village unit areas (VUA or Wilayah Unit Desa, WILUD). Under SES supervision, FEWs and SEWs at each REC office conducted field trials in locally-adapted technologies before disseminating them to farmer groups. Each office was supplied with printed extension material and media produced by AARD and AICs.

At the grassroots level, individual FEWs were responsible for visiting their Working Area of Agricultural Extension (Wilayah Kerja Penyuluhan Pertanian, WKPP) which was divided into 16 Farmer Group Areas (Wilayah Kelompok Tani, WILKEL) across two or three villages. Typically, in any one week, a FEW would visit and motivate a separate farmer group area morning and afternoon from Monday to Thursday. In this way, each FEW would visit eight WILKEL per week. Each Friday, following these visits, FEWs were required to prepare a weekly report of their field activities and the progress of technology adoption. On the Saturday, they attended training on new recommended technologies.

Two supporting institutions were central to the success of BIMAS and other rice intensification programs using the T&V extension system. Local branches of the national bank (Bank Rakyat Indonesia Unit Desa, BRI-UD) provided credit to rice farmers and village cooperative kiosks (Koperasi Unit Desa, KUD) sold agricultural inputs to farmers and purchased their unhulled paddy for on-selling to the national Food Logistic Board (BULOG). Accordingly, the BIMAS and...
other rice intensification programs using the T&V system can be described as a planned and structured highly commodity-specific extension system.

By 1984, Indonesia was self-sufficient in rice as a result of green revolution technology and there is no doubt that the BIMAS and other rice intensification programs with T&V system played a significant role in this achievement. However, negative impacts of the programs also emerged. Excessive use of inorganic fertilizers and chemical pesticides endangered the environment and significant financial and social problems generated by the program, particularly among small scale and poor farmers, were often overlooked (Thorberke and Pluijm 1992).

In 1985 and 1986, serious outbreaks of brown plant hopper affected rice crops and forced the abandonment of the rice intensification program’s T&V system with its conventional technology package and top-down approach. The Indonesian government banned 57 broad spectrum pesticides for rice, gradually eliminated state subsidies on other pesticides and disseminated integrated pest management (IPM) technology to irrigated rice farmers across the country. To support these changes, a new extension approach, with training based on adult education principles, experiential learning, farmer participation and empowerment, was applied at farmer field schools (FFSs) (Quizon et al. 2001; Anderson 2007).

However, experience has shown that this extension system is unsustainable, mainly because of its cost. One solution being explored is to use ‘special training for farmer’ (TOFT or PETANDU – Guiding Farmers) programs. Under this arrangement, TOFT alumni will organize and facilitate the local FFS using local resources to disseminate the technology to neighbouring farmers. The IPM FFS approach involves daily monitoring of the pest situation in rice fields, identifying the types and abundance of natural enemies of the pest in the observation plot, determining the economic threshold of pest, promoting group dynamics and cooperation, sharing information and coordinating strategies with neighbouring farmers (Quizon et al. 2001). Currently, the alumni of TOFT have established the FFS Alumni Association which meets annually. Some alumni are also looking at extending the IPM principles to enable organic farming with zero use of pesticides and inorganic fertilizers (TO Suprapto, FFS Chairman, Alumni Association, personal communication). In support of this participatory extension approach, the Ministry of Agriculture has established FFS for Agribusiness, designated SL UBA (Sekolah Lapangan Usahatani Agribisnis) with the aim of disseminating agribusiness principles to farmers. This FFS extension system was implemented until the reformation movement began in 1998.

In 2000, as a means of increasing ‘autonomy’ in government, the central government in Indonesia transferred responsibility and funding for most services to district-level and, to a lesser extent, provincial-level governments. Extension services were included in this process, with the intention of replacing the traditional top-down approach and its linear research-extension-client farmer relationship with a bottom-up, participatory approach responsive to farmers’ needs. This decentralized extension system is based on Law No 22/1999 (subsequently amended as Laws No 32/33/2004) and is implemented using decentralized adaptive agricultural research conducted at Agricultural Technology Assessment Institutes (Balai Pengkajian Teknologi Pertanian = BPTP). These Institutes integrate research and extension functions under one roof and assess new adaptive technology to formulate solutions to local farmers’ problems. In order to implement the policy in agricultural extension services, the World Bank funded two consecutive projects, i.e., the Decentralized Agriculture and Forestry Extension Project (DAFEP) beginning in 1999 and the FEATI project beginning in 2007. In general, the projects aimed at enhancing farmers’ capacity to participate in extension activities and at integrating research and extension components at local level using information technology to improve market access and increase incomes and competitiveness. The current Extension Law (Law No 16/2006) recognizes the roles of multi-provider actors including government and private sector extension workers as well as self-supporting extension volunteers. In addition, it also reunified three primary sectors (agriculture, fisheries and forestry) by establishing a new institution named the Agency for Extension Coordination (Badan Koordinasi Penyuluhan = BAKORLUH). The current extension system shares some features with the 1970s extension system, however the implementation program is not yet well established because a Presidential Decree executing the law is still pending.

However, there remains a wide gap between local and national government perspectives on the importance and roles of agricultural extension services. In addition, much district-level funding is being allocated to routine programs rather than agricultural development and its extension activities (World Bank, 2002). As a result, extensionists are uncertain about their roles, are poorly paid and have little support for their activities. In fact, most farmers we have interviewed...
state that the extensionists are unable to help in solving their problems under the current autonomy system.

The research system, whereby innovations consistent with local technologies are developed in government research institutes or university sites, is essential to real changes in agricultural development and productivity. However, under their own initiative, farmers have been reviving indigenous knowledge from local practice and experiments and either disseminating this knowledge to neighbours or inheriting it through intergenerational transfer. This indigenous knowledge is to some extent related to religious belief and culture. For example, local farmers in Java believe that natural pesticides can be effective against plant diseases and pests. Based on their indigenous knowledge, some Yogyakarta farmers use natural pesticides made of brown planthopper for controlling brown planthopper attacks in their paddy fields. They trap planthoppers, grind them and mix with water before spraying onto rice plants (Sutanto Dhobo, organic farmer of Sleman-Yogyakarta, personal communication).

**BMP programs for smallholder shrimp farmers – current extension initiatives**

Aquaculture is an important component of the Indonesian fisheries sector as it contributes to national income, employment generation and foreign exchange earnings. Shrimp is the most important aquaculture commodity with shrimp exports generating about US$1 billion annually with 93% from the farmed shrimp (ACIAR, 2007). However, white spot disease (WSD) caused by white spot syndrome virus (WSSV) is a major problem in shrimp farming, not least for smallholders. BMP programs offer a solution to this problem; they focus on proper management of the pond environment, on maintaining pond biosecurity and on socioeconomic issues. Their aim is to improve the productivity and profitability of shrimp farming. In this context, the Centre for Brackishwater Aquaculture Development (BBAP- Ujung Batee, Aceh) and the Main Centre for Brackishwater Aquaculture Development (BBPBAP-Jepara, Central Java), with support from ACIAR, have been conducting action research involving BMP technology application in Nanggroe Aceh Darussalam (Aceh), Central Java and South Sulawesi provinces of Indonesia. A technology dissemination process based on demonstration ponds is being applied in these areas.

**Nanggroe Aceh Darussalam Province**

A key step in the development of project-based extension and advisory services to farmers in Aceh in the aftermath of the 2004 tsunami was the development of a coordinated approach by the major donor agencies involved in aquaculture reconstruction and rehabilitation. This resulted in the formulation of a ‘Practical Manual – Better Management Practices for Tambak Farming in Aceh’ jointly produced by the Asian Development Bank (ADB), ACIAR, Aquaculture without Frontiers, the Food and Agriculture Organization of the United Nations, German Technical Cooperation (GTZ), the International Finance Corporation of the World Bank, the Network of Aquaculture Centres in Asia-Pacific and the World Wildlife Fund. This coordinated approach allowed the dissemination of a consistent set of technical recommendations across the various projects operating in Aceh, and ensured that farmers received consistent advice.

While the responsibility for fisheries and aquaculture extension lies principally with the District Department of Marine and Fisheries (Dinas Kelautan dan Perikanan [DKP] Kabupaten), surveys and conversations with DKP staff and farmers in Aceh have indicated that the effectiveness of government extension services is extremely limited. A survey of 200 farmers in Aceh by Briones (2008) found that 93% had never met a government extension agent, 6% had met ‘rarely’, 1% ‘sometimes’ and none ‘regularly’. Results for farmer associations were somewhat better, with 15% meeting ‘rarely’, 15% meeting ‘sometimes’ but only 1% meeting ‘regularly’ with a farmer association representative. DKP staff cite lack of training, lack of resources (transport, fuel) and lack of practical experience for their reluctance to actively engage with farmers.

Many projects have overcome this constraint to extension service provision by employing ‘field facilitators’ who provide technical information and support either directly or indirectly to farmers who participate in BMP implementation programs. While this approach provides a short-term solution, the field facilitators are not available to farmers following the cessation of project activities, leaving a void in the provision of extension services.

The Aceh Aquaculture Rehabilitation Project, funded by the Australian Indonesia Partnership for Reconstruction and Development, developed BMP demonstration ponds in Bireuen and Aceh Utara districts. Their purpose was to allow staff of Balai Budidaya Air Payau (BBAP) Ujung Batee to practice the implementation of BMPs for shrimp culture in an ‘on-farm’ situation, and to provide farmers and DKP staff with an opportunity to learn about BMP implementation in a practical setting. BBAP Ujung Batee staff use the demonstration ponds as focal points for the provision of information and technical support services. The ‘crop calendar’ approach, based on the crop calendar in the BMP Practical Manual, is used to coordinate extension needs with farm
production cycles. BBAP Ujung Batee staff hold farmer field days to teach farmers about key aspects of BMP implementation in shrimp farming. The field days are a combination of theoretical and practical teaching, with the demonstration ponds being used to train farmers in the relevant techniques. The farmer training is supported by extension products developed by BBAP Ujung Batee, primarily technical brochures explaining key BMPs and based on the ‘Practical Manual – Better Management Practices for Tambak Farming in Aceh’.

While the demonstration pond sites have been valuable in providing focal points for BBAP Ujung Batee and DKP staff to engage directly with farmers, they have also demonstrated the high level of risk associated with shrimp culture in Aceh, with only one successful crop to date. However, the demonstration sites have successfully stimulated interest amongst farmers in specific aspects of pond management, such as pond preparation, and in culturing milkfish (Chanos chanos) at higher densities to improve farm profitability.

A significant development for aquaculture extension in Aceh has been the recent establishment of the Aceh Aquaculture Communications Centre at BBAP Ujung Batee. The AACC is funded by the Indonesian Government’s Department of Marine Affairs and Fisheries, with support from ADB’s Earthquake and Tsunami Emergency Support Project, ACIAR’s Aceh Aquaculture Rehabilitation Project, and the Japan Fund for Poverty Reduction. The AACC provides technical support to farmer groups, arranges technical training through farmer field days, publishes a monthly newsletter including a question-and-answer column for farmers, and manages an information website (www.tambak.org).

Central Java Province

During 2008 and 2009, under FIS/2005/169, staff from BBPBAP Jepara have assisted farmers operating demonstration/BMP trial ponds in two villages in Demak District, on the north coast of central Java. Each village supports its own smallholder shrimp farmer group: the inactive ‘Udang Raya (UR)’ group in Serangan and the active ‘Windu Jaya Dua – (WJ)’ in Sidorejo. The demonstration/trial ponds are operated by selected volunteer farmers under close advice from the project’s field technicians who live on-site and advise operators on BMP implementation during the approximately four-month period between pond preparation and pond harvest. Senior technical staff from BBPBAP Jepara visits the ponds regularly to provide additional technical support.

Briefly, the BMP programs aim to reduce risks of crop losses (mainly due to shrimp-specific virus disease) to acceptable levels and to maximise the quality of harvested shrimp. Although the project’s BMP program comprises 16 BMPs comprising both technical and socioeconomic components, these can be simplified to the following: (1) Implement programs in physically suitable locations only; (2) Maintain a unified and disciplined farmer group; (3) Maximise pond biosecurity (= keep dangerous shrimp viruses out of the pond); (4) Maintain optimal pond growing conditions; (5) Maximise food safety, product quality and profitability.

Conducting the demonstration ponds in each farmer group’s village allowed other group members, as well as non-members and farmers from surrounding areas to directly observe the demonstration ponds. In this way, interested farmers can learn and discuss the ponds’ management and shrimp production with the resident field technicians. The active farmer group has monthly member meeting to discuss the technology adoption and other issues important to their group. This demonstration pond method appears similar to the olie vlek extension system by which the technology eventually will be adopted and spread by the farmers via a slow diffusion process.

It is important to note that, as for Aceh, the government’s district-based fisheries extensionists are currently unable to participate fully in facilitating BMP program adoption at these Demak sites. Informal enquiries indicate inadequate training, poor remuneration, poor resources and unclear job direction are the main reasons for this inability. Not surprisingly, Leta et al. (2005) identified an almost identical set of factors impeding the effectiveness of Indonesian agricultural extensionists in West Timor. There are additional specific factors limiting the fisheries service extensionists’ participation in the Demak demonstrations. First, because the District Marine Affairs and Fisheries office lacks extensionists specialising in shrimp development and no formal shrimp-focused program, extensionists have little hands-on experience in this very challenging field and few contacts with shrimp farmers. Second, they lack confidence in disseminating BMP technology since the innovation is new to them. For these reasons, the project, in collaboration with the Provincial MAF office conducted training for selected government extension workers and field technicians in February and April 2009 to assist disseminating BMP programs to those parts of their working areas targeted by the district governments.
After two shrimp stocking seasons in the demonstration ponds, the project, with support from consultants from Universitas Gadjah Mada, conducted a socioeconomic study involving farmer group members and non-members. The main objective was to identify socioeconomic determinants, including personal, demographic, asset and technological factors influencing BMP program adoption. In order to estimate the parameters of twelve explanatory variables influencing respondents to adopt BMPs, a logistic regression model was used. The explanatory variables were as follows: education level, number of family members, pond holding, contribution of shrimp farming income to the family income, length of experience in shrimp farming, successful experiences in shrimp farming, and the farmer’s perception of potential problems in relation to individual BMPs within the program. In addition to these variables, five dummy variables were also hypothesized in influencing the respondent’s behaviour, including membership in a shrimp farmer group (SFG), personal goals in shrimp farming, whether a full-time shrimp farmer or not, type of secondary occupation and whether growing shrimp in monoculture or polyculture.

**Estimated logistic regression model for BMP technology adoption**

The estimated function using standardized regression coefficients for WJ in Sidorejo village in Table 1 shows that education level, number of family members and pond holding were significant and positively associated with adoption behaviour. The positive sign of the education level variable indicates that those respondents with higher education level were more likely to adopt BMP technology. The positive sign of the number of family members implied that the greater the number of family members, the more likely the respondent was to adopt the BMP technology. It suggests that they expected the BMP technology would provide higher potential margin or income than traditional shrimp technology. Since the BMP technology requires a bio-filter pond for managing water and maintaining bio-security, only those farmers with more than one pond were able to adopt BMPs. Out of five dummy variables, one dummy variable – SFG membership, was positive and significantly influenced shrimp farmers’ behaviour. It indicated that, with demonstration ponds in the farmers’ group area, the SFG members had greater opportunity to observe and discuss BMPs with the project FA than non-members.

**Table 1. Determinant factors for BMP technology adoption levels based on individual shrimp farmers responses from Sidorejo village, Demak District, Central Java, 2008.**

<table>
<thead>
<tr>
<th>Determinant Variables</th>
<th>Unstandardized coefficients</th>
<th>Standardized Coefficients (β)</th>
<th>T - test Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant = $\beta_0$)</td>
<td>1.959</td>
<td>0.803</td>
<td>0.426 ns</td>
</tr>
<tr>
<td>Education level</td>
<td>0.384</td>
<td>0.362</td>
<td>2.914 0.005**</td>
</tr>
<tr>
<td>Occupation (DV)</td>
<td>1.020</td>
<td>0.120</td>
<td>1.022 0.312 ns</td>
</tr>
<tr>
<td>SFG membership (DV)</td>
<td>2.463</td>
<td>0.370</td>
<td>2.540 0.014**</td>
</tr>
<tr>
<td>No of Family member</td>
<td>0.597</td>
<td>0.358</td>
<td>2.773 0.008**</td>
</tr>
<tr>
<td>Pond holding</td>
<td>0.000</td>
<td>0.332</td>
<td>2.514 0.015**</td>
</tr>
<tr>
<td>Contribution of SFarming Income</td>
<td>0.005</td>
<td>0.040</td>
<td>0.281 0.780 ns</td>
</tr>
<tr>
<td>Personal Goal in SF (DV)</td>
<td>-0.127</td>
<td>-0.046</td>
<td>-0.379 0.707 ns</td>
</tr>
<tr>
<td>Length of Experience in SF</td>
<td>0.054</td>
<td>0.084</td>
<td>0.574 0.569 ns</td>
</tr>
<tr>
<td>Success experiences in SF</td>
<td>0.042</td>
<td>0.025</td>
<td>0.205 0.569 ns</td>
</tr>
<tr>
<td>Types of Shrimp Farmer (DV)</td>
<td>-0.179</td>
<td>-0.027</td>
<td>-0.183 0.856 ns</td>
</tr>
<tr>
<td>Types of Shrimp Farming (DV)</td>
<td>0.431</td>
<td>0.040</td>
<td>0.319 0.751 ns</td>
</tr>
<tr>
<td>Farmer’s Perception in the problems of BMP components</td>
<td>0.018</td>
<td>0.077</td>
<td>0.673 0.504 ns</td>
</tr>
</tbody>
</table>

Notes: * = significance at $\alpha$=10%; ** = significance at $\alpha$=5%; ***=significance at $\alpha$=1%; $R^2 = 0.443$ and Adjusted $R^2 = 0.301$; F test ***

Source: Field Survey Data Analysis 2008

The estimated function of UR in Serangan village using the same model in Table 2 shows that two explanatory variables, i.e., education level and the farmer’s perception of the problems relating to BMP program adoption were positive and significant. The positive sign of education level indicates that those respondents with higher education levels were more likely to adopt the BMP technology. It is consistent with the fact that the BMP technology is more complex than traditional technology. The better-educated respondents, therefore, will have better understanding of the advantage of this technology and have higher probability of achieving better income than the respondents with low education level.

Two dummy variables of SFG membership and type of shrimp farming in Table 2 below were positive and significantly affected the respondent’s behaviour. The SFG membership variable indicated that members had higher likelihood of adopting. The type of shrimp farming variable indicates that shrimp farmers who have more than one pond in Serangan village with monoculture shrimp farming had higher probability to adopt the BMP technology on order to minimize the risk of viral disease infection by practicing recommended technology components, such as bio-filter and bio-security management.

Table 2. Determinant factors for BMP technology adoption levels based on individual shrimp farmers responses from Serangan village, Demak District, Central Java, 2008.

<table>
<thead>
<tr>
<th>Determinant Variables</th>
<th>Ustandardized coefficients</th>
<th>Standardized Coefficients (β)</th>
<th>T - test Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant = β₀)</td>
<td>5.141</td>
<td>2.357</td>
<td>0.023**</td>
</tr>
<tr>
<td>Education level</td>
<td>0.221</td>
<td>0.263</td>
<td>1.747 0.087*</td>
</tr>
<tr>
<td>Occupation (DV)</td>
<td>-1.550</td>
<td>-0.165</td>
<td>-1.289 0.204ns</td>
</tr>
<tr>
<td>SFG membership (DV)</td>
<td>1.598</td>
<td>0.236</td>
<td>1.817 0.076*</td>
</tr>
<tr>
<td>No of Family member</td>
<td>-0.150</td>
<td>-0.074</td>
<td>-0.660 0.512ns</td>
</tr>
<tr>
<td>Pond holding</td>
<td>0.000</td>
<td>0.188</td>
<td>1.500 0.140ns</td>
</tr>
<tr>
<td>Contribution of SFarming Income</td>
<td>0.020</td>
<td>0.162</td>
<td>1.391 0.171ns</td>
</tr>
<tr>
<td>Personal Goal in SF (DV)</td>
<td>0.175</td>
<td>0.077</td>
<td>0.652 0.518ns</td>
</tr>
<tr>
<td>Length of Experience in SF</td>
<td>-0.035</td>
<td>-0.100</td>
<td>-0.836 0.407ns</td>
</tr>
<tr>
<td>Success experiences in SF</td>
<td>0.217</td>
<td>0.053</td>
<td>0.470 0.641ns</td>
</tr>
<tr>
<td>Types of Shrimp Farmer (DV)</td>
<td>0.158</td>
<td>0.025</td>
<td>0.204 0.839ns</td>
</tr>
<tr>
<td>Types of Shrimp Farming (DV)</td>
<td>1.456</td>
<td>0.225</td>
<td>1.875 0.067*</td>
</tr>
<tr>
<td>Farmer's Perception in the problems of BMP components</td>
<td>0.185</td>
<td>0.556</td>
<td>4.502 0.000***</td>
</tr>
</tbody>
</table>

Notes: * = significance at α=10%; ** = significance at α=5%; *** = significance at α=1%; R² = 0.508 and Adjusted R² = 0.383; F test ***

Source: Field Survey Data Analysis 2008

These findings indicate the difficulties farmers faced in committing to BMP program adoption and the challenges faced by extensionists in facilitating such adoption.

Conclusions

This research includes a review, from era to era, of the long history of agricultural extension in Indonesia. The shift in agricultural extension systems is in line with the government’s focus and policy on agricultural development, with the democratization process, as reflected in the autonomy policy, and budgetary constraints.

During earlier phases, the agricultural and fisheries extension services used a commodity-based, linear, top-down approach under which self-sufficiency in rice, the priority goal, was achieved. This was followed by an emphasis on environmental friendly technology, as exemplified by the FFS system used for disseminating IPM technology. More recently, in the autonomy era, the focus has shifted to farmers’ needs and institutional collaboration. The establishment of the Agency for Extension Coordination has led to extension effort across agriculture, forestry and fisheries becoming more balanced. However, problems remain in the organisational structure and in the delivery of this multi-sectoral extension system. Indonesian solutions to these problems must be found to enable wider scale-out of promising technologies across all three sectors.

The Indonesian government is currently giving considerable attention to the fisheries sector, especially shrimp farming, with its potential for foreign exchange earnings. The two ACIAR-funded BMP projects aim to increase productivity and profitability of shrimp farming using group approach. However, based on the adoption research and its extension services research, there is a need to formulate an effective extension strategy to roll out the technology across major shrimp farming areas; the projects’ demonstration plot method, as in the olie vlek system, is too slow in disseminating the relatively complex BMP technology.

Acknowledgements

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Facilitating an effective information supply chain from R&D providers through agribusiness advisers to growers

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Abstract. Earlier research by the author indicated that although agribusiness was emerging as a key conduit for transfer of research and development outputs and outcomes to end users such as growers, little strategic engagement appears to exist between agribusiness and Research and Development providers (RDCs). The objective of this project was to focus on development of a central point of access to R&D outputs that would meet the priorities of RDCs and agribusiness with resulting benefits for growers. Additional research was conducted to identify issues and common factors between stakeholders affecting the development of an effective information supply chain. There are differences between the environments in which agribusiness and RDCs operate, which could inhibit future engagement. Collaboration between RDCs and agribusiness on development of an appropriate supply chain was suggested as an effective means to both facilitate stakeholder access to R&D information, and foster engagement. A Working Group of RDC stakeholders concluded that the commercial entity FarmPlus would be an effective central access point for R&D information. An effective supply chain solution is based on three key learnings: 1. R&D outcomes must be reported by RDCs in terms that are relevant to agribusiness and growers; 2. agribusiness is an effective conduit for both outputs from R&D organisations to growers, and inputs back in to R&D priorities through a feedback loop; and 3. Terms of trade that exist between RDCs and agribusiness need to be understood and acknowledged to foster appropriate engagement.

Keywords: agribusiness, RDC, R&D, engagement, information delivery, conduit, supply chain, FarmPlus.

Introduction

As stated on the website of the Council of Rural Research & Development Corporations' (RDCs) Chairs:

there are 15 Rural Research and Development Corporations covering virtually all of the agricultural industries. The RDCs bring industry and researchers together to establish research and development strategic directions and to fund projects that provide industry with the innovation and productivity tools to compete in global markets.

The $500m/year Australian Rural Industries Research and Development Corporation sector represents all major farm industries using farm production levies and matched Government funding. This sector is seeking new ways to spearhead Australia’s $35b farm sector as changing economic, climatic and environmental threats loom. Agribusiness companies, through their valuable grower relationships are ideally placed to support these developments.

Contemporary agribusiness can be described as encompassing, consultants, trainers, accountants, associations, reinvented producer organisations, farmer directed groups, resellers and their product suppliers, privatised and semi-government organisations, banks, advisers on insurance and superannuation, marketers and seed companies (Stone 2005). It has been estimated that there are approximately 1,300 private consultants operating in rural Australia. Coutts et al. (2005) and in excess of 1,500 personnel employed by national and regional company resellers, suppliers and banks.

Stone (2005) noted that 'Agribusiness has largely supplanted the previous government extension role and increasingly, it is undertaking R&D work and can act as an information conduit from farmers back to researchers and decision makers'. The role of extension is described by Coutts et al. (2005) in the national extension/education review ‘... in terms of its outcome, i.e. capacity building. It is defined as the process of engaging with individuals, groups and communities so that people are more able to deal with issues affecting them and opportunities open to them’. The capacity-building role of agribusiness advisers is also noted in Coutts et al. (2007) ‘... there is a lot of evidence gathering that agricultural consultants are becoming an increasing force in supporting managers of agricultural enterprises across Australia and that they play a critical role in assisting managers to integrate wider learnings in to their specific farming system’.

Therefore the importance of the engagement of all RD&E providers including RDCs, (Co-operative Research Centres (CRCs), universities and state agricultural departments to facilitate the role of agribusiness in capacity building is apparent. An effective information supply chain between these providers and agribusiness generates widespread benefits:

• For research organisations to promote research outputs, meet key performance indicators (KPIs) and encourage adoption of new practices and technologies
• For agribusiness organisations and consultants by facilitating access to sources of relevant, cutting-edge information allowing them to maximise their value to their clients
• For end users such as growers, whose sustainability ultimately relies on an effective information supply chain from both the RD&E providers and agribusiness
• For all stakeholders in the form of a feedback loop at many stages of the supply chain, including from end users back to RDC research priorities.

The project ‘Maximising the connection between Research, Development and Extension providers and agribusiness’ – was undertaken for the Cooperative Venture for Capacity Building (CVCB) and was completed in June 2008. The objective of this project was to develop an effective strategy for future interaction between these RDCs and agribusiness in order to build the capacity of agribusiness to carry out extension and transfer of R&D information. The focus of the study was to canvass how this might be achieved in an applied setting and to consider how to get both RDCs and agribusiness to address the issues and find ‘common ground’ for collaboration.

**Project background**

Stone (2005) in his previous CVCB funded project ‘Agribusiness Role in Extension, Education and Training: a Case Study’ recognised agribusiness as a ‘key conduit to facilitate the delivery of levy funded knowledge and information from Research and Development Corporations and other R&D organisations, to growers’. He suggested that although the advisory processes for agribusiness to operate effectively with clients are largely in place, a key impediment for agribusiness to advise grower clients effectively is the ready access to relevant, robust, scientifically based information. Similarly, this current project has confirmed that farmer innovation is driven by access to cutting-edge data and found that limited access to cutting-edge data and information on innovative practices, through agribusiness, was a key impediment facing growers. Stone and Coutts et al. (2005) made the point that private consultants have a specific and crucial role in building capacity and are seen as ‘honest brokers’. Stone suggested that agribusiness should provide feedback to support the RD&E priority setting of RDCs and that the RDC/agribusiness link be strengthened. This led to CVCB funding of this subsequent project which commenced in 2005.

The specific objectives of this new project were to:

• Gain a baseline understanding of how RD&E providers currently connect with agribusiness and how they propose to do so in the future.
• Assess and report on the key success factors that would characterise a strong RD&E provider-to-agribusiness link.
• Explore potential strategies to: maximise the interaction between RD&E providers and agribusiness that support and benefit end users; facilitate access and transfer of R&D information by agribusiness; and develop a feedback loop whereby RDCs can ensure they are meeting on-ground needs of users through feedback from agribusiness and end users who assist in priority setting.

**Methodology**

Stone’s previous CVCB project in 2005 provided a rapid overview of the role of agribusiness in capacity building, and it was determined that more detailed research was needed. The focus of this project was to research and answer several key questions:

• What are the agribusiness information needs that RD&E providers can supply?
• How can the needed information be best supplied/accessed?
• How can a RD&E advisory, priority setting and feedback model be established to collectively satisfy the needs of growers, agribusiness and RD&E providers?
• Can this be widely implemented?

Key Stakeholders were identified as: growers who are the ultimate users of R&D outputs; agribusiness which acts as a key conduit to growers; and RDCs that are primary strategists and funders of rural RD&E. The original proposition was to gather data about the information needs of these stakeholders, using that data and three case studies to: canvass a likely interaction process; determine an appropriate framework; confirm and test that framework; then report back to stakeholders accordingly.

Engagement with RD&E Stakeholders was based on face-to-face meetings and phone interviews with senior program managers of the major RD&E providers. These included nine of the then 14 RDCs and three of the then 20 relevant CRCs (those who were known to be most interested in
and affected by the possible strengthening of their engagement with agribusiness). Interviewees were asked four simple open questions:

- What is the value or otherwise of an R&D provider connection with agribusiness?
- What is your current connection with the agribusiness sector if any?
- What is your proposed future connection if any?
- What view do you hold about the value of some form of information management process?

Growers and agribusiness adviser stakeholders (as well as senior agribusiness personnel) were also directly interviewed with a variant of the above four questions. Grower surveys were carried out with 25 growers in four varied regional locations around Australia: Bendigo (Victoria), Wagga Wagga and Junee (Southern NSW), Toowoomba and Brisbane (Qld) and regional sites east of Perth, Western Australia. The majority of the growers operated in the grain or mixed farming sectors.

The survey of growers particularly sought their views about their information needs and their preferred methods of access to information. It sought their views on the role of their agribusiness adviser as an information provider and the ideal or preferred process their adviser should use to provide access to information that would best meet their needs. This included seeking their opinions on the links with R&D providers and the niche they saw for their advisers as information conduits to them. Since advisers referred all grower respondents to the project leader, this could have biased the sample.

Adviser surveys were carried out in those same survey areas. Of the 59 adviser participants, 32 described themselves as agronomists, 12 as business advisers, 7 as specialists, and 8 as other. The survey questioned advisers about their links with their clients, information needs and preferred methods to access that information and about the role of information providers to supply that information. The direct views of consultant agribusiness personnel on best connections with R&D providers, how to develop and manage those connections, who their grower clients were and the extent/type of R&D information they sought and how they expected it to be delivered to them, were obtained.

Upon completion of this data collection in late 2005, work began on development of a conceptual model for a structured framework of RD&E provider and agribusiness interaction so that outputs and learnings from the project could be made available. This was proposed to encompass a series of forums, discussion groups and newsletters. More research was expected to come from the case study process.

Case studies were chosen on the basis that they demonstrated collaboration between RD&E providers and agribusiness with agribusiness functioning in a capacity-building role. The three case studies selected were:

- Dairy Australia – through their ‘Taking Stock’ program
- GRDC – through their proposed project of ‘Connecting the grains industry more strongly with agronomy’
- The national agribusiness company, Landmark – through their work with the former Salinity Cooperative Research Centre (now the Future Farm Industries CRC) as the extension partner of the salinity management program.

Engagement of all three case studies commenced early in 2006. However, the worsening drought and reduced staffing levels affected the overall contribution of stakeholders to the project and in late 2006 the case studies concept was abandoned. Instead, it was decided that the required baseline data could be gathered through additional direct contact, discussion groups or field visits with agribusinesses and their clients as described above.

**Findings**

**Growers**

Results from the grower interviews confirmed that growers see their agribusiness adviser as a key person who is the specialist or expert ‘information contact’ and who is a direct source of information or has direct access to the information required specifically by them as growers. A significant number of growers indicated that there was so much information available to them, that they were in ‘information overload’. They indicated a need for the agribusiness adviser to not only be a conduit for information from all sources, but to be a skilled synthesiser of information, to possess or access a significant collection of relevant and current information with a corresponding depth of knowledge, while being able to provide a snapshot view on request. Growers indicated that the agribusiness adviser is regarded as the ‘honest broker’ in comparison
to a sense of mistrust that growers have about the motivations of RDC and government (publicly funded) staff.

**Agribusiness**

Key messages from the agribusiness advisers were:

- Advisers foresee a more specialised role in the future as a synthesiser to the grower of the increasingly vast array of information available due to rapid changes in technology and the move to more business like farm enterprises (this is in accord with grower views).
- Accessing data is difficult and locating relevant information rapidly are two significant limitations. This is due to the considerable volume of information available from RDCs alone, let alone other public sources and because it is widely scattered in disparate systems that must individually accessed/searched.
- Growers have an expectation that the adviser will possess an in–depth knowledge of relevant information and be able to present it in language that they understand.
- Access to information is crucial and many advisers suggested that one centralised repository would be a practical place to access R&D.
- There would be benefits in fostering better linkages between advisers and RDCs.
- An understanding of grower segmentation is needed to effectively categorise the diverse range of growers into groups or market segments – for targeted information delivery.

The emerging role of the agribusiness advisor as a source of knowledge and information transfer between R&D organisations (Information Suppliers) and Farmers/growers (Information Users) is demonstrated in Figure 1.

**Figure 1. Agribusiness Knowledge Framework**

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**Research and Development (R&D) organisations**

Outcomes from the surveys of these organisations identified that there was a strong perception of a lack of interaction and understanding between RDCs and agribusiness and vice versa. When the project began, there was little initial strategic engagement between RDCs and agribusiness, although both groups indicated a desire to seek a level of strategic engagement. During the project life there was progress towards greater interaction, due in significant part to this project. Future engagement of target audiences to access outputs from R&D organisations would need to encompass knowledge of how these audiences seek their information and how it is best delivered. Recognising that data from grower surveys indicated that they preferred that agribusiness act as the conduit and a provider of this information in more relevant forms, this provides an opportunity for RDCs to address their KPIs by increasing adoption of innovation practices and technology by growers via the agribusiness sector as a conduit.

**Summary**

Findings from the data collection process were reported at the CVCB project meeting held in November 2006. It emerged that the matter of connection between agribusiness and providers...
of RD&E information was a secondary issue. It became apparent that the primary issue for agribusiness and growers was access to cutting edge, relevant R&D information and addressing issues in the supply chain to support access to that information. A key issue emerging from the surveys was that growers and advisers were both seeking more streamlined access to information and sought a ‘one stop shop’ where they could find what they needed in a variety of formats.

This indicated that further investigation was needed to determine the factors that affect that delivery from R&D providers to agribusiness and acquire greater understanding of the interaction between RD&E providers, RDCs, agribusiness and growers. Accordingly, with the demise of the case study process and the issues arising from the interim report noted above, it was decided that the focus of the project should shift to the development of an effective supply chain model to improve Stakeholder’ access to R&D outputs.

New project direction – development of an information supply chain solution

The notion of a structured framework for interaction, designed to achieve the objectives of the project, was substituted with a core investigation into methods to facilitate access to and delivery of RD&E information via agribusiness to growers. A CVCB Agribusiness Working Group consisting of RDC and agribusiness representatives was established as a project reference group for the last half of the project.

Key findings of the project research to date would drive the next phase of the project:

- Information delivery to grower end users is a key area of common ground between R&D providers and agribusiness.
- Agribusiness is a key information delivery, advisory and practice change agent for the most influential grower segments and potentially more widely for all growers.
- Agribusiness seeks to engage with RDCs.
- RDCs seek to engage with agribusiness.
- Strategic and structural issues with agribusiness influence their ability to be an information conduit to growers and these issues must be understood by R&D providers.
- Agribusiness is evolving in its extension role and this provides an opportunity for RDCs to engage with and support that process. This in turn addresses the accountability of RDCs to funding agencies, to be able to demonstrate delivery of R&D results.
- Further collaboration on providing feedback on R&D priorities for RDCs and R&D providers from growers via Agribusiness is another area of common ground and reciprocal benefit.

Segmentation of growers and the agribusiness sector

To better understand these issues, it became apparent that work was needed on segmentation of the agribusiness sector, segmentation of agribusiness clients (growers), the motivation of agribusiness and their clients, and the value in a ‘whole of RDC approach to agribusiness interaction’. It was agreed that in order to facilitate information transfer, it needed to be determined how to encourage effective direct engagement between RDCs and agribusiness.

Work focussed on: identifying structural issues on both sides that impede links between RDCs and agribusiness; identifying and understanding the segmentation of the target audiences on all sides; investigating contextual differences that influence the interaction; understanding transaction parameters such as how each sector operates and their terms of trade; and greater understanding of the key drivers of growers and agribusiness which dictate how they ultimately interact.

The CVCB Agribusiness Working Group agreed on a 5–Step process for the remainder of the project:

1. Review the interaction of member RDCs with agribusiness and see what changes had occurred in the interaction between RDCs and agribusiness.
2. Consider how to value add to these relationships through joint RDC projects to create a win: win for RDCs, growers and agribusiness.
3. Determine how to formally engage relevant RDCs with agribusiness to discuss how to establish relationships and what to bring to the table.
4. Convene an agribusiness and RDC forum to consider how to achieve the outcomes.
5. Enter a partnership phase with agribusiness and RDCs.

The Working Group also defined stakeholders encompassing growers, agribusiness and RDCs, and discussed their drivers and value propositions. The importance of understanding the various market segments was acknowledged.

Categories of growers, from an agribusiness perspective, were defined as:
‘A’ class clients/growers are the top growers in their discipline and are proficient farm business operators and innovators
‘B’ class clients/growers – are actively moving towards the ‘A’ class and follow ‘As’
‘C’ class clients/growers – have operations that are largely static in terms of innovation and development – and are regarded as traditionalists
‘D’ class clients/growers – are expected to exit the industry
Peri–urban/lifestyle – mostly professionals and city dwellers with smaller weekend farms
Corporate farms – aggregated family farms and corporate entities like super funds
Next generation farmer young professionals returning home.

Of the grower/farmer clients surveyed in this project, the majority of clients were A (34%) and B (33%) class clients with the remaining 33% of clients at C and D. Advisers reported that they preferred A and B clients, to C and D clients and would actively pursue that mix for profitability and job satisfaction reasons as these are the clients who generally implement their advice and recommendations and are their main source of income. Similarly, they also preferred clients from the corporate and professional categories.

It can be expected that existing drivers will continue to focus agribusiness advisers on the more profitable and motivated clients. This reinforced the importance and value of fostering the connection between RDCs and agribusiness to influence the most influential groups of growers.

In terms of segmentation of agribusiness as a market, the following categories were identified:

- Suppliers of products such as chemical suppliers and equipment suppliers e.g. Monsanto, NuFarm, Bayer, Netafim
- Resellers with personnel who are both experienced and in-experienced and have multifaceted businesses, e.g. Landmark, Elders, CRT/Ruralco, IHD Group
- Private consultants such as agronomists, marketers, farm financial advisers, specialists, (e.g. irrigation), including personnel who are both experienced and (less so) in-experienced
- Specialist management consultants, e.g. Hassalls
- Dealers, e.g. Case IH, John Deere
- Technical associations and marketing groups, e.g. Kondinin Group
- Bankers, accountants

**Cultural differences between R&D organisations and agribusiness**

It was reported during this project that there was contextual disparity between the public and private sector and that this could have a negative influence on the interaction between these groups. It was considered essential to examine the differences in order to overcome limiting influences and to foster positive interaction between the sectors.

One limitation (as perceived by RD&E personnel) is that ‘agribusiness can make money’ from access to and the use of R&D outputs. While this is true, as the terms of trade of agribusiness revolve around generating income, this is at odds with a similarly strongly held RDC perception that growers (their levy payers) are encouraged to make money from implementing R&D outputs on farm and for industry good. Table 1 contains a range of issues that illustrate the differences between drivers and needs affecting the target outcomes of agribusiness and R&D organisations.

The contextual disparities demonstrated above create barriers to engagement between agribusiness and RDCS and effect how they interact. Conversely, the cultures of agribusiness and growers are strongly aligned with a focus on greater profitability versus less accountability.

It appears the crucial action to diminish the effects of these differences and foster collaboration is to determine the terms of trade for the interaction between the two groups. Understanding and acknowledging differences and collaborating on determining appropriate terms of trade was concluded to be a key factor in maximising engagement.
Table 1. Comparison agribusiness vs RDC stakeholders drivers/needs

<table>
<thead>
<tr>
<th>Agribusiness stakeholders drivers/needs</th>
<th>RDC stakeholders drivers/needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long term, high profit client relationships that generate a win: win</td>
<td>Industry survival and ‘good’ (rather than individual business growth)</td>
</tr>
<tr>
<td>Meeting specific client goals and drivers to grow their business</td>
<td>R&amp;D strategic planning &amp; management of aggregated / leveraged investments of public monies that is accountable and transparent (that is time based rather than needs / urgency based)</td>
</tr>
<tr>
<td>Access to specific information on a needs basis (that meets grower client needs)</td>
<td>Manage the R&amp;D system or process (rather than focussing on achievement of outcomes direct to growers)</td>
</tr>
<tr>
<td>Delivery (making sense of information) in terms growers relate to, in language relevant to them – that is detailed yet simple and practical using specific outcomes</td>
<td>Show benefits and ROI to stakeholders – especially levy payers – over time and at a program level</td>
</tr>
<tr>
<td>Ability to synthesise – into advice / products – that can be on-sold to clients or form part of the business relationship</td>
<td>Development of a system of Extension, Adoption and Practice Change for the wider industry</td>
</tr>
<tr>
<td>Relationships based on $ changing hands to generate mutual profits.</td>
<td>Increase $ returns to industry rather than individual growers</td>
</tr>
<tr>
<td></td>
<td>Triple Bottom Line.</td>
</tr>
</tbody>
</table>

Engaging the cultures

The Working Group agreed that common ground exists between agribusiness stakeholders and RDCs with regard to their joint requirements. These are:

- To facilitate access by agribusiness to R&D information for delivery to growers.
- To deliver practical and relevant R&D outputs associated with the end-user’s needs in terms of their segmentation, their industry sector and geographic location.
- To seek input from agribusiness into setting future priorities for R&D.
- To encourage agribusiness and growers to assist in trials/R&D work.
- The strong desire of agribusiness to engage with R&D providers and provide strong feedback mechanism from growers to RDC/RD&E priority setting is a desirable factor.
- The joint aim of RD&E providers and agribusiness is for practice change through the adoption of new technologies thereby creating financial benefits for individual enterprise and wider industry/community benefit.

The Working Group also considered that meaningful RDC and agribusiness engagement was a joint priority and that reciprocal benefits could result from collaboration. To do so, it was agreed that one relevant key project or activity could serve to focus the engagement. The CVCB Working Group members canvassed how current and future activities of each RDC could connect with agribusiness. Specific projects were targeted for further investigation as potential mechanisms to foster engagement between RDCs and agribusiness.

The information access point in the supply chain

One overarching issue had emerged from the needs analysis. This was the importance of common access by agribusiness and growers to R&D information in appropriate and relevant formats. This issue was identified as being a joint priority and one which could initiate and facilitate meaningful engagement between RDCs and agribusiness.

The emerging proposition was to develop a central information repository or (central access point) in the R&D supply chain, at which R&D information from RDCs could be housed and then accessed by agribusiness and end-users. The Working Group began investigation into options for a central information repository. Such an access point was proposed as the means to establish a supply chain for R&D information from RDC to agribusiness and on to the grower. It would also have to encompass a feedback capacity – from grower to agribusiness, and from grower and agribusiness back to the R&D organisations.

Figure 2 is a representation of the ideal process – transferring information from RDCs to agribusiness (next users) to growers (end users). This system would be web based.
The information repository – a supply chain solution

The development of such an information repository was identified as being a major value-adding proposition that could benefit rural industry overall, as well as individual RDCs and agribusiness. Some of the particular considerations with regard to the application of the Information Repository included that it would:

- Generate benefits (link to a value proposition) for all stakeholders
- Need to consider knowledge exclusivity
- Address commercial in confidence and intellectual property issues
- Focus on agribusiness as the primary client of the repository
- Be marketed as a place where ... ‘Agribusiness can get access to unprocessed knowledge and summarised information – that directly meets your needs’.

It was considered that some form of commercial information repository might already exist. It was noted that some RDCs had already canvassed models. It was proposed that such a model would ideally link with the existing Australian Agriculture and Natural Resources Online facility (AANRO) and the specific delivery processes of the RDCs. As a result of investigation, the commercial entity ‘FarmPlus’ was canvassed as a suitable model.

The two key elements for the information repository concept were described as being:

1. AANRO is a facility for storing R&D outputs in an e-library. AANRO was regarded as creating a central R&D results ‘warehouse’ where unprocessed R&D information was catalogued and stored. It was noted that AANRO’s function was primarily a storage facility for use by the R&D community.

2. FarmPlus, the commercial model developed by Sydney based consultants was known to aggregate information in such a way that users could easily search for specific issues like ‘weeds at Dubbo’. It was being developed to operate on the slower line speeds used by many agribusinesses and growers in regional sites.

The FarmPlus product

Specific features and benefits of the FarmPlus product were detailed as follows:

- Its ability to be an in-store information shop that agronomists and others can use when clients come into the premises.
- Its ability to be used on-the-road by agronomists / advisers.
Its capacity to be used ‘at the farm table’ during advisory sessions between advisers and growers.

Its search capability which allows it to separate and sort information specific to Australia and specific regions / issues / sources of information.

Its classification capability which allows sorting by people who are time poor and want to decide whether to explore further into final R&D reports.

It has both a detailed information access point and ‘overview / summary information’ capability.

It has defined plans to provide potential 2/3 coverage of growers who use advisers.

A prototype FarmPlus model was presented at the final meeting of the Working Group in late April 2008. A series of issues were canvassed that would finalise the next stages of implementing FarmPlus as an information delivery tool. In terms of this implementation phase, a series of key issues were to be considered by FarmPlus management – in terms of a final business plan – before further engagement with the Working Group.

Implementation

A further one-year Implementation Phase in 2008/9 was conducted in order to commence securing the engagement of agribusiness with RDCs using the FarmPlus model as the ‘point-of-engagement’. It was anticipated that such an implementation phase would include:

- A proposed RDC-Agribusiness Roundtable to commence communication
- Confirmation of the FarmPlus Business Plan and its value to both agribusiness and RDCs
- Discussion of arrangements for Terms of Reference between a group of the RD&E providers as potential users – CRDC, HAL, LWA, RIRDC, GRDC and possibly Future Farm Industries CRC, who had expressed an interest in FarmPlus – to engage with FarmPlus
- Monitoring success of the proposed outcomes against agreed objectives – over 6-monthly intervals – to create a robust measurement and management method for accountability thereby ensuring future management of the RDC and FarmPlus relationship would be built on strong achievables.
- Using FarmPlus as a driver for longer term engagement by RD&E providers with agribusiness to ensure R&D findings could be cost effectively accessed by the agribusiness adviser sector.

A series of immediate steps to finalise key issues regarding the suitability of operations of FarmPlus to meet RDC accountability and management parameters were finalised by project conclusion on 30 June 2008.

Since project completion

Since project completion in June 2008 the FarmPlus system is being trialled in the cotton and horticultural industries, there has been agreement to commence operations in the meat and livestock industry and negotiations continue with one major national agribusiness company. It is known that GRDC has an agribusiness interaction strategy as does FFICRC.

Unfortunately, it was announced that Land and Water Australia, the manager of AANRO, would cease operations on 30 June 2009. It is understood that the CVCB, which took a leadership role with this project but ceased operations on 30 June 2008, is also unlikely to be reconvened.

There are specific positive initiatives that have resulted from the project in order to develop RDC and agribusiness sector engagement. However, it is disappointing that no ‘whole of RDC’ strategy to engage with agribusiness is being undertaken, as that was a clear signal from this project. This illustrates the imperative of a leadership entity to take a coordinated and integrated approach to strategic issues such as the engagement between the RD&E sector and the agribusiness sector. This is particularly relevant given the emerging role of agribusiness in capacity building and that growers (50% funders of the R&D work of RDCs), agribusiness and RDCs all agree that R&D outputs and technical information delivery to growers is an extremely high priority for attention.

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Website of the Council of Rural Research & Development Corporations’ Chairs
Social research: insights into farmers’ conversion to no-till farming systems

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Abstract. The conversion to no-till farming systems in the Victorian Mallee has been both recent and rapid. The Mallee Catchment Management Authority commissioned a project to begin the process of better understanding the no-till situation in the region by collecting local information regarding the extent of cropping practice change and the underlying reasons behind it. An exploratory social research approach was adopted using in-depth interviews as the primary means of data collection. Issues explored included: the extent and drivers of practice change, the reasons for some farmers maintaining a preference for cultivation, farmers’ views about the profitability and sustainability of different tillage systems, farmers’ preferences for accessing information to assist practice change, and their expectations and opinions about the role and value of agencies, producer groups, private advisors and resellers. Farmers changing to no-till are seeking greater flexibility around sowing decisions, agronomic gains and increased efficiency in their operation. They are accessing the services of private advisors to assist in making the change. In contrast, Multiple-till farmers are concerned about profitability and not yet convinced that no-till will advance their goals. They have specific concerns about the value of a no-till system on heavier soils. The findings reinforce the importance of understanding motivations for adoption of practices and designing extension activities around this.

Keywords: cropping practice, adoption, decision making, Mallee

Introduction

No-till crop production reduces soil erosion and conserves soil. With little new land available for agriculture, the need to mitigate and adapt to climate change, rising food security concerns and calls to increase the conservation value of private land, attention is increasingly turning to no-till crop production. No-till farming means broadly, that land is not cultivated prior to sowing, and is often referred to by other terms, such as conservation tillage. No-till also helps farmers respond to the critical problem of climate change. A no-till system can mean fewer passes and less fuel used and thus less carbon emitted (Khan et al. 2009). By keeping crop residue in situ, no-till also builds up soil organic matter, increases soil carbon sequestration, increases water infiltration and reduces evaporation and runoff (Huggins and Reganold 2008). For farmers in southern Australia, no-till's ability to help them mitigate climate change while also adapting to the drier conditions created by it makes it particularly pertinent (Ugalde et al. 2007).

Despite its potential contribution to sustainable agriculture, no-till farming is still the exception in most parts of the world, with only 7 per cent of the world’s cropland under no-till management in 2004 (Huggins and Reganold 2008). A 2004 survey by D’Emden & Llewellyn (2006) reports that, while approximately 80% of respondents in Western Australia’s grain growing region were using no-till technologies for at least part of their cropped area, less than 40% were in South Australia. Similarly, in Australia’s northeastern grains belt, it is estimated that less than half of farmers employ no-till practices (NSW DPI 2009).

As valuable as no-till farming can be, it is not without its limitations. Chief among these is the trade-off farmers face in the greater reliance on chemical herbicides that no-till demands, with concomitant financial, human and ecological health, and weed resistance issues (D’Emden and Llewellyn 2004; D’Emden et al. 2006). No-till farming goes hand in hand with increased cropping intensity, which means greater inputs. A substantial amount of energy is embedded in agrochemicals, with nearly half of the energy expended in conventional dryland wheat production embedded in the fertilisers and herbicides used (Khan et al. 2009).

Given the importance of no-till, numerous studies have investigated what obstacles farmers face in adopting such a system. Previously reported obstacles to adopting no-till include the need for specialised machinery, stubble management (including other uses for crop residues), and concern about the performance of no-till on heavier soils (see, for example, Lai 2007; Davey and Furtan 2008, Huang et al. 2008, Huggins and Reganold 2008). More generic obstacles to change include the difficulty of obtaining new knowledge to convert from a conventional to no-till system (Junge et al. 2009).

Much has been written about obstacles to the adoption of new practices in agriculture. Such obstacles can be broadly summarised under the headings of farmer characteristics (including goals, circumstances and perception of the extension messenger) and practice characteristics (mainly to do with relative advantage and trialability). These influence the timing and type of
learning involved in the adoption process, which proceeds roughly along the following lines: awareness of the problem or opportunity; non-trial evaluation; trial evaluation; adoption; review and modification (Pannell et al. 2006). A farmer may also decide not to adopt or to cease adoption of a new practice at any stage. Furthermore, they may decide to partially adopt a new practice, not as a trial per se but as an endpoint in itself. Appreciating the temporal and intensity elements of adoption challenges the older ‘black and white’ picture of practice change.

Farmers’ perceptions of the characteristics of no-till farming systems are central to this paper. According to a comprehensive review of adoption of conservation practices by Pannell et al. (2006), the two main characteristics of a practice that influence adoption are its relative advantage and trialability. Relative advantage - which the authors state is ‘the decisive factor determining the ultimate level of adoption of most innovations in the long run’ (p. 1413) – stems from a wide range of factors including: the expected profitability of the new practice over different time scales and in comparison with the practice it would replace; the innovation’s expected effect on and compatibility with existing components of the farm and the lifestyle, beliefs, values and self-image of the farming family; the innovation’s environmental credibility; the innovation’s complexity and effect on the riskiness of production; and the adjustment costs involved in making the change.

The ease of learning about an innovation is its trialability, which is determined by two main factors: the risk and cost of trialling the innovation, including the ability to adopt it partially; and the ability to attribute results of the trial to the innovation. The riskiness of a trial is affected by the quality of information one has about the new practice, which is influenced in turn by how much trust one can place in the source of that information. As research in other fields such as public administration, public health and disaster management emphasises, trust is key to successful behaviour change and is dependent in large part on the relationships between ‘messenger’ and ‘message recipient’, in particular the latter’s perception of whether the messenger respects them and their goals (Longstaff and Yang 2008, Palmer et al. 2009).

No-till farming is rich ground for investigating the above topics, given its complexity, substantial transaction costs and conflicting environmental credentials, among other factors. For this reason, the following paper contributes not only to improved extension efforts around no-till in the Victorian Mallee but to a broader understanding of obstacles to adoption and the role of extension efforts in contemporary agriculture.

The Victorian Mallee is a large and important crop-growing region in northwest Victoria. It is home to recent rapid adoption of no-till farming systems. In recognition of this adoption, the Mallee Catchment Management Authority commissioned exploratory social research into the extent of the practice change and the reasons behind it. The primary purposes of the project were to: collect local information about the extent of recent cropping practice change in the Mallee and the reasons behind the apparent widespread adoption of no-till; and to help define a direction for future extension services that encourage and help farmers adopt no-till. For the purposes of this study, "no-till" is a generic term used to include "direct drill" (one pass seeding with a full cut), "no-till" (one pass seeding with knife points) or "zero-till" (one pass disc seeding).

Methodology
Given the exploratory, ‘early research’ purpose of this study, a qualitative grounded theory methodology was adopted in which a relatively small number of in-depth interviews were used to collect suggestive insights about the no-till situation in the region. In keeping with this, a local interviewer approach was used, following Rickards (2008a, b). This approach was chosen to take advantage of the way local interviewers can easily develop rapport with interviewees from the same region and further the depth of questioning and quality of data collected, as they draw on their local knowledge of farming issues in the area. Training and using local advisors as interviewers also carries the further advantages of building social research capacity in the local extension population and allows more interviews to be conducted than would be possible using fewer external interviewers (such as the authors). The disadvantages of this approach are that multiple interviewers can introduce systematic variation into the results. To minimize this, structured questions were used, interviewers were carefully trained and interview findings were screened to check for obvious bias.

Potential interviewers were approached from local agricultural consulting businesses, farm input resellers and a local producer group. Six interviewers were selected (three consultant agronomists, two resellers and one producer group member) and trained in good interview technique and ethics.
A sample of 90 farmers, consisting of approximately even groupings (30 farmers) of full, partial or non-adopters of no-till practices, was then selected for interview. A purposive sampling frame was used whereby the six interviewers were each asked to use their local contacts to construct lists of approximately 5 farmers from each of the above categories, defined as:

1. **No-till** – those whose entire crop in 2007 was sown with no soil disturbance prior to sowing;
2. **Combination** – those who use a combination of no-till and conventional tillage;
3. **Multiple-till** – those who prepared the vast majority of their 2007 crop using one or more cultivations prior to sowing.

The farmer samples selected by the interviewers covered diverse geographical areas, rainfall zones and soil types, as well as a range of farmers in terms of age, enterprise size, business stage (expansion, consolidation, wind down), level of practice change and clients and non-clients. Accessing farmers via local interviewers reduced the randomness of the sample and thus the generalisability of the results, but was necessary for pragmatic reasons. Importantly, such an approach still allows valuable qualitative insights to emerge.

Interviews were conducted in February and March 2008. Set questions were asked for consistency in data collection and at the same time, a conversational approach was used to encourage farmers to talk freely about their business. Interview questions explored: the extent and drivers of practice change; the reasons for some farmers maintaining a preference for cultivation and the constraints to the adoption of no-till farming; views about profitability and sustainability of different farming systems; and where farmers access information to assist practice change and their expectations and opinions about the role and value of NRM agencies, producer groups, private advisors and others in the Mallee. Cropping data about the 2007 season in comparison to five years ago was also collected. Percentage frequencies of quantitative cropping practice data and attitudinal scale responses were collated, although the non-randomness of the sample meant that statistical testing was not appropriate. Qualitative responses were coded into themes and used to try to understand farmers’ perspectives and stories.

**Results**

**Rapid conversion to no-till**

No-till farmers were using knifepoint seeding rather than “direct drill” or one pass seeding with a full cut. Combination farmers were using a mix of tynes and knife points. No one was disc seeding (zero till).

Around 85% of farmers interviewed reported that they had reduced their tillage levels over the past five years. The results are shown in Figure 1 and Figure 2. The conversion to no-till has been recent given that only 10 out of the 90 farmers interviewed were using no-till as a ground preparation method five years ago, increasing to 68 farmers or 75% (using it for at least part of their crop) for the 2007 season. Five years ago, No-till farmers were still preparing over 50% of their ground in a conventional or multi-till manner. Similarly, the Combination group multi-tilled over 80% of their ground five years ago compared with less than 40% now. While the Multiple-till group have not adopted no-till to any substantial extent, 70% reported that they had reduced the number of workings or level of cultivation over the past five years. Many initiated the fallow period using chemicals.

Cropping intensity had increased on over 60% of farms (participating in the study) over the past five years, with the average intensity across the sample being 77% sown for the 2007 season. Almost three quarters of interviewees rated livestock as either moderately or very important to their enterprise, despite livestock numbers dropping on nearly 40% of participating farms over the past five years.

Farmers using no-till (to any degree) were from diverse age groups and operated a range of farm sizes in various business growth stages. They were more likely to run a larger farm and to be planning to expand their operation than Multiple-till farmers.

The key reasons for adoption put forward by No-till and Combination farmers, was to reduce soil erosion and to gain increased flexibility around sowing decisions to enable a change in cropping plan as the season unfolds. Other prominent reasons for change included their desire for a system using less tractor hours (both less labour and wear and tear on machinery) and one that would increase the efficiency of their operation (greater cropping intensity and better use of capital) and ultimately business profit. No-till farmers were also striving for agronomic gains (for example, water use efficiency in growing grain, weed control, better targeting of inputs) and soil health improvements.
Farmers within the Combination group included those trialling no-till and some building confidence with the new system and looking to convert to 100% no-till for the following season. Others expressed a preference for maintaining a flexible ‘combined’ system: one involving both no-till and conventional cultivation, with the mix determined by soil type and season.

Almost half of Multiple-till farmers interviewed expressed a strong ongoing preference for cultivation for ground preparation. They had deeply held beliefs and concerns about shifting to no-till (discussed below) and were not contemplating making a change in this direction. The remaining Multiple-till farmers expressed a desire to change their system towards no-till sometime in the future. Like the others in this category, however, they resisted the idea that no-till was the best approach for all farmers and all land. As two of them stated:

“Every farm and paddock is different and no one system fits them all”,

“Best management practices are different for different people – it comes down to farming practices for your own soil type”.

**Concerns about no-till**

Farmers were asked to rate a list of potential obstacles to (or concerns about) adopting no-till according to level of importance, on a scale of one to five (five being very important). A summary of the ‘high importance’ responses (rated 4 or 5/5) is provided for each tillage group in Figure 3.
There was a high level of consistency across all tillage groups in terms of the order of importance of each of the main concerns listed. The top three concerns were: cost of herbicide; herbicide resistance; and the cost of modifying or purchasing new machinery. It is notable that there was concern (across all three tillage groups) about a heavy reliance on herbicides under a no-till system. There were also concerns about health effects, rising herbicide costs and resistance.

The main difference between the groups was the level of importance they attributed to each obstacle. It was evident that fewer No-till farmers rated each potential obstacle or concern as high importance. Combination farmers tended to be somewhere in between, while a higher percentage of Multi-till farmers reported stronger concerns for ten out of the twelve questions. An exception is that Multiple-till farmers place more importance on their preference for a less complicated cropping system and have a higher concern about moisture retention than the other two groups. Across all three groups, there were comparable levels of concern about the compatibility of livestock with an increasingly intensive cropping system, access to paid labour, and the cost of other farm inputs.

Many Multiple-till farmers expressed concern about the profitability of no-till and, especially, about yield penalties they believed to exist on heavier soils. Like some in the Combination
Multiple-till farmers were also troubled by the high labour demands of no-till at sowing time. Overall, they want to know more about:

- The financial aspects of no-till, particularly its profitability (or lack of).
- Yields and performance by region and broad soil type.
- Labour requirements at different times of the year.
- How to run livestock in an increasingly intensive cropping system.
- Herbicide resistance and weed control issues.

In reflecting on their own conversion to no-till, many of the No-till farmers indicated that the biggest hurdle was belief that the new system would work and the confidence to go through with the change. They then faced the hurdle of getting the machinery right and, most challengingly, the issue of managing the agronomic aspects of the no-till system, which tends to increase in complexity when operated at a higher cropping intensity.

**Views about sustainability and profitability**

Although some No-till farmers had reservations about its sustainability (due to the heavy reliance on chemicals) one of the most notable observations was their enthusiasm about the success of no-till and belief that the system was good for the environment. In contrast, those farmers expressing a preference for staying with multiple-till did not generally equate no-till farming with improved sustainability.

Around 50% of Combination and No-till farmers believed no-till to be more profitable and a further 24% of No-till and 13% of Combination farmers indicated they believed the systems to be as profitable as conventional systems. Only about 10% of these two groups felt no-till to be less profitable.

The No-till adopters who believed it to be more profitable mostly attributed this to: economies through more intensive cropping; ability to produce more grain on poorer ground; lower input costs per hectare; greater flexibility and efficiency, including enhanced sowing timeliness and responsiveness in the face of dry seasons; and better utilisation of fixed assets. Many also mentioned that their soil was now in better condition.

Most multiple-till farmers felt that no-till was either the same or less profitable in their area. Others were unsure of its profitability, with around 30% believing that no-till was profitable in other regions in the Mallee, namely those with lighter soils, but not in their particular region. As one stated:

“I have been following neighbours with interest, and I like the idea of direct drill, but I would really like to see what cost savings or yield increases there are to be made”.

For the time being many Multiple-till farmers don’t see a strong relative advantage of no-till over multiple till for them.

**Sources of advice and information**

Use of paid advisors was a central difference between those who adopted no-till (partially or fully), and those who did not. No-till and Combination-till farmers generally used paid advisors for advice on business, agronomy and land management decisions. Around 80% of No-till farmers used a paid advisor compared with 40% of Multiple-till farmers (and 60% of Combination farmers). Multiple-till farmers also expressed a stronger preference for a less complicated cropping system. Over 40% of Multiple-tillers (compared with 12% of No-till farmers) considered this preference an important barrier to adoption (refer to Figure 3). No-till and Combination farmers were also more accustomed to accessing and using information and rated producer groups of moderate importance for information on land management decisions. In contrast, Multiple-till farmers sought advice more heavily from resellers and looked to agencies for information on land management matters. They did not regularly access extension information. There was found to be only limited engagement between the different sources of advice, namely: private advisors and resellers, with government agency staff and producer groups.

**Discussion**

Irrespective of the type of sowing system they are using, this study suggests that farmers in the Mallee region are aware of the need to reduce cultivation-induced soil erosion. The widespread reduction in the level of tillage reported by farmers in the sample points to the success of the extension message in the region about soil erosion and the role played by cultivation. While there is still obviously broad scope for further practice change, in terms of farmers reducing
their tillage intensity and practicing no-till proper (e.g. direct drilling), the farming population seems to be well versed about the issue.

In addition to a strong awareness of the link between no-till and reduced erosion, the main drivers for adoption of no-till seem to be the flexibility, efficiency and profitability it offers. These inter-related drivers point to adopters’ focus on how they utilise their time, a concern which is further indicated by their use of private advisors to allow them to fast track the learning process by filtering information and receiving advice on decisions. Combined with the facts that the No-till group is generally characterised by their larger farm size and interest in expansion, and no-till generally demands the outsourcing of labour at sowing time, it seems adopters of no-till generally fall into what McGuckian and Rickards (2009) called ‘the CEO model’ of farmer. Such farmers are happy to delegate a significant number of farming tasks, ranging from tractor work to complicated decisions about aspects of the business such as finance, machinery and agronomy. The ‘CEO farmer’ is then left to manage and integrate the various components and people that make up the complex whole that is their modern farm business (see McGuckian and Rickards for further discussion). No-till assists farmers in implementing this approach by freeing up their time to focus on questions such as enterprise mix and the sort of just-in-time adjustments to cropping programs in response to dry seasons, for example, that no-till also enables.

In contrast to the No-till farmers, the Multiple-till farmers are a much more diverse group. Some are less used to outsourcing labour or advice, preferring to continue running a predominantly family operation (often one-person). A feedback loop ensues for a proportion of farmers, such that they do not have the time (or the money) to learn about or implement the no-till system that would then provide them with these resources. For some Multiple-till farmers, the shift in labour requirements under no-till from work across the season to a short sharp period at sowing time, is a threat to their self-sufficiency. While a cultivation-based sowing system may involve more hours overall, because these hours are more evenly spread throughout the year, it is still achievable for one person. Furthermore, the time savings that no-till offers across the year are of less value to a farmer who does not need to free up time to manage paid advisors and others. Overall, cultivation seems more in keeping with the self-sufficient model of farming that many Multiple-till farmers seem to value, and the benefits of flexibility, efficiency and profitability of no-till are of less relative advantage to Multiple-tillers than to those farmers using their time and money in a different, more CEO-like fashion.

One of the reasons that time is a prerequisite for adopting no-till (not only a consequence of it) is that it is a complicated practice that demands the acquisition of a significant amount of new knowledge and skills. To the extent that this investment involves employing a paid advisor and/or accessing and synthesising large amounts of information, it represents a greater risk and barrier to those unaccustomed to working in this way.

If paid advisors are in practice the main ‘keepers of knowledge’ about no-till, and engagement with them is virtually compulsory for successful evaluation and adoption of the practice, expanding adoption of no-till requires that these extension agents extend their reach to those currently not using their services. Moreover, it requires that these advisors develop a trusting relationship with potential Multiple-till clients. The literature on trust highlights, however, that this may be hampered if the advisor is unable to respect the farmer’s style of operating, which, as discussed above, is characterised not only by certain tillage decisions but by their general preference for avoiding the purchase of services such as those the advisor offers. The risk is that if farmers such as the Multiple-till group feel their goals are not respected, they will not develop a trusting relationship with the sort of paid advisors who operate to a large degree as gatekeepers to no-till adoption. Such farmers then face becoming increasingly isolated and wedded to cultivation.

The trialability of no-till is further reduced for Multiple-till farmers by their lack of engagement with producer groups who, like paid advisors, are likely to be able to provide access to observable examples of no-till in action. Some farmers’ comments that they do not believe no-till works well in their particular region suggests that they have few if any close neighbours using the system. It also suggests that cultivation type is clustered geographically, perhaps in keeping with soil type.

Trialability is enhanced in cropping by the ability to compare new and old types of cropping systems on the one property (Abadi Ghadim et al. 2005). This is one of the advantages enjoyed by the Combination-till group, who operate both conventional and no-till approaches. As their comments indicated, however, it cannot be assumed that the co-presence of the two approaches is purely about trialling no-till. In keeping with the literature on the non-linearity of adoption (e.g. Buck et al. 2001), some indicated a preference for maintaining a mixture of the
two. Flexibility for these farmers is about being able to move between system types as well as the flexibility inherent within no-till.

The Multiple-till group were relatively unique in raising concerns about the profitability of no-till. This suggests that their concerns could be addressed through further exposure to successful examples of no-till. However, elements of their farm systems such as heavier soils or a commitment to mixed farming could mean that their concerns are well-founded and point to limitations of no-till that require further research. Some benefits of no-till, for example erosion control and particular agronomic gains, are more easily won on lighter soils. Other elements of their systems such as a desire to remain relatively self-sufficient in labour further highlight how no-till – as currently practiced - demands trade-offs between their goals, and comes out the less appealing of the options available. A considerable proportion of the Multiple-till group are not convinced that there is a relative advantage for them with adopting no-till.

It is significant that herbicide costs and resistance, and machinery costs – which generally match the main limitations of no-till reported in an earlier survey of South Australian and Western Australian grain growers (D’Emden & Llewellyn 2004) – were reported as concerns with no-till irrespective of farmers’ level of adoption of the system. The inverse relationship that exists between level of concern with these factors and level of adoption of the system indicates that, once practicing no-till, farmers’ confidence in the no-till system builds and/or they begin to place less value on the system’s shortcomings. Nevertheless, combined with widespread interest in further information about how compatible no-till is with livestock, weed management is a further area of no-till that demands primary research and improved answers as much as further extension efforts. There are questions about how sustainable is no-till’s heavy reliance on chemical herbicides (D’Emden and Llewellyn 2006, Huggins and Reganold 2008). To the extent that no-till encourages a move away from livestock, there are also questions about how sustainable this direction is, given the recent emphasis placed on diversification and mixed farming as potential risk management tools in the face of drought and climate change (McGuckian and Rickards 2009). Greater compatibility between no-till and livestock would further increase the flexibility that farmers already value about no-till.

These ongoing gaps or imperfections in the no-till farming system as currently promoted and practiced are highlighted by the extension context it exists within. Side-by-side with the extension messages farmers receive about no-till is a general community call for reduced agrochemical use. There are also extension programs promoting better integration of livestock and crops (e.g. the Grain and Graze program). There are divergent views on the compatibility of no-till with livestock between growers, agencies and advisors, which tend to cloud the issue and is another barrier to adoption for those with more stock, particularly on heavier soils in the southern Mallee area. Unacknowledged and unresolved tensions between desired directions in extension messages risks confounding and irritating farmers, reducing the credibility of all the messages and messengers involved.

In addition to further work on resolving questions about no-till and improving the complementarities between different environmental and other goals, better integration of extension sources is needed to improve consistency across them. Given private advisors’ and resellers’ existing relationships with farmers and local knowledge, they themselves could be targeted with improved information on no-till as further research on the system produces results. Such integration could assist in overcoming the kind of cultural barriers between agribusiness and research and development found by Stone (2005, 2008).

Conclusion

No-till has an important role to play in improving the sustainability of agriculture in the Mallee and beyond, particularly in the context of reducing soil loss and also climate change. While only exploratory, this study has contributed insights about the farmer and practice characteristics influencing adoption and non- adoption of no-till. The small snap-shot provided by this study also points to the research and extension challenges that remain, including the need for a larger quantitative survey to test the statistical significance of the differences between groups suggested here, a more in-depth qualitative study to better understand how farmers weigh up the potential costs and benefits of no-till, and a longitudinal study into the process of decision-making and possible adoption.

One of the significant things this study suggests is that cultivation-based and no-till farming appeal to different models of farmer, with the former suiting those who value self-sufficiency and the latter suiting those taking on more of a ‘CEO’ role. One of the implications of this is that, to the extent that paid advice is a necessary route to no-till adoption, private advisors have a type of gate-keeping role in the adoption process. For those unused or unable to utilising
such paid services, this will remain a barrier to no-till. In recognition of their responsible role, private advisors should be targeted with high quality information about no-till, as should resellers, to whom Multiple-till farmers already talk. Further research is also needed into the role of external advice in encouraging no-till adoption or non-adoption and why and how different advisory professions seem to have developed different orientations towards no-till systems.

As emphasized by Vanclay (2004), it is important that extension efforts around no-till are respectful of the knowledge and experience of those resistant to or yet to change. Farmers’ reasons for non-adoption or partial adoption are legitimate, and relate either to their own characteristics (such as some Multiple-till farmers’ concerns about costs, which may be an involuntary consequence of their circumstances) or to the characteristics of the practice (such as unresolved shortcomings of no-till like its reliance on chemical herbicides, its possible incompatibility with livestock, and the poor visibility of environmental and agronomic gains on heavier soils). As Llewellyn et al. (2006) argue more generally, extension efforts need to selectively target the farmer perceptions about no-till, focusing on those that are able to be addressed through more information or by assisting farmers to apply the information to their properties to see how no-till could work for them. For such efforts to be credible and effective, they also need to be open about the gaps that remain in our knowledge about no-till and how it can best be integrated with other desirable practices. Further research is needed on no-till itself to address its limitations from a farmer viewpoint. By improving the environmental, social and production credentials of no-till systems as well as our understanding of how best to enable adoption of them, we could take a significant step toward a more sustainable agriculture.

References


Trouble on the water: understanding the context of dairy farmers work in Canterbury, New Zealand

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Abstract. In Canterbury New Zealand, water is a contentious issue, especially when irrigation and dairy farming are involved. Our research aimed to determine dairy farmers’ understanding and perceptions of water use efficiency in regards to their irrigation system. A comprehensive search of popular press revealed that a negative perception of dairy farming exists, especially in regards to irrigation. While this research did not explore the direct link between public perception and farmers, farmers were very aware of how the urban population perceive dairy farming. However they argued that these non-farmers did not truly understand the benefits farming brings to the region. When asked whether dairy farmers should pay for water, many (90%) argued that they already do so through the resource consent process and infrastructure to take the water. However, 23 of the 27 farmers had modified their practices and on-farm infrastructure because of public perception and perceived difficulty with future water allocation.

Keywords: water efficiency, irrigation, dairy farmers, Canterbury.

Introduction

Water, in Canterbury New Zealand, is a contentious issue, especially when irrigation and dairy farming are involved. The importance of irrigation to Canterbury’s overall development has been recognised by local government and has been given priority in the Environment Canterbury Regional Development Strategy. This has a focus on the development of further irrigation schemes in the Canterbury region. A common theme raised in previous research (Payne and Steven 2007a, b) was the negative responses that farmer interviewees received from members of the community about the use of water by dairy farmers. We realised that the context in which they live and make decisions must first be understood before researchers can truly interpret dairy farmers’ views on irrigation.

Two key issues which have arisen are water use efficiency and ownership of irrigation water. This research aimed to investigate the views and actions of farmers on improving water use efficiency. It also aimed to understand their views on ownership of water.

Background

Popular press and Canterbury irrigation

An understanding of the context in which dairy farmers work and live is required to gain a better understanding of their perceptions of irrigation water-use efficiency. A search was undertaken looking at public views of water irrigation on dairy farms in the Canterbury region through the popular press. Overall the search revealed that there is considerable opposition to the increased water use by large dairy farm irrigators on the Canterbury plains. In particular, there is much controversy surrounding the planned Central Water Plains irrigation scheme, which opponents see as backing the needs of the expanding dairy industry and threatening the recreational and environmental assets of the region by harming fisheries and reducing water flows. Some also fear that increased irrigation and dairying could lead to an increase in potentially fatal waterborne illnesses. Opponents also include farmers who have their livelihoods and farms threatened by proposed water storage and dams.

The public see farming as one of the main contributors to almost all of New Zealand’s environmental problems. When people are asked about irrigation, most New Zealanders think of Canterbury. In Canterbury, dairy farming is perceived to be putting huge pressure on water supplies and the environment. For example Lee (2003, p.14) said ‘Dr La Follette an environmental scientist had dire warnings that proposed large-scale irrigation schemes on the plains and the likely dairy development which would follow could have disastrous consequences for the environment and people’. He goes on to say that ‘environmentally, the best practice was not to try and beat nature at all, and dry land should be left as it is’.

A State of the Environment report released by the Ministry for the Environment identified ‘intensive agriculture and the associated deterioration of lowland water quality [as] the number one issue facing New Zealand’s environment’ (Fish and Game 2008).

Farmers are perceived, by some individuals in the community, to ‘take, take, take’, when it comes to water in Canterbury. Table 1 illustrates some of the articles that have been published
between October 2001 and December 2008 on irrigation in Canterbury. Many of the titles portray a very negative view of this industry. For example ‘dairying blamed for water crisis’, ‘dry horrors’ and ‘water wars’.

### Table 1: Articles published on irrigation in Canterbury (Oct 2001 - Dec 2008)

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<th>Date</th>
<th>Source</th>
<th>Title of article</th>
<th>View point</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 01</td>
<td>NZ Dairy Exporter</td>
<td>Conflict over water in Mid-Canterbury: safeguarding their water resource</td>
<td>negative</td>
<td>(Lee 2001)</td>
</tr>
<tr>
<td>26/2/02</td>
<td>The Press</td>
<td>Irrigation: too many unknowns</td>
<td>negative</td>
<td>(Clark 2002)</td>
</tr>
<tr>
<td>31/1/03</td>
<td>NZ Environment</td>
<td>Are we reaching the bottom of the bucket?</td>
<td>negative</td>
<td>(Hansford 2003)</td>
</tr>
<tr>
<td>15/5/03</td>
<td>The Press</td>
<td>No new irrigation</td>
<td>negative</td>
<td>(Rodgers 2003)</td>
</tr>
<tr>
<td>9/8/03</td>
<td>The Press</td>
<td>Draining the well dry</td>
<td>negative</td>
<td>(Henzell 2003)</td>
</tr>
<tr>
<td>Mar 04</td>
<td>NZ Dairy Exporter</td>
<td>Allocation in Canterbury reaches a watershed</td>
<td>negative</td>
<td>(Lee 2004a)</td>
</tr>
<tr>
<td>Dec 04</td>
<td>NZ Dairy Exporter</td>
<td>IRRIGATION: National benefit from SI schemes</td>
<td>positive</td>
<td>(Lee 2004b)</td>
</tr>
<tr>
<td>Jul 05</td>
<td>NZ Dairy Exporter</td>
<td>Irrigation effects felt on lower Canterbury Plains</td>
<td>positive &amp; negative</td>
<td>(Lee 2005)</td>
</tr>
<tr>
<td>Oct 05</td>
<td>NZ Dairy Exporter</td>
<td>Testing time for take-up rights</td>
<td>negative</td>
<td>(Anon 2005a)</td>
</tr>
<tr>
<td>26/2/06</td>
<td>The Press</td>
<td>Lifeblood of Canterbury</td>
<td>positive &amp; negative</td>
<td>(Cronshaw 2005)</td>
</tr>
<tr>
<td>15/4/06</td>
<td>NZ Listener</td>
<td>Dry horrors</td>
<td>negative &amp; positive</td>
<td>(Anson 2006)</td>
</tr>
<tr>
<td>Nov 06</td>
<td>NZ Dairy Exporter</td>
<td>Irrigation: ‘work together’ plea in Canterbury</td>
<td>positive</td>
<td>(Lee 2006)</td>
</tr>
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<td>5/6/07</td>
<td>The Green Party</td>
<td>Pull plug on Canterbury water plan</td>
<td>negative</td>
<td>(Tanczos 2007)</td>
</tr>
<tr>
<td>24/7/07</td>
<td>The Press</td>
<td>Time to cry outrage over spilt milk and water</td>
<td>positive</td>
<td>(du Fresne 2007)</td>
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<tr>
<td>Sep 07</td>
<td>NZ Dairy Exporter</td>
<td>Water: irrigation for ‘whole community’</td>
<td>positive &amp; negative</td>
<td>(Lee 2007c)</td>
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<tr>
<td>13/8/07</td>
<td>Country-Wide</td>
<td>Canterbury water issues boiling over</td>
<td>negative</td>
<td>(Anon 2007a)</td>
</tr>
<tr>
<td>13/8/07</td>
<td>The Press</td>
<td>Water plan ‘risks health’</td>
<td>negative</td>
<td>(Morrall 2007)</td>
</tr>
<tr>
<td>17/8/07</td>
<td>The Press</td>
<td>The downside of dairying</td>
<td>negative</td>
<td>(Williams 2007)</td>
</tr>
<tr>
<td>17/8/07</td>
<td>The Press</td>
<td>Dairying debate cloued by misinformation</td>
<td>positive &amp; negative</td>
<td>(Mackenzie 2007)</td>
</tr>
<tr>
<td>28/8/07</td>
<td>The Press</td>
<td>Time to talk on dairying</td>
<td>positive</td>
<td>(Penno 2007)</td>
</tr>
<tr>
<td>31/8/07</td>
<td>The Press</td>
<td>Groups move to protect river</td>
<td>negative</td>
<td>(Bristow 2007)</td>
</tr>
<tr>
<td>19/9/07</td>
<td>The Press</td>
<td>More facts needed in water debate</td>
<td>positive</td>
<td>(Fleming 2007)</td>
</tr>
<tr>
<td>21/9/07</td>
<td>The Press</td>
<td>Water debate vital</td>
<td>negative</td>
<td>(Memon and Nicolle 2007)</td>
</tr>
<tr>
<td>6/11/07</td>
<td>The Press</td>
<td>Study on health impact of irrigation</td>
<td>negative</td>
<td>(Anon 2007b)</td>
</tr>
<tr>
<td>Nov 07</td>
<td>NZ Dairy Exporter</td>
<td>Environment Canterbury farmers: we’re clean</td>
<td>positive</td>
<td>(Lee 2007a)</td>
</tr>
<tr>
<td>Dec 07</td>
<td>NZ Dairy Exporter</td>
<td>Meeting backs Central Plains</td>
<td>positive</td>
<td>(Lee 2007b)</td>
</tr>
<tr>
<td>4/2/08</td>
<td>The Press</td>
<td>Some good news</td>
<td>positive &amp; negative</td>
<td>(Editorial 2008)</td>
</tr>
<tr>
<td>1/3/08</td>
<td>NZ Listener</td>
<td>Water wars</td>
<td>negative</td>
<td>(Macfie 2008)</td>
</tr>
<tr>
<td>7/3/08</td>
<td>ruralnews.co.nz</td>
<td>Irrigation bid off to a bad start</td>
<td>negative</td>
<td>(Carnachan 2008)</td>
</tr>
<tr>
<td>25/7/08</td>
<td>Ashburton Guardian</td>
<td>Farmers make case for more water</td>
<td>positive</td>
<td>(Clarke 2008a)</td>
</tr>
<tr>
<td>1/8/08</td>
<td>Unlimited</td>
<td>Water – a $40 billion issue</td>
<td>negative</td>
<td>(Anon 2005b)</td>
</tr>
<tr>
<td>5/8/08</td>
<td>The Press</td>
<td>Report reveals threat to rivers</td>
<td>negative</td>
<td>(Silkstone 2008)</td>
</tr>
<tr>
<td>23/8/08</td>
<td>The Press</td>
<td>The big water grab</td>
<td>negative</td>
<td>(Gorman 2008)</td>
</tr>
<tr>
<td>24/10/08</td>
<td>Straight Furrow Website</td>
<td>Irrigation possible, says water study</td>
<td>positive</td>
<td>(Keene 2008)</td>
</tr>
<tr>
<td>22/12/08</td>
<td>Ashburton Guardian</td>
<td>Water survey reveals concerns</td>
<td>negative</td>
<td>(Clarke 2008b)</td>
</tr>
</tbody>
</table>

Many stakeholder groups voice their opinion about dairy farming and irrigation in Canterbury (Table 2). There are also many research reports investigating the issue of irrigation in Canterbury. Stakeholder groups take parts of these reports to add weight to their arguments and viewpoints. Fish and Game, an angler and game bird hunter organisation, believe that the Canterbury region is facing ‘an additional 100 000+ hectares of irrigated land for intensive agriculture, probably dairying. We all know there’s a large mismatch between land capability and land use’ (Fish and Game 2008). Fish and Game believe the Central Government must use regulation to pause large-scale water developments until suitable national policies and standards are put into place.
Table 2: Stakeholder groups who have issues with dairying and irrigation as identified in the popular press search

<table>
<thead>
<tr>
<th>Stakeholder group</th>
<th>Issue with dairying and irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish and Game</td>
<td>• Water quality</td>
</tr>
<tr>
<td></td>
<td>• Clearance of trees and vegetation</td>
</tr>
<tr>
<td></td>
<td>• It is a public resource and should be there for everyone to use</td>
</tr>
<tr>
<td>Green Party</td>
<td>• Climate change</td>
</tr>
<tr>
<td></td>
<td>• Quantity and quality of water available in Christchurch</td>
</tr>
<tr>
<td>Save our water</td>
<td>• Want to protect bird and fish species which rely on the river</td>
</tr>
<tr>
<td>Forest and Bird</td>
<td>• Native plants</td>
</tr>
<tr>
<td>Kayakers</td>
<td>• Irrigation depletes the Waimakariri and Rakaia Rivers</td>
</tr>
<tr>
<td>Other farmers</td>
<td>• Impact new water consents have on their own water allocation</td>
</tr>
<tr>
<td>Water Rights Trust</td>
<td>• Central Plains Water scheme</td>
</tr>
<tr>
<td>Canterbury District Health Board</td>
<td>• Infant health due to risk of heightened nitrate levels in regions drinking water</td>
</tr>
</tbody>
</table>

In the summer of 2004, Canterbury experienced a drought and the demand for irrigated water increased. Existing dairy farmers defended their irrigation right and objected to new consent applications to draw water from their areas. When an application went in from Te Pirita dairy farm, Lynton Dairy Ltd, to take water from 10 bores across 999ha, Robindale Dairies, a 3,000 cow neighbouring farm asked that conditions be imposed. Robindale wanted conditions put in place to stop major effects the take might have on their own water supply (Lee 2004a). However, not just large corporate farms object to new consent application; smaller units also see new consents as threatening the security of their water supply. As Dairy Holdings general manager Colin Glass said (Lee 2004a, p.26); 'it is farmer having to be pitted against farmer’ for this valuable resource.

**Literature**

Freshwater resources are usually described as a common property resource because they have no specific owner and belong to everybody. In 1968, Hardin (1994) coined the phrase ‘tragedy of the commons’ to describe the degradation typically associated with common property resources (Hardin 1994; Dryzek, 1997). He used the image (or metaphor) of the medieval village common to illustrate why common property will always be degraded. Each user will attempt to maximise the benefits from resource utilisation by putting as many grazing animals on the commons as possible. This rational pursuit of self interest acts against the collective long-term interest of conserving the commons and results in degradation (or in this case over grazing and erosion). This example highlights the social dilemma present in social debates i.e. the pursuit of rational self-interest acts against the collective good (Karp 1997). It is widely believed that degradation occurs because property rights are poorly assigned (O’Neill and Scrimgeour 1991) thus making self-interest a rational choice. However, because dairy farmers, and/or water schemes, have to apply to local government, i.e. councils, for a resource consent for irrigated water this does imply that the water, although a common property resource, is managed by the Councils.

**Methods**

**The Kaine framework**

The Kaine Framework has been designed ‘for predicting the adoption of innovations by primary producers’ (Kaine 2009, p.52). Consumer behaviour theory and farming management underpin this framework. Kaine (2009) identifies four propositions that underlie this framework:

1. Benefits from adopting agricultural innovations depend on farm context;
2. Farm context can consist of elements that are external to the decision-maker;
3. Producers reasons for adopting innovations will mirror their farm context; and
4. Producers are the most authoritative source of knowledge about their farm context.

The Kaine Framework allows farmers to be placed into segments based on their similarities and differences in ‘the purchase criteria that they use to evaluate a product’ (Kaine 2009, p. 52). Understanding the key purchase criteria that farmers in a particular segment use, can be used to modify innovations and information to meet the specific needs of people in that segment (Kaine 2009).

The framework developed by Kaine (2009) has two stages, the first is to identify the elements in the farm system that shape the benefits from adopting a particular innovation and form the farm contexts. The first stage is an elicitation process that will (Kaine 2009, p. 101):
yield a set of hypothesised associations between the various elements that constitute the set of farm contexts for an innovation, the adoption of the innovation and the benefits of the innovation.

This process provides the information to design a survey (Converse and Presser 1986 cited in Kaine 2009, p. 101). The second stage identifies the proportion of farmers with farm systems that are consistent with the farm context for the innovation is quantified’ (Kaine 2009, p. 115).

Research methods

The Kaine Framework provided the conceptual approach for this research. This approach enables the identification of the benefits sought from adopting a particular technology, or in this case, the benefits sought from adopting a particular strategy - improved water use efficiency on farm. In the case of farming, the benefits resulting from adopting a particular technology depend on a range of contextual factors that are specific to the circumstances of each farm enterprise (Bewsell and Kaine 2004). The research questions are designed to adopt a particular technology.

The use of complex decision making in high involvement purchasing implies that the purchaser develops explicit chains of reasoning to guide their decision making. This suggests that there should be shared and complementary patterns of reasoning among dairy farmers and consistency in the decisions they reach. Hence, to identify the factors influencing dairy farmers decisions we followed a convergent interview process (Dick 1999). Convergent interviewing is unstructured in terms of the content of the interview. The interviewer employs laddering techniques to systematically explore the reasoning underlying the decisions and actions of the interviewee (Grunet and Grunet 1995).

Farmers were asked questions based around four key themes: farm demographics, water irrigation system and efficiency, views on water availability and their thoughts on the future for irrigation water in Canterbury in the next five years. The demographics of their property included the size, number of cows and the ownership structure of the farm. Questions about the water delivery and systems focused on the water scheme the property was involved with, the irrigation system on-farm and how this was monitored. Questions on water availability focused on who farmers believed owns the water in Canterbury and explored whether they felt they have the right to use it once they have a resource consent. Pseudonyms have been used where part excerpt or descriptions from interviews have been inserted. Kaine (2009) recommends identifying the farmer segments in the first instance, and then identifying the proportion of farmers in each segment. Thus, due to the small sample number we were unable to quantify segment size. This will be undertaken with the results of the survey.

Participant characteristics

We interviewed 27 dairy farmers throughout the Canterbury region. Names were provided from a list of past questionnaire participants who indicated that they would like to be further involved. Care was taken to interview a geographical representation of farmers throughout the Canterbury region and to interview farmers across different age brackets. We had a spread from farmers in their late 20’s to late 50s. These included farmers from Waimate, Timaru, Ashburton, Rakaia and Oxford. In Table 3, other characteristics of the interviewees are outlined. When organising the interviews 40 farmers were contacted with 13 farmers declining to be interviewed. This is a lower acceptance rate than has previously been experienced in this type of study which has usually been 75 to 85%. This in part could be due to pressure from negative publicity and perceived urban views.

Table 3: Demographics of Canterbury dairy farmer participants

<table>
<thead>
<tr>
<th></th>
<th>Size of property (ha)</th>
<th>Number of cows</th>
<th>Years on farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>356</td>
<td>1 369</td>
<td>20</td>
</tr>
<tr>
<td>Maximum</td>
<td>1 070</td>
<td>4 300</td>
<td>40</td>
</tr>
<tr>
<td>Minimum</td>
<td>162</td>
<td>530</td>
<td>1</td>
</tr>
</tbody>
</table>

Results

We classified farmers into four segments based on how they received their irrigation water (i.e. via a scheme or from wells), which in turn appeared to influence the amount of control they had over their water, and whether they monitored water use efficiency. The segments are outlined in Table 4 and Figure 1.
Table 4: Segments for water use efficiency on irrigated dairy farms.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Segment</th>
<th>Segment</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Two</td>
<td>Three</td>
<td>Four</td>
</tr>
<tr>
<td>Monitor the efficiency of the irrigation system</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Member of an irrigation scheme</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Figure 1: Typology of segments for water use efficiency on irrigated dairy farms.

Segment one consisted of farmers who had systems in place to test how efficient their irrigation system was. These farmers were not part of an irrigation scheme and therefore tended to have control of their water supply. Alan was an example of a farmer from this segment:

Alan owns 1,070 hectares and milks 4,300 cows. They have 5 sheds on the property and 20 staff. He tests the efficiency of his system by installing sensors in the ground which measure the water capacity.

Segment two included farmers who had systems in place to test the efficiency of their irrigation system but were on an irrigation scheme and therefore had less control over their water supply. An example of a farmer from this segment was Tony:

Tony owns 185 hectares and milks 625 cows. The farm gets its irrigation water from the Ashburton-Lyndhurst scheme via a pipe. He has a flow meter on the pipe as the scheme insisted.

The third segment consisted of dairy farmers who did not test the efficiency of their irrigation system and they were not on an irrigation scheme so had control over their water supply. Karl was an example of farmers from this segment:

Karl runs 1,100 cows on 280 hectares. He does not test the efficiency of his system as the farm has lots of untapped springs and he is not concerned about running out of water. The farm’s irrigation system is run from a number of bores.

The final segment, segment four, were dairy farmers who did not have systems in place to test the efficiency of their irrigation system and were part of an irrigation scheme so had less control over their water supply. An example of a farmer from this segment was Paul:

Paul owns 162 hectares and runs 530 cows. He does not have control of his water supply. The farm has border dyke irrigation. His water allocation is every 16 days. He does not test the efficiency of his system because he believes his experience on the property is enough.

Discussion

Generally, most dairy farmers we talked to were aware of the issues around water efficiency and the public perception of dairy farmers in Canterbury. Farmers were very aware of how the urban population perceive dairy farming but argued that these non-farmers did not truly understand the benefits farming brings to the region. Across the four segments there were common views expressed on a number of issues. Every farmer believed that they had the “right” to take water, either from rivers or underground sources, to irrigate their properties, as one respondent noted ‘no point sending water to sea’. None of the farmers interviewed believed that they should pay for the water they used for irrigation per se. In fact, the majority believed that they already did pay for water through infrastructure costs and having shares in water.
schemes. Furthermore they argued that water was a public good ‘no one owns water – like the air’. However one participant commented ‘don’t know who owns the water...maybe ECan...tell us where we can fish’. When asked about the future of water irrigation in Canterbury, one participant believed that when there are ‘enough competitors who demand it [water] than will pay’, although none of the other 26 participants raised this issue.

All interviewees noted the importance of irrigation to their farming system. Indeed many believed that you could not run dairy cows without water irrigation and this had flow-on effects for the local communities in terms of the business small companies get either directly or indirectly.

However, while every farmer indicated that water use efficiency was important for their system, farmers in segment three and four did not have any systems in place to test the efficiency of their irrigation. The reasons for this are discussed in the following sections.

Many farmers had changed their irrigation systems from border dykes to centre pivots. Although this required a lot of initial capital, farmers noted that they saved water, money and grew more grass than under other irrigation systems. Replacing their systems with centre pivots also saved time in terms of labour. Therefore, although the main motivation for installing centre pivots may not have been water-use efficiency, this has been one of the benefits to adopting this system. Thus, when encouraging farmers to adopt more water efficient irrigation systems, the benefits listed above need to be raised.

When farmers were asked where they saw the future of water allocation in Canterbury over the next five years, the majority indicated that they did not believe the amount of water for irrigation would increase. Many believed that the ‘urban voice’ would get louder and this would put pressure on farms.

Segment one

Farmers’ in segment one, tested the efficiency of their irrigation system in a number of ways. One means of testing efficiency is knowing exactly how much water is used on-farm. This is measured with a meter at the point at which water goes onto the farm. The metering systems will shortly be required by Environment Canterbury as part of the resource consent and farmers must send their records to the Council every year as one of the conditions of their resource consent. However, some farmers noted that this did not always happen ‘its low on the list of things to do’. Furthermore, just because farmers have systems in place to test the efficiency of their irrigation system does not mean they are necessarily going to change their system. Some farmers commented that ‘it was there to tick the box’. Other voluntary measures included moisture probes and ‘dig holes to check water capacity’.

Farmers in this segment had control of their water supply, as they were not involved with a water irrigation scheme. Instead, they had their own bores/wells from which they extracted water. This allowed them the freedom to change the amount of water applied for each irrigation event or to change the timing of an irrigation event more readily than farmers in segment two and four. Although they were not part of an irrigation scheme, this did not guarantee resource consents were awarded. Environment Canterbury still controls when and the amount of water farmers can draw, so although they have more control over their water supply than farmers involved with a water scheme they are still restricted by regulations, as one farmer noted ‘can’t drill wells down due to the water table level’.

Although water use efficiency was important, as one farmer noted; ‘always want more water than you got’. Many farmers believed that there ‘is oodles of water’, however the media in Canterbury portrayed dairying in a negative way. One participant noted that water is an ‘emotional situation’ and ‘dairy seen as the devil....The Press fault...media loud and influential’. For others, they ‘want to grow more grass not by having more water but using your water allocation more efficiently’.

Segment two

Farmers in this segment were part of an irrigation scheme and therefore were perceived to have less control over their water supply. In effect the scheme, via their resource consent, determined how much water farmers received and how often. However, they did test the efficiency of their irrigation system, to save money and time.

Some farmers in this segment were from the Ashburton-Lydhurst scheme. Farmers involved with this scheme have been pro-active in trying to improve water-use efficiency. Due to farmer pressure the scheme has invested a considerable amount of capital in replacing canals with pipes. The estimated saving due to loss of evaporation is 15% before the water is delivered on
farm. At this stage only a small percentage of water is delivered to farms via a pipe, with those farmers involved paying it off over a number of years. Farmers in this segment are aware that their water allocation will not increase in the future, and thus they need to ‘get smarter with the water we have’.

**Segment three**

Farmers in this segment were not on an irrigation scheme and so had control over their water supply. However, they did not test the efficiency of their irrigation system, even though they did believe that water efficiency was important. Belief in the importance of something does not necessarily mean you will do something about it. One farmer from this segment noted that they had ‘lots of underground springs untapped’. This farm had centre pivots but noted that ‘without irrigation could not farm...land unsuitable...needs more than pivot water, needs rain’. The centre pivot not only irrigates water but effluent goes through the pivot and ‘keeps consent people happy’. In effect, farmers in this segment did not have any pressing need to aim for better water use efficiency, and had addressed any need to save time or labour through changes to their irrigation system such as installing a centre pivot.

Some farmers in this segment considered having control over water supply was a bonus but they acknowledged that they ‘don’t think too seriously about person downstream’. Thus, farmers are aware of the impact which extracting underground water has but it does not bother them enough to incorporate a system for monitoring their water use.

**Segment four**

Farmers in segment four did not test their system, they were part of an irrigation scheme and so did not have control over their water supply. However, farmers in this segment were relying on the water schemes they were involved with to deal with this issue. Water-use efficiency was still important to this group of farmers; however, they believed that it was up to their water scheme to deal with this issue. It was not a high priority for them compared to other aspects of their farming system. Farmers in this segment tended to have border dyke systems, which are not considered to be the most efficient use of irrigated water.

Farmers argued though that there were many other benefits to border dykes that outweighed putting in new systems perceived to be more efficient. Border dykes were seen as cost effective as they are gravity fed. Farmers argue that the water schemes control the efficiency as a representative will turn up to check every time you take your water allocation, around every 16 days. Furthermore, you can ring and say ‘you don’t want water’ and it does not affect your total allocation.

**Environment Canterbury**

Individuals who worked with the local government body, Environment Canterbury, and worked on water issues, were also interviewed to gain an understanding of the issues Canterbury faces in regards to water irrigation. Water metering on all consented water takes is becoming law under national legislation, due to be confirmed this year. This means that no matter where the farm is located you must have a water meter. Canterbury holds 60 percent of meters for the entire country. One participant noted that they did not believe farmers used their full water allocation. The current Environment Canterbury plan is for the information from these meters to go to a third party who will then pass on the information to the council. Environment Canterbury do not want this information directly as they do not have the staff to process it all. These third party providers will send information to Environment Canterbury on those farmers not complying. Depending on the severity of the breach of consent (e.g. too much water used, or at the wrong time) a number of actions will be taken. If it is deemed ‘green’ breach, nothing will occur, if it is ‘yellow’ breach, farmers will be called and a follow-up visit will take place. If it is considered a red breach, a site visit will occur and potentially a prosecution could follow. They believe at the moment only 5-10% of consent holders are non-compliant. While their view was that farmers are accepting of the metering system, they believed farmers were not accepting of the accountability requirements and reporting of the results from the meters.

There was the general view that most farmers do not have a good understanding about the water they use. One respondent commented that a lot of farmers do not want to know about water-use efficiency and they were not sure what incentives could be used to change this behaviour. However, most believed that farmers had improved their views of water use efficiency recently.

No one we interviewed from Environment Canterbury believed that farmers should pay for water as water is considered a public resource and therefore farmers should be entitled to use it without paying. One participant noted that some people believe making farmers pay for water...
will improve their efficiency. However, they argued that this was a simplistic view on how farmers see the issue. One participant believed that in the future, storage of water, either on-farm or not, will occur. Environment Canterbury are aware that they need to work with industry to improve water-use efficiency on-farm as regulation alone will not achieve this.

Conclusions

The aim of this project was to explore dairy farmers views and actions on improving water use efficiency. It also aimed to understand their views on ownership of water. The Kaine Framework was used to see if on-farm context influenced their views and actions of water use efficiency and ownership. While every farmer believed water use efficiency was important only those farmers from segment 1 and 2 had systems in place to test this. Farmers in segment 4 relied on their water scheme to provide them with efficient delivery of water. Thus, water schemes are an important influence for on-farm water use efficiency. However, just because farmers believe that water-use efficiency of their irrigation system is important, and may have systems in place to test it, making substantial changes based on this information does not follow.

Farmers realise that using water for irrigation is a contentious issue in Canterbury, but they believe that water is a public good and they have the right to use it for economic benefits, for not only themselves but also the Canterbury region and New Zealand as a whole. Furthermore, the majority of farmers believed that they had already paid for water through the cost of water shares and/or the infrastructure needed to get the water onto their property. The common view held was that it was a waste to let the water run out to sea and water should be used to increase the Canterbury economy.

Two key learnings from this research were:

1. Urban perceptions influence farmers’ decision making as shown by the significant changes farmers have made to their irrigation systems to improve water use efficiency.
2. Farmers believe that a successful resource consent application gives them the right to extract water without further charge.

While these are the views of the farmers, the continued negative publicity around irrigation suggests that the public does not hold the same views. Changes that farmers are making to improve water use efficiency do not appear to be changing the opinion of the public as publicity continues to be negative. Further work is needed to understand the views of the public about irrigation and identify the gap between farmers and the public.

Acknowledgements

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Pilot Roll-Out: adaptive research in farmers’ worlds

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Abstract. Agricultural research in Indonesia has resulted in limited impact in farmers’ fields, particularly in the more marginal areas, because innovations are often not suited to the specific agroecological and socioeconomic conditions. In addition, the physical and institutional separation between the strategic research, regional adaptation and local development constrains the spread of innovations. An ACIAR project in Eastern Indonesia experimented with a Pilot Roll-Out (PRO) approach involving medium-scale testing of promising innovations by farmers in the context of their overall farming system and socioeconomic networks. All major stakeholders were involved in a participatory process of: (1) needs and opportunity assessment, (2) identification of suitable innovations and their implications for on-farm implementation, (3) design of a development model and communication strategy, (4) testing and adaptation of the development model, (5) medium-scale pilot roll-out, and (6) participatory monitoring and evaluation. Initial key learnings include the importance of stakeholder participation in and ownership over all research and development processes, the need of a systems approach to allow for sustainable internalisation of innovations into existing farm management practices, and institutional change from a technology-centred to a people-centred paradigm of research for development.

Keywords: participatory research, research for development, systems development, communicating innovations.

Introduction

In Indonesia, the main bodies responsible for adaptive research are the Agricultural Technology Assessment Institutes (AIATs), which are central government institutes based in each of the 33 provinces. The AIATs are overseen by the Indonesian Centre for Agricultural Technology Assessment and Development (ICATAD) based in Bogor, which in turn comes under the Indonesian Agency of Agricultural Research and Development (IAARD) of the Ministry of Agriculture. Key roles of ICATAD are:

- To establish and support agricultural technology assessment and development programs at the province level.
- To coordinate collaboration in agricultural technology assessment and development (i.e. linkages between the AIATs and central commodity-based research institutes) and in the utilisation of research outcomes (i.e. linkages between the AIATs and the extension system and communities).
- To assess the effectiveness of the technology assessment processes conducted by the AIATs.

The provincial AIATs locally test innovations generated by central research institutes and adapt them to prevailing farm conditions. The trials are typically done on the farms of selected farmers who take care of the crops or animals but have little influence over decisions made by researchers about what technologies are tested and adapted to suit their specific needs. The sites selected for the adaptive trials tend to involve optimal farm conditions and model farmers, which are generally not representative of the community. Consequently, innovations are often not adopted because they are not suited to the agroecological and socioeconomic conditions of the average farmer. In addition, a physical and institutional separation exists between the national/provincial research institutes and the local development organisations. The government bodies responsible for agricultural extension are district based and governed. As a result of the Regional Autonomy laws that have been applied over the past decade, each district has its own structure of technical departments and extension system, but all have an Agency for Food Security and Extension. This agency provides policy advice to the implementing bodies. Generally, Field Extension Workers operate from sub-district level Rural Extension Centres, but in areas where infrastructure is limited they may be based at the district Department offices. For example, in the 20 districts of East Nusa Tenggara province only 247 out of 283 sub-districts claimed to have a Rural Extension Centre in 2008, out of which only 56 had a functional
building while 49 operated from broken buildings and 105 had no building at all. The dysfunctional relations between the bodies responsible for the development, adaptation and dissemination of agricultural technologies have led to poor linkages, creating problems with both the development and dissemination of appropriate technologies for farmers.

Indonesia has not been alone in having patchy results from adapting and promoting technologies for small-scale farmers. In a review of case studies from Africa looking at the spread of agricultural technologies to small-scale farmers, Lado (1998, p. 165) concluded that 'where useful technologies exist, their spread has been very limited and where they have been adapted, the benefits only accrue to a small segment of the community'. This problem appears to be longstanding and widespread (e.g. Röling 1988; Collinson 1999). Inappropriate research and extension theory and practice have been blamed for some of this failure (den Biggelaar 1991; Lado 1998; Douthwaite et al. 2003).

Like many countries around the world, Indonesia adopted the Training and Visit system (T&V) that the World Bank began promoting in the middle of the 1970s (Benor and Harrison 1977). It was a classic example of a Transfer of Technology (ToT) model of communication serving the prevailing modernisation paradigm for development (Van de Fliert 2007). Technologies to be promoted came from research centres and subject matter specialists who were supposed to provide regular training to village extension workers. The extension workers were scheduled to pass on the simple messages through regular visits to contact farmers who, in turn, were expected to convey the information to a group of follower farmers. Although criticisms of this approach began to emerge in the literature in 1982 (Howell 1982) and continued to mount (e.g. Moore 1994; Chambers et al. 1989), much of the debate did not address the more deep-seated problems with its theoretical foundations. These include the problems already recognised by Farmer Systems Research advocates: farmers were treated as homogeneous; the technologies were not relevant to the physical, socio-economic and institutional constraints of many farmers; advice came in small, disconnected chunks and was discipline based rather than systems based; and the service providers failed to take account of farmers’ knowledge (Röling 1988; den Biggelaar 1991; Lado 1998; Douthwaite et al. 2003). Perhaps more fundamentally, the T&V system had the same weaknesses identified for other transfer of technology models by Tully (1964), in that many farmers did not recognise that the knowledge promoted was relevant to their situation and problems because they had not been involved in a process that linked the solutions to their perceived needs. These more general critiques are at the heart of the problems identified by advocates of another paradigm for development incorporating farmer empowerment and participatory methodologies (Chambers et al. 1989).

Farmer empowerment has been a long time coming; perhaps because it requires many agricultural scientists to acknowledge another epistemology, constructivism, rather than positivism that has been the basis of much of their training. This is difficult for many and probably impossible for some. Farmer empowerment calls for a reversal, or at the very least a significant realignment, in the traditional power relationships. This realignment requires a shift in culture, a significant and difficult thing to achieve in cultures and institutions that have hierarchical systems of organisation and respect. In many countries, including Indonesia, farmers are at the bottom of the hierarchy from a social and educational perspective. The T&V system entrenched this outlook. It requires a major shift in thinking by researchers and extension officers alike for them to acknowledge that farmers have prior knowledge and experiences, and hence a valid role to play in identifying, assessing and adapting innovations.

In 2007, a scoping study was conducted in four provinces of Eastern Indonesia for an AusAID funded program aimed at supporting ICATAD in their adaptive research functions (the ACIAR SADI program) to explore ways of improving the outcomes of adaptive research (Connell et al. 2007, p. iii). It found that the successes had to be tempered by a failure in many cases to take advantage of opportunities, resulting in reduced impact because of poor adaptation of technologies and poor linkages with dissemination partners. While it addressed many issues, a key finding was the need for the AIATs to involve farmers more in identifying, assessing and adapting innovations to suit local constraints and conditions, and to integrate this process with the dissemination partners (e.g. government extension service, non-government organisations (NGOs), commercial businesses) so that these partners would take ownership of the technologies.

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2 Smallholder Agribusiness Development Initiative – sub-program 3 coordinated by the Australian Centre for International Agricultural Research with a focus on Support for Market-Driven Adaptive Research
One of the recommendations arising from the scoping study was for the development of a roll-out phase in the technology assessment process, hereafter referred to as Pilot Roll-Out (PRO). PRO was to be ‘the process of further testing agronomic or management approaches with a wide group of farmers and villages beyond the original adaptive trial site with farmers taking the lead on how they use or modify the agricultural technology, agronomic or management approaches, with researchers and extension agents watching to assist them in making more useful recommendations to those farmers in other places’ (Connell et al. 2007, p. 9). This was to follow on from the traditional Adaptive Research phase defined as ‘the process of testing a variety of modifications to recommended agricultural technology, agronomic or management approaches in conjunction with a small number of cooperative farmers to see what variation is best adapted to the particular provinces, districts or villages in a process overseen closely by researchers’ (p. 9). While conventional adaptive research at the AIATs typically implies technology assessment in farmers’ fields (primarily considering the agroecological context), PRO assesses the applicability and adaptability of technologies in farmers’ world (including socioeconomic and institutional context).

In the context of PRO, one of the key limitations of participatory approaches is that they focus on the local level. To deal with the pressing issues of development at the regional and national level, however, a successful model must address the issue of scale (Douthwaite et al. 2003). For the purposes of this paper we will use the definition of the Consultative Group on International Agricultural Research (CGIAR) to describe the objective of scaling up: ‘Scaling up leads to more quality benefits to more people over a wider geographic area more quickly, more equitably, and more lastingly’ (Menter et al. 2004, p. 10). Its aim, therefore, is to spread beneficial innovations arising from research and development activities so that they can be adapted and adopted to suit a wider range of people and farming systems to improve their living standards. This includes: (a) horizontal scaling up – the geographical spread through replication and adaptation of innovations to key stakeholders in more communities at the same social scale of decision making; and (b) institutional scaling up - building an enabling environment for the spread of innovations by expanding institutional involvement to higher levels from community to district and national scale, and broadening indirect impact through integrating with, involving and influencing other institutions and stakeholders (Uvin et al. 2000; Douthwaite et al. 2003; Menter et al. 2004).

With support of the ACIAR SADI project, ICATAD established an Innovation Team in 2008 involving sixteen researchers and extension specialists from within its own staff and four AIATs in Eastern Indonesia. The aim was a critical review of the institution’s methodologies for technology assessment and knowledge exchange, and to experiment with the concept of Pilot Roll-Out as an adaptive research phase. The purpose of this paper is to provide a theoretical framework for PRO and outline the methodology being trialled to develop an effective technology assessment process leading to farmer practice change. The methodology will be illustrated by a case from East Nusa Tenggara and tentative conclusions will be drawn based on initial evaluation activities.

**Framework for agricultural research for development**

The Indonesian Agency for Agricultural Research and Development (IAARD) has been operating on the basis of a ministerial decree issued in 2005 that outlines the guidelines for agricultural technology development and implementation. These guidelines present a framework for agricultural research and development, implying four phases that are connected in a linear way (Badan Penelitian dan Pengembangan Pertanian 2005):

- **Phase I:** research, resulting in technology components ready for field testing.
- **Phase II:** assessment of technology components in field locations, resulting in location specific technologies and recommendations.
- **Phase III:** development of a technology package considering agroecological, socioeconomic, cultural and institutional conditions, resulting in a development model.
- **Phase IV:** dissemination of the technology package through implementation of the development model, resulting in agribusiness development.

Although the guidelines describe the need for feedback mechanisms across the various phases, in reality linkages between the institutions in charge of Phase I (central research institutes), II/III (provincial AIATs) and IV (provincial/district technical departments) are generally poor due to the reasons described in the previous section. This causes a disconnect between the phases and, hence, prevents maximum impact in the farmers’ fields.

The ACIAR SADI supported Innovation Team critically analysed the methodologies applied for technology assessment and development in their respective provinces (South and Southeast
Sulawesi and West and East Nusa Tenggara) through a range of case studies conducted in 2008-09 (Tim Inovasi in prep.). They came to the following conclusions calling for a substantial institutional change:

1. Technology assessment activities are not planned based on needs identified among target communities. The methodology lacks a needs and opportunity assessment process. This leads to the testing and introduction of technologies that (a) are not needed, (b) do not solve existing problems, and/or (c) do not suit the agroecological, socioeconomic and/or market conditions of the majority of farmers in a target area.
2. Assessment activities often consider only one technology, whereas accompanying innovations (technologies or management approaches) necessary for an overall improvement of the system are not available.
3. Technologies are often complex and require knowledge, inputs, labour and investment funds, whilst the development model applied does neither reckon with the need for training pitched at farmers’ abilities nor with continued and adequate provision of inputs, labour and credit facilities.
4. Collaboration and coordination between stakeholder groups (researchers, technical staff, service providers, private sector) is weak, which is partly due to the short-term project-based nature of activities, and partly to institutional isolation of the stakeholder groups.
5. Technology assessment activities tend to target the same communities over and over again and involve the relatively more prominent community members (village officials and farmer group leaders) who are not necessarily representative for the majority of farmers in the community. Results are therefore not necessarily replicable to the conditions of the average farm and farm family, let alone the more marginalised groups in the community.
6. Communication and knowledge exchange processes in the farm-based technology assessment trials are top-down (from researcher to farmer) and media used are not effectively pitched to the target audience. There is no process in place to empower farmers to have their say and influence decisions. Research results are generally not analysed with or communicated to them. As a result, no or limited location-specific adaptation of technologies takes place and outreach is not effective.

A first step for the Innovation Team to instigate institutional change was reviewing the IAARD framework for agricultural research and development in reflection of their own case study findings. This was followed by a reformulation of the framework into a ‘Research FOR Development’ (RfD) framework to represent possible solutions to the limitations they identified. They agreed on the need for (a) the addition of diagnostic and evaluation research phases, (b) the articulation of the concept of pilot roll-out in the adaptive research phase, and (c) substantiation of linkages and feedback mechanisms across stakeholder groups involved in research and development. The reorientation of phases in the framework, the linkages amongst the phases, and the expected outcomes of each phase are illustrated in Figure 1. A diagnostic research phase is placed in the centre of the framework, representing a mechanism that continuously identifies, analyses and reports on farmers’ needs and opportunities. This implicitly implies a different development focus, namely that farmers have a need to solve their problems and improve their livelihoods themselves. This has, on the one hand, implications for how research and development agendas are set, and, on the other, how support is offered. Instead of the usual but unsustainable practice of handing out ‘goodies’, development should focus on farmers’ capacity building to identify needs, review and test options, and make better informed decisions of what change would work for them. Simultaneously, services and inputs required by farmers to implement the change need to be made available.

The proposed framework is also innovative in the Indonesian context in that it positions pilot roll-out as an adaptive research activity - one that allows the testing of innovations within the farming system’s context at an intermediate scale to assess the potential for large scale application and impact. This extra step in the RfD cycle is expected to result in development models with (a) innovations that are better suited and adapted to local conditions, (b) outreach mechanisms and media effectively pitched at the intended target audiences, and (c) better prepared service providers to facilitate outreach of the development model at a larger scale.

The framework implies that stakeholders assume clearly pronounced but shifting roles and responsibilities across the phases, as displayed in Table 1, to ensure that the function of each phase can be fulfilled effectively and linkages across phases will materialise. Collaboration and communication at all phases is important to make the transition of roles and responsibilities possible and ensure the establishment of effective linkages.
Table 5. Stakeholder roles in the Research for Development framework

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Diagnostic research</th>
<th>Basic research</th>
<th>Applied research</th>
<th>Adaptive research</th>
<th>Technology assessment</th>
<th>Pilot roll-out</th>
<th>Development</th>
<th>Implementation</th>
<th>Evaluation research</th>
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</thead>
<tbody>
<tr>
<td>Farmers</td>
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<td>Universities</td>
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<tr>
<td>Research institutes</td>
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<td>+</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>AIAT</td>
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<tr>
<td>Extension officers</td>
<td>+++</td>
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<tr>
<td>NGOs, CBO</td>
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<td>-</td>
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<tr>
<td>Private sector</td>
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</tbody>
</table>

+++ = initiation and coordination  
++ = limited participation/interest  
+ = major participation/interest  
- = no active role

**Principles, practice and evaluation of pilot roll-out**

The pilot roll-out (PRO) is a crucial phase in the research for development process to make available options that support sustainable change in the farming system. The function of the PRO is to develop (design, implement, evaluate and improve) an effective model for community outreach of potential innovations. The PRO links previous research phases to community outreach activities to result in more successful on-farm implementation of innovations (testing, adaptation and internalisation). The concept of PRO is based on the mandate of AIATs to carry out technology assessment to include both (a) local adaptation of promising innovations, and
(b) proof of significant impact from locally-adapted technical options. As such, PRO serves three main aims:

1. **To assess the potential of an innovation on a larger scale and in a realistic context**
   PRO implies a true test of the potential of an innovation to generate significant impact. The number of farmers to be testing and adapting the innovation in a PRO activity could be 300-500 farmers, depending on the sector of agriculture. Researchers will have to work with farmer groups, rather than individuals, and service providers (public and private extension officers, other development practitioners and/or retailers). To reach larger numbers of farm families, well designed, gender specific communication processes will need to be developed and tested as part of the PRO.

2. **To encourage local adaptation of innovations**
   Sustainable practices are fully suited to local agroecological and socioeconomic conditions. This means that agricultural innovations need to be adapted to individual farm conditions, considering both physical and socioeconomic factors. Consequently, extension methods promoting these innovations require training and guidance to farmers about how to adapt technologies to their local realities and only integrate those components into their farming system that offer benefits to them. At the PRO scale mentioned above, individual farmers will mainly be making their own decisions based on the options offered to them and the skills developed to test, adapt and evaluate new ideas, inputs and/or implements. The PRO process, however, should ensure that the necessary information is made available to farmers and skills are taught for them to make better decisions.

3. **To involve multiple stakeholders**
   The proposed scale of technology assessment in PRO allows for different stakeholders to be brought together to reflect real world operations and break down the research-extension divide. These stakeholders include farmers, extension officers, researchers, private sector partners, staff from NGOs and members from community-based organisations. Knowledge exchange will be fostered between disparate stakeholders when the piloting is done at a reasonable scale, which will demonstrate the possible effects of external supporting and counteracting processes and forces on the spread of innovations within communities. Involvement of stakeholders in the adaptive research phase is expected to cause a greater sense of ownership over the development model that is designed, which will benefit large-scale implementation later.

PRO should be conducted at a scale that encourages local adaptation of (technical) options but which is still manageable as an adaptive research activity. It minimally implies a two-season activity, with a first small scale design phase and a second intermediate-scale pilot phase. It could, however, stretch over three to four seasons depending on the need for finetuning both technology and communication methods for either of the two phases. Consecutive seasons preferably involve increasing levels of scale and/or complexity to match farmers’ realities. PRO must encourage farmers to adapt innovations to their own opportunities and constraints, and where necessary strengthen their skills for adaptation. These include experimentation, observation, agronomic and economic analysis, and informed decision-making skills.

Innovations to be trialled in PRO need to be confirmed as robust and ‘ready’ for scale. The criteria applied for selection of ‘PRO content’ include:

- Evidence that the innovation helps solve an important technical problem in the area, one that occurs widely, causes substantial production loss, has negative socioeconomic impacts, and/or is perceived as being important by producers and agribusinesses.
- Proof that the innovation will help farmers meet a market demand.
- Proof that the innovation is locally adaptable, considering environmental and socioeconomic conditions and labour availability.
- Evidence that the innovation enables significant impacts.
- Indications that the technical knowledge and skills needed to implement the innovation can easily be acquired and implemented by farmers locally.
- Confirmation that inputs or services needed to implement the innovation are available locally.
- Evidence that the innovation will not have any significant negative impacts or expose farmers to greater risk.

PRO needs to have substantial activity focused on monitoring and responding to outcomes in the field. If farmers are encouraged to adapt options, they will do so. Inevitably, there will be some surprising outcomes, which need to be captured for better understanding both the limitations of technical options in the field and the potential for wider uptake.
As of September 2008, the four AIATs participating in the ACIAR SADI project tested and developed the PRO concept on carefully selected cases. These concern regeneration of cocoa plantations in South and Southeast Sulawesi, corn-cattle systems in East Nusa Tenggara, and improved upland rice varieties in West Nusa Tenggara. The first phase in each of the locations consisted of (a) community based needs and opportunity assessment activities, (b) participatory workshops to design the development model and a monitoring and evaluation system, (c) socialisation and planning meetings with stakeholder groups, (d) piloting of the development model, which depending on the location, included a variety of field based training events, experiments and group meetings, and (e) monitoring and evaluation activities. Implementation of the second phase, testing the development models at an intermediate scale, is planned for 2010-11.

Evaluation of the first phase of the four PRO cases (September 2008 to December 2009) was conducted by applying a triple loop learning approach. The stakeholder groups in each location reviewed whether PRO activities were implemented and delivered as planned in the development model (single loop), and whether these activities and outcomes actually resulted in the achievement of the goals of the PRO concept (double loop). In addition, the Innovation Team established criteria to review whether the overall PRO concept, as a new adaptive research phase, addressed their initial concerns about traditional ways of conducting technology assessment (triple loop). These criteria particularly related to the effectiveness of a diagnostic research phase (needs and opportunity assessment), the benefits of active involvement of farmers and other stakeholder groups as research partners, and the importance of applying a systems approach acknowledging farmers’ realities. The next section will describe the PRO case in East Nusa Tenggara to illustrate the above principles and practices, and present initial evaluation findings.

Pilot Roll-Out in East Nusa Tenggara: Plant maize, harvest cattle

The AIAT team in East Nusa Tenggara (NTT) initially intended to design their pilot roll-out project with a focus on livestock management issues. They believed that their institute had produced several field-tested technologies for livestock management, such as legume cultivation and preservation, which were considered ready for larger scale testing and dissemination. However, during the community-based needs assessment in the district of West Timor, where the pilot activities were concentrated, it became clear that the majority of farmers were not in a position to try out any of the technologies, let alone adopt them. The main reason was that hardly any of them owned cattle. They appeared to take care of cattle owned by others, including the local government’s livestock department, based on a range of agreements that provided them with varying levels of benefits and risks. In all cases, however, the actual income for the farmers was so low that there would be no incentive for them to invest in any improved management practices. Nor did they have any capital to invest in innovations. Apparently, in the previous technology assessment activities the AIAT researcher in charge had only involved the farmer group leader, but his farm, with some 10 self-owned cows, was not at all representative for the rest of the community and no one would ever be able to follow his example.

The community needs assessment activity revealed that the farmers are trapped in a downward spiral of dependency. The small income they earn from raising other people's cattle is barely enough to buy food during the two to three months of food shortage that they are generally experiencing before harvesting maize, their main food crop. Farmers in West Timor tend to cultivate maize only on an area of land that they can manage with their own family labour using traditional practices, generally less than 0.5 ha. This is, however, not sufficient to feed the family throughout the year, partly due to substantial post-harvest losses. After discussions with representative groups of farmers, the NTT Innovation Team became convinced that farmers can only be helped out of this dependency cycle if they would collaboratively work on the farming system as a whole. The AIAT in NTT had produced several improved maize production technologies over the years (including improved varieties, cultural practices, weed control and post-harvest technology), none of which ever gained acceptance from farmers. Using several of these technologies within a systems approach, the PRO team, including several farmers, designed a scenario in which farmers would realistically be able to improve their maize production. The anticipated maize yield would provide enough food for the family for the whole year and a surplus that could be sold at the market, allowing them to purchase their own cattle. The slogan became ‘Plant maize, harvest cattle’.

The main components introduced for an improved maize production system were: increased cultivation area (preferably a minimum of 1 ha), use of an improved (but non-hybrid) variety, reduced seed rate, herbicide use, post-harvest technology and marketing. At the end of the
season, farmers harvested two to three times more maize than they used to do, stored more using better storage methods to last them throughout the year, and sold the surplus. Most of the participating farmers bought one to two calves from the surplus maize income, although a few started out with purchasing pigs, and some even invested in a rice threshing machine or home renovations. Once they had their own livestock, the AIAT team began to introduce livestock management innovations. The main input for the farmers from the researchers consisted of awareness raising, technical training, mentoring throughout the year, and a loan to buy seed and herbicide to be paid back in kind (maize seed) at the end of the first or second season.

During the evaluation process, the farmers provided very positive feedback about the process and initial outcomes, but were also able to outline areas for improvement. On top of harvesting more and being able to expand their farming enterprise, they particularly valued the fact that they had been consulted and listened to, at an early stage as well as throughout the implementation process and during the evaluation. The regular interaction with the researchers and extension officers, through training sessions and group meetings during which they provided their opinions about the innovations and activities, allowed them to build up confidence that the proposed changes would actually fit their specific farming conditions. Moreover, they immediately practised and trialled the innovations in their own fields and made the necessary adjustments. The variety of choices made in how to invest their surplus income is an indication of adaptive management, and hence internalisation of principles, which is more likely to lead to sustainable change than straightforward adoption of standard recommendations. Whether this process can be replicated on a larger scale, when the extension system is in charge rather than the AIAT researchers, still remains to be seen, but enthusiasm about the approach displayed by the extension officers involved in the design process is promising.

Lessons learned

While farmers have generally expressed their appreciation for being involved as partners in the research activities, for the Innovation Team members, this project has also been a liberating experience, although at times a hard learning process. The realisation about what farmers actually need emerged out of a question that they had never thought of asking before: "Why DON'T things work?" Initial key learnings from the experiences of the first year of designing and experimenting with the PRO approach include:

1. The importance of a participatory and gender-specific needs and opportunity assessment phase for (adaptive) research agenda setting, and hence the capacity of researchers and extension officers to facilitate such a process
2. The need for a systems perspective when introducing innovations, and hence the possible integration of a range of innovation and traditional practices; and
3. The importance of ownership over all stages of the research and development process by all relevant stakeholders for effective adaptation and sustained implementation of innovations.

All three aspects call for a strong participatory approach in research planning, implementation and evaluation as well as a farming systems focus at the PRO phase. This requires the researchers to be competent team players and facilitators of a communication process. They need to be able to accommodate sharing of perspectives between stakeholders with different disciplinary and practical backgrounds. Such functions require capacity building of researchers and may not suit every researcher. This should be taken into consideration when the PRO concept is reviewed for its suitability to be institutionalised in a revised agricultural research for development framework by ICATAD. The experience of the Innovation Team has shown that this is a process that cannot be achieved through a short training in introducing participatory methods and toolboxes. It requires individual and institution learning and self-reflection through a continuous and context-specific process, implying trial and error. The Innovation Team members have shown tremendous growth in their ability to critically analyse their own approaches and practices, design and try out new models, and suggest ways to institutionalise these in the current system, while bit by bit stretching the boundaries of the system and their own abilities. The challenge will be for ICATAD to expand this experience across the 33 provinces, and not fall into the trap of introducing the new approaches as yet another project with a limited lifespan and ignoring implications within the institutional context. Institutional change will be required to allow a transition from a technology-centred to a people-centred paradigm for agricultural research for development in Indonesia. This will eventually lead to more consistent impacts of research in the farmers’ fields.
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Making capacity building theory practical: The On the Fast Track project

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Abstract: On the Fast Track was a project initiated, developed and delivered by the members of the Cooperative Venture for Capacity Building (CVCB). The project aimed to improve the use of CVCB research outputs by rural R&D corporation project managers and practitioners. It involved a trial of practical capacity building approaches that applied the CVCB research findings. The design involved consolidating CVCB research outputs into meaningful learning tools and supporting capacity-building practitioners in applying their learning in their day-to-day work or projects through mentoring. Sixty-three people from all over Australia participated in the project. Participants included farm/rural advisers and consultants, project officers and managers/investors, project designers and extension staff as well as people involved in community development. They came from rural industries (Dairy, Cotton, Sugar, Meat & Livestock, Horticulture, Wool, Grains), NRM/property planning, community and farmer representative organisations and research organisations. Each participant attended a 2-day workshop, applied what was learned on an issue in their own work with mentoring support over a 9-month period, and participated in a final reflective workshop. This paper provides an overview of the project’s tools and processes, the key learnings from applying the approach, and evaluation of the approach. The paper concludes with insights relevant to people seeking to enhance the practice of the professionals engaged in capacity building, and to better implement capacity-building research.

Introduction
Capacity building is about improving our ability to learn and adapt through change (Macadam, et al. 2004). Given the current context facing rural industries (e.g. long-running droughts; uncertainty and complexity associated with climate change; access to resources like water and people; and changing consumer preferences) improving how we adapt through these conditions for resilient and sustainable industries can be seen as a priority investment for governments, research and development organisations and rural industries themselves. However, improving our ability to adapt is not straightforward and progress can be hindered. For instance, the push toward privatisation of knowledge can slow adaptation because knowledge and information are viewed as tradeable commodities to be protected rather than shared (Carney 1995; Leeuwis 2000; Marsh and Pannell 2000). Further, techno-centric investment in research and extension removes the focus from human and social capacity and privileges technology as the adaptation solution (Vanclay and Lawrence 1995). Finally, the capacity building professions that focus on how best to build and support an individual or groups ability to adapt (e.g. extension, farm advisers, natural resource management and community development services) may suffer from limited support and development and therefore the adaptation of an industry or system is constrained (Nettle 2003; Campbell 2001; Bouma 1999).

To address some of these hindrances R&D corporations collaborated to co-invest in a research initiative known as the Cooperative Venture for Capacity Building (CVCB) to improve capacity building for innovation in rural industries in Australia. The role of the CVCB was to develop a program of R&D that focused on enhancing the understanding of learning, improving organisational arrangements to support rural human capacity building, and inspiring innovative farming practices. Its partner members were: Rural Industries Research and Development Corporation; Australian Wool Innovation; Cotton Research and Development Corporation; Dairy Australia; Grains Research and Development Corporation; Grape and Wine Research and Development Corporation; Horticulture Australia Limited; Land & Water Australia; Meat & Livestock Australia; Murray-Darling Basin Commission; Sugar Research and Development Corporation; and the Australian Government Department of Agriculture, Fisheries and Forestry. This collective investment resulted in documentation of the body of literature and examples of...
practice that described the importance of capacity building for the future of rural Australia (www.rirdc.gov.au). However, the program investors considered the use of these research outputs by the CVCB member organisations and capacity building practitioners were below potential. Experience by the project team suggested that the ‘world’ of the project managers and practitioners choosing, designing, implementing, supporting and evaluating capacity building had not aligned sufficiently (and meaningfully enough) with the ‘world’ of capacity-building research. This represented significant cost and inefficiency because the networks and linkages the member organisations brought to the CVCB were not being used effectively to support learning and change, and the research was viewed as not being grounded enough to effectively inform and transform the practice of capacity building.

To improve this situation, a 12-month project called ‘On the Fast Track - bringing capacity building research and practice together’ was initiated by the CVCB members (Nettle 2008). The project aimed to: design and test a route-to-market for CVCB research; bring together key capacity building project managers and practitioners to enhance their capacity to choose (invest), design, support and evaluate their current capacity building programs; and, identify new research and/or development questions in capacity building. The practitioners were people involved in supporting innovation and change in industries. They include farm/rural advisers and consultants, project officers and managers/investors, project designers and extension staff, and people involved in community development. The objectives of the project were that participants in the project had: greater skills and knowledge in capacity building; improved practice; greater capacity to work together because of the links and networks created between managers and practitioners from different industries; and that capacity building projects that participants were currently working on demonstrated greater efficiency in resource use, less errors and better design, delivery and evaluation leading to more productive and sustainable industries.

This paper provides an overview of the On the Fast Track approach, that is, the tools and processes developed, key learnings from applying the approach and some results for participants in the project. The paper concludes with insights relevant to building the capacity of the profession and recommendations to better ‘operationalise’ capacity-building research.

The On the Fast Track approach: Making capacity building theory practical

In order to design and test a process to embed the outputs of the CVCB research into the practice of capacity building professionals, it was necessary to mobilise a collaborative effort of people involved in capacity building in rural industries across Australia. The On the Fast Track project included a core project team responsible for delivering the project including key expertise in project leadership and management, content development and delivery, mentor support, communication and evaluation. The project also involved a working group consisting of all members of the CVCB to oversee project delivery. The On the Fast Track approach consisted of ten key activities (refer to Figure 1):

1. CVCB members collaborated to develop a route-to-market for the CVCB research investment.
2. Common issues experienced by rural industry project managers and practitioners in capacity building were identified, the CVCB research outputs were reviewed for their fit with these issues and a framework developed for people to think about capacity building (‘The Capacity Building Wheel’).
3. The CVCB research outputs (e.g. research reports) were translated into a workbook and workshop design building off ‘The Capacity Building Wheel’.
4. Participants were invited to join the project through CVCB member networks and they completed a pro-forma that identified a project they wanted to improve and the main reason they wanted to be involved.
5. A ‘pool’ of mentors was selected using CVCB member networks and based on the range of participant projects and needs. Mentors were invited to join the project.
6. Cross-sector 2-day workshops were delivered in three locations around Australia.
7. Workshop participants developed action plans for their work and choose mentors.
8. Action plans are put into practice with mentor support.
9. Mentors are supported in their role through regular teleconferences and assistance from a mentor developer.
10. A final workshop reports on results of participants and a final report of the process and outcomes developed. A resource kit of tools developed through the project was also compiled.

Sixty-three people from all over Australia participated in the project. Participants came from rural industries (Dairy, Cotton, Sugar, Meat & Livestock, Horticulture, Wool, Grains), NRM/property planning, community and representative organisations and research. Each
participant attended a two-day workshop, worked through a project or issue with mentoring support for nine months and attended a final wrap-up workshop. Participants’ projects ranged from improving the delivery, evaluation and reporting of industry projects (sugar, dairy, extensive livestock, NRM), to improving the effectiveness of grower groups and knowledge management in cotton and grain irrigation.

An evaluation plan for the project guided the data collection concerning the impacts and outcomes from the On the Fast Track project. Three main data collection methods were used: participant and mentor questionnaires (pre- and post-) about their experience in the workshops and use of CVCB resources; participant project reports detailing what participants did and the results they achieved; and mentor reports (Kelly 2008).

The key processes involved in making capacity building research practical

Each element of the project (Figure 1) proved essential for increasing the use and ‘practicality’ of CVCB research amongst capacity-building project managers and practitioners. However, three key processes provided the ‘glue’ or foundation for change. It is important to make these processes explicit when discussing the design, delivery and evaluation of projects as they are often overlooked and/or suffer from underinvestment.

**Figure 1. The On the Fast Track project elements**

1. **A learning process: how can people best make sense of capacity building research?**

The importance of diagnosing learning needs and acknowledging and building from ‘lived-experience’ is well established in adult learning literature (Kolb 1976; Knowles 1990; Burns 1995) and foundational for supporting change in practice. Therefore, the On the Fast Track project team acknowledged that the CVCB research on its own would need to be transformed into meaningful information and tools that met such learning criteria. Further, since the work of managers and practitioners is predominantly based on project cycles, the research was organised around what became known as ‘the capacity building wheel’ (see Figure 2) which provided a framework for thinking about and working through the meaning and practice of ‘capacity building’ in the context of a project or program. The CVCB research outputs were then organised into a workbook for practitioners that linked practitioner questions and experiences to the relevant research outputs of the CVCB.
There was some confusion about what capacity building is and what approaches are (or are not) capacity building. The framework allowed people to think about capacity building – and how to position the CVCB research to their practice. It helped people think about capacity building as a process of focusing on outcomes for rural industries that built the ‘capitals’ (human, social, financial, natural and physical). The process then engaged both target audiences and stakeholders in achieving these outcomes. Next, innovative approaches were designed and delivered to support those outcomes. Finally the process was continuously monitored, adapted and evaluated to determine impacts.

Figure 2. The capacity building wheel.

The framework was built on a metaphor of a bike wheel. If the outcomes for capacity building are well defined and central to the process (wheel ‘hub’), if all capacity building elements (wheel ‘spokes’) are operating well, if the elements are continually informed by best practice principles, and if there are sophisticated indicators of progress and useful techniques and tools (the bike tyre is pumped up so the tyre is at full inflation), then the wheel runs smoothly and achieves its intent (the destination). If one or more spokes, the hub or the tyre are not working well – so the wheel is unbalanced or broken – the aim will not be achieved. This framework was suggested as a way to think systemically about capacity building, applicable whether participants were project managers, practitioners or investors.

The framework was used to develop the workshop program and align CVCB research outputs to a ‘topic’, and became a key tool for participants and the project team to explain capacity building. It proved a powerful guide for both the project team and participants in aligning CVCB research, workshop delivery and action planning with the questions and needs of practitioners:

“The wheel gave me a way of better explaining capacity building to others.” - On the Fast Track participant

“I have found using the capacity building wheel to be a useful model for planning delivery of projects, and I will use it again.” - On the Fast Track participant.

The capacity building wheel became a tool for project participants to relate CVCB research outputs to their own situation and to communicate capacity building to others. It became a ‘translating device’ for CVCB research and was a creative development of the project.

The On the Fast Track Workshops were also designed using action learning principles where research findings were applied to participants’ own issues or projects. Topics were aligned to questions such as:

- What are we trying to achieve from our efforts in capacity building?
- How do we engage stakeholders, organisations, farmers and communities in our efforts?
- What is best practice design and delivery for capacity building? How can we improve what we do and how we do it?
How do we better evaluate what we do?

Case studies, exercises, ‘expert panels’ and participant presentations were used to help consolidate learning. Over the two days of the workshop, participants built action plans. These plans formed the basis of a mentoring relationship that supported plans into action over the next eight months.

2. A networking process: capitalising on cross-industry experience and expertise

The project philosophy was based on the idea that ‘fast tracking’ capacity of practitioners required more than exposure to research. In addition, it needed to capitalise on the different experience of different industries and people in different roles, e.g. project managers as well as field workers. This networking dimension meant people from industries such as dairy, wool, meat, cotton and sugar as well as from NRM and community groups got to know each other and were exposed to new ways of looking at capacity building. It also meant participants could work with people that had similar issues but worked in different contexts. A project blog was also established for participants to share progress.

The project ended with a final workshop in Sydney that involved people from all workshops coming together to share their results with each other. This not only consolidated and reinforced learning but also turned networking opportunities into more established relationships that would endure beyond the project.

3. A mentoring process: building up the capacity builders does not happen overnight

Building people’s confidence and skills in the principles and elements of capacity building is not an immediate process. Mentoring was built into the project to support participants in using the learning from the workshops in an ongoing way in their own projects or work. The objective for the mentoring was to help participants put their plans into action after the workshop, continue to support their development as ‘capacity builders’ and encourage continued use of CVCB resources.

Twenty mentors with experience and an interest in capacity building were invited to participate. Mentors were identified through the CVCB members’ networks and were briefed on the vision of the project and their role prior to the workshops. A mentor developer was also part of the project team. Her role was to support the mentors in their role through regular phone hook-ups.

The mentors attended the workshops and participants were able to nominate their preferred mentor. Mentoring agreements were then established between each participant and their mentor to help build the relationship and set out the aim of the mentoring experience. Mentors also appreciated being exposed to the CVCB research materials and interaction with other mentors as well as participants. This meant that participants, mentors and the project team were ‘co-learning’ throughout the whole project.

Some mentoring relationships were less successful than they could have been. To improve this, the project team believes more effort could go into helping participants understand how to use their mentors effectively and giving more guidance to both mentor and mentees in how to work effectively together.

Some participants’ projects changed over the time or were too broad to enable effective action over a short period of time. The project team believes more effort in defining and tightening participants’ projects and aims for involvement would have improved the outcomes for some participants.

Results for participants from On the Fast Track

Sixty-three participants (including 20 mentors) were involved in the project. Participant projects were diverse and included:

- developing mentoring systems in the dairy industry;
- improving women’s involvement in industry decision making;
- improving group processes;
- designing effective farm business management groups in the sugar industry;
- building stronger young farmers networks;
- developing a better extension project proposal with a greater focus on capacity building;
- creating extension leverage from NRM networks;
- building indigenous employment strategies in the cotton industry;
- building capacity of commercial irrigation services in the cotton industry;
- and more effective reporting of capacity building efforts to stakeholders.
Participants reported a range of impacts and outcomes from their involvement in the project including:

- improved team work in projects;
- more engagement with stakeholders in projects leading to better participation and greater results;
- greater confidence in capacity building efforts;
- better quality projects from well executed engagement strategies and design, delivery and evaluation of projects;
- using their experience to train others in capacity building;
- more motivated extension teams;
- greater use of CVCB research after workshops.

The self-reported use of CVCB research outputs by participants doubled through involvement in On the Fast Track with the reported rate of use of CVCB research by participants increasing from 25% pre-project to 56% post-project. This increase is statistically significant at the 95% confidence level (Kelly 2008). Further, participants suggested their confidence in capacity building had increased across a number of aspects of capacity building (see Table 1).

<table>
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<th>Table 1. Participant’s response to the survey question: By being involved with this project, in which aspect(s) of Capacity Building has your confidence increased?</th>
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<td><strong>Capacity building aspect</strong></td>
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<tr>
<td>The definition and understanding of capacity building outcomes</td>
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<td>Engagement of different stakeholders and groups in capacity building</td>
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<td>Design and delivery of capacity building programs</td>
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| It is estimated that 40 of the 43 participants benefited directly from involvement in the workshop and exposure to the resources (three participants did not continue in the project after attending the first workshop). Of those that followed through into projects and mentoring: 30/40 (75%) had a moderate to high impact as evidenced by their project reports and mentor comments, and 10/40 had a low impact.

The experiences of participants in the project suggest that the On the Fast Track approach has led to their increased confidence in the methods, approaches and outcomes from capacity building. This confidence has led to better capacity building projects and through this, a greater reach and impact into rural industries. Many participants valued the mentoring and support to their practice and personal development in capacity building through the project. There was an expressed demand by managers and practitioners of capacity-building projects for continued support to help them to better support rural industries.

Some feedback from participants when asked what the results have been from their involvement included:

"I have learnt how to do an evaluation plan that does a better job of demonstrating impacts on people’s capacity from involvement in our NRM programs."

"It has reinforced the importance of an outcome and impact focus - to establish and demonstrate change and the benefits to industry, government and community from investment in RD&E."

"Through my involvement with the On the Fast Track project I led an exercise with our main stakeholders to work on a strategic direction, planning, mentoring and support for extension practitioners within the group". This extension manager used the capacity building wheel and lessons from the workshop to work with his team to plan more effective extension for the extensive beef industry – which is now being put into practice.

"My involvement in the project has meant I have a tighter focus on farmers’ needs and ensure all efforts are put into producing a quality product to meet these needs"

"In designing and delivering an industry mentoring program I found myself jumping in and out of the spokes of the ‘capacity building wheel’ – integrating the elements of capacity building – it helped me focus, each decision I make or action to be
delivered. My mentor was amazing and contributed so much to my personal development and the project. I am inspired ...”

“Our mentor played a vital role in providing direction and challenged our thinking about capacity building for our projects and mostly importantly for ourselves.”

“...My mentor emphasised the importance of building celebration into the end of projects, and the workshops taught me that involving key contacts in organising workshops and inviting workshop participants is a very successful strategy. I am currently applying these learning’s to the development of an e-network.”

Lessons from On the Fast Track - critical success factors in the On the Fast Track approach

In compiling the final report from the project, participant feedback and project team reports (including the project evaluation report) were compiled to identify critical success factors within each element of the On the Fast Track approach. Critical success factors were identified and these form the basis of recommendations for improving processes in 'making capacity building research more practical':

1. Collaborative development: involving all CVCB member representatives in the project enabled different interests, expectations and perspectives on capacity building to be discussed and built into project objectives. This created ownership and involvement in the project by the CVCB stakeholders, and therefore an impact into their organisations.

2. Walk-the-talk: Applying the principles of capacity building to all the elements of the project provided a high level of responsiveness to participant needs.

3. Develop 'translation' devices and design the learning experience: The foundation elements of the On the Fast Track approach (elements 1 through to 5) ensured an effective and useful workshop for participants that increased the use of CVCB research. The 'Capacity Building Wheel' was a central development in the project, helping people position the CVCB research for their day-to-day work. It also provided a way for people to talk about capacity building with each other, helped in the logical design of the workshop and, it enabled participants to target areas for improvement (i.e. 'fast-track' their learning). It emerged as a key legacy of the project. The development of 'translation devices' such as this is important for bringing research and practice together.

4. Develop tools to support reflection: The project developed a number of tools to support participants and mentors in reflecting on their current practice of capacity building what better practice is and how to close the gap between current and ideal practice. These included: a) A practical workbook that previewed research findings, case studies and provided questions for reflection and discussion on each element of the capacity building wheel; b) An "action-planner" and an action planning process in triads during the workshops that took reflective questions into steps for new action; c) High quality action plans were the foundation for the mentoring process (what mentor and mentee's focused on in their interactions). These tools were highly valued by participants, led people to look further into research findings, made the full CVCB research reports more accessible, and enhanced the mentoring experience.

5. Mentors are participants too: Mentors are a key target audience for use of CVCB research and this was underestimated at first.

6. Close the loop and celebrate success: The final workshop is essential for consolidating learning’s, celebrating successes and building networks to improve capacity building approaches.

7. More time (1-3 years) is needed for more effective mentoring and more significant changes to capacity building approaches. This project (its design, delivery and evaluation) was a 12-month project and would have benefited from longer time frames for mentoring and project enhancement.

There were also significant insights into the implementation of a mentor-participant relationship:

1. A robust and valued mentor-matching process is essential: The mentor matching and mentoring process increased the effectiveness of the follow up process to get the action plan 'on the ground'.

2. Have a designated mentor-support role and a mentor support process: Having a designated mentor development role was critical to the success of the mentor process.
Mentors learning from each other and hearing about each other’s progress helped reduce isolation in the mentor role.

3. **Mentoring success is a two-way street**: Effective mentoring relationships require not only an effective matching process, but also effort and commitment from mentees and mentors to the relationship; understanding of roles by both mentor and mentee; rapport between mentor and mentee (including trust and respect) and a sharing of some common passion; a good understanding by the mentor of the organisation the mentee is working within; adequate time allocated to the relationship; use of communication skills, and a solid mentoring process built on action plans. The needs of the mentors (e.g. for benefits, stimulation, challenge and reward) also need to be prioritised and acknowledged through the mentoring experience.

**Conclusion**

It is clear that the *On the Fast Track* approach delivered increased use of CVCB research and was well accepted by practitioners as a way to increase their confidence and improve their practice. Participants valued the mentor matching and mentoring process; meeting and learning from other industries and others working in the field; working in small groups to focus on each others’ issues; a balanced mix of learning, pondering and doing; the effectiveness of follow-up process (mentoring and reporting) to get the action plan ‘on the ground’.

The On the Fast Track approach led to increased confidence of participants in the methods, approaches and outcomes from capacity building and this confidence led to better capacity building projects and a greater reach and impact into rural industries.

**Mentoring as an approach to building capacity**

Mentoring was shown to be an important process in the *On the Fast Track* approach for: increasing confidence of participants; exposing more people (e.g. the mentors) to capacity building research; and supporting people to turn increased confidence into action.

Although mentoring may be viewed as one tool amongst many for increasing confidence in capacity building, we argue that characterising mentoring in this way diminishes its value. Certainly, without mentoring, this project would not have achieved the amount or extent of its impact. However, the more significant finding is that mentoring emerged as a vehicle for capacity building itself - for both mentee and mentor. That is, mentoring supported the development of the capacity-building practitioner and mentor alike.

Although the suitability and success of mentoring relationships varied widely in this project, it can be concluded that if mentoring processes are improved (as outlined in the report) and supported then mentoring provides the leverage for turning capacity-building knowledge into tangible outcomes for RD&E projects and ultimately rural industries.

**Building capacity in capacity building**

The *On the Fast Track* project met a need in this area for ongoing and meaningful connection to others with similar interests and needs. A community of practice (a group of people that share an interest in a way of doing things) is therefore developing and requires nurturing. A key feature of this community is that project funders, managers and deliverers share the need to develop themselves in this realm to improve outcomes from RD&E.

In many rural industries, the nurturing and development pathway for the field workers, managers and practitioners in the development and extension part of RD&E occurred via public sector investment in ‘growing the profession’. With changes in public investment and greater privatisation, a sustainable professional development pathway has been lacking. *On the Fast Track* may offer an alternative for rural industries to build up lost confidence in the professional status of capacity building. Increasing people’s ability to support themselves and others in adapting to the needs and issues of rural Australia requires development of the professional practice of capacity building, ongoing research to improve practice and ongoing support. Participants in this project report these three things as essential for increasing their effectiveness in contributing to the issues of rural industries.

Rural industries would benefit from investment in the mentoring of project managers and project practitioners involved in capacity building as part of their day-to-day practice.

**Where to from here?**

From this project, gaps have emerged in three main areas that would be of interest and concern to rural industries.
1. There is strong demand from practitioners for further professional development in capacity building, yet little more is known about the needs of the professional. A cross-industry needs analysis is suggested as a starting point to scope the development needs of the people expected to support adaptation and change in rural industries.

2. The right balance and timing of investment by rural industries in ‘development’ and ‘delivery’ is often difficult and yet there are limited tools or processes to help these decisions. For instance, the On the Fast Track approach was a key investment for the CVCB aimed at delivery of CVCB research outputs to target audiences. In order to ‘deliver’ however, required an investment in the development of resources and tools. Further, CVCB members would argue, in hindsight, that the investment in development and delivery needed to occur earlier in the R&D cycle. Tools or processes were not available for getting the balance and timing right of development and delivery. This has been substantiated by the CVCB evaluation findings (Hassall and Associates, 2008).

3. Building capacity in capacity building requires the right approach in the right situation. The On the Fast Track approach may be adequate (if adapted to fit the situation) to achieve greater capacity building outcomes for industries and to some extent address issues of market failure (e.g. CVCB research via On the Fast Track used widely in the private and public sectors to reduce hindrances from the privatisation of knowledge). However, this alone does not address future issues for capacity building such as how the professional adapts their practice to future challenges. It is these ‘where-to-next?’ questions that provide a focus for further collaborative investment.

To read the final report, access the On the Fast Track workbook, tools or CVCB research reports go to: https://rirdc.infoservices.com.au/collections/cvcb.

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Keynote Paper
The what, who, and how of shaping change in African communities through extension

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Abstract. This paper provides positive examples of shaping change in African rural communities. First the author discusses perceptions of change and what change really is. Education, extension, and learning are all about change. We need to move beyond simple information, technology transfer, and ‘old-school’ top-down training as means of bringing about change, to real learning opportunities that are empowering, grassroots-based, and holistic. Different frameworks for change in rural areas, including the technology transfer paradigm and the innovation systems approach, are discussed. The paper then discusses who needs to change, and stipulates that people at all levels of development need to change. It is not only rural communities or the poor who should change, but also the educators, practitioners, researchers, and politicians. Skills needed by change makers and by communities in order to effect beneficial change are given. These skills go much beyond technical aspects, and include features such as critical thinking, problem-solving, decision-making, and creativity. The paper then discusses how change needs to occur. Using examples gained through field and desk research over the past five years, the author discusses extension and education initiatives that have been bringing about change in African rural communities. These change initiatives attempt to be sustainable, holistic, grassroots- and demand-driven, and sensitive to culture and gender. The examples fall into three levels: community, organisational, and institutional. The community-level examples are focused on individuals and groups. Organisational examples typically involve one particular organisation, while the institutional examples are broader and may include changes across several different organisations. The initiatives focus on several issues surrounding change: empowerment issues using the farmer field schools approach at the community level, cultural and gender issues in providing rural services at the organisational level, and various trends in extension in Africa at the institutional level (involving multiple organisations). While change is very important for improving incomes and livelihoods in rural communities worldwide, practitioners, policy makers, and researchers have not always gone about bringing about change in the right way. Change has been implemented in top-down ways, or imported from another part of the world without regard to local conditions. Thus communities and others have not made beneficial changes in the long run. Based on some examples from Africa, the author discusses some of the new approaches to positive and lasting change in rural communities. The aim is to improve education and extension approaches worldwide.

What is change?
What is change? Many things come to mind when we hear the word ‘change.’ In 2008 we heard about ‘Change we can believe in’ during Barack Obama’s presidential campaign. Today we hear constantly about climate change. Essentially, change is about making something different, or altering it in some way. In rural development, this usually entails bringing about improvement in people’s lives and livelihoods. For example, there has been a focus on adoption of new technologies, literacy and training programs to bring about change.

Education, extension, and learning are all about change. But there have been many different approaches to change within these fields. Some of these have proved ineffective because they were not accepted by the people being changed, or because they only brought about short-term change. There is a need to move beyond traditional modes of change, for instance, ‘banking’ education (Friere 2000), technology transfer in extension, and ‘old-school’ top-down training. Instead, real and sustainable change comes through learning opportunities that are empowering, grassroots-based, and holistic. Such change involves facilitation, sustainability, and innovation.

This section will discuss the evolution of frameworks for bringing about change. There are many different frameworks for change in extension and development, covered quite adequately in other papers (FAO/World Bank 2000; Rivera et al. 2006). This paper will briefly cover major frameworks for change in rural areas, including the technology transfer and diffusion of innovations paradigms, the agricultural knowledge and information systems framework, and the innovation systems approach (Figure 1).
One of the most well-known theories of change for extension is the diffusion of innovations concept (Rogers 1995). The diffusion of innovations theory states that technologies are communicated over time among the members of a social system, and adopted according to various characteristics of both the technology and the user (Rogers 1995, p. 5). The diffusion of innovations model was focused on a very linear process of technology development and transfer. Thus the transfer-of-technology approaches, including the ‘national agricultural research institutes (NARI)’ approach and the national systems approaches are strongly linked to the diffusion of innovations philosophy. These approaches also came about partly as a result of the Green Revolution, where high-yielding varieties of wheat and maize were developed at international research stations and passed on to farmers via national agricultural research systems and extension.

However, Rogers’ model and the technology transfer approach have been critiqued for many shortcomings, including the linearity of the proposed innovation-diffusion process, pro-innovation bias, blame of farmers for ‘non-adoption’ of technologies, lack of recognition of farmer innovations, and focus on the change agency and change agents instead of the farmers and others in rural communities who are traditionally seen as ‘end users.’

The thinking that followed the linear approaches focused on models that were more iterative, dynamic and cyclical in nature. This included the agricultural knowledge and information systems (AKIS) approach, first promoted by FAO and the World Bank (FAO/World Bank 2000; Rivera et al. 2006). The AKIS approach, which focused on the knowledge triangle of education, research, and extension—with farmers in the middle—broadened the technology transfer approach to include more actors and a focus on the ways that they interacted to generate and share knowledge.

The AKIS approach was then expanded to the agricultural innovation system (AIS) framework in the 2000s (Hall et al. 2001; 2003). The AIS approach highlights how individual and collective absorptive capacities translate information and knowledge into a useful social or economic activity in agriculture. The framework requires an understanding of how individual and collective capabilities are strengthened and how these capabilities are applied to agriculture. This suggests
the need to focus less on the supply of information (e.g. brick-and-mortar research organisations and educational institutions) and more on systemic practices and behaviours that affect organisational learning and change. The approach essentially unpacks systemic structures into processes as a means of strengthening their development and evolution (Spielman et al. 2009).

Thus there have been several main frameworks or theories for how change can and should take place in rural areas. The current innovation systems thinking is much more dynamic, complex, and process-focused. It also places more emphasis on capacities of individuals and organisations.

This section has discussed the concept of change, stating that change is about altering something, and in the case of rural development, contributing positively to people's livelihoods. Different frameworks of change, including the diffusion of innovations theory, the AKIS approach, and the AIS approach were explained. The next section will discuss who needs to change.

**Who to change?**

The previous section discussed what change is, and various frameworks that have been used in rural development to better understand change. This section discusses who needs to change.

Many times change paradigms focus on beneficiaries, end users, or program participants. They are the ones who should adopt a new technology, or change the way that they operate. This was seen in the transfer of technology paradigm for extension.

But from a systems perspective, such as the AIS approach described above, this is not good enough. Instead, change needs to occur at all levels. It is not only rural communities or the poor, who should change, but also the educators, practitioners, researchers, and politicians. This concept, of changing ourselves—the change makers—is provocatively discussed in Robert Chambers’ book ‘Whose Reality Counts? Putting the First Last.’ In the book, Chambers challenges the ‘uppers’ and other powerful people to ‘upend the normal, stand convention on its head, to put people before things and lowers before uppers’ (Chambers 1997, pp 210-211). In other words, we must first focus on the people that we are ‘trying’ to change, and to understand their realities and worldview, before we can even think about devising programs and projects to ‘help’ them. While people at the local level can and should change, this cannot happen without the change makers themselves also modifying their way of thinking and acting.

In order for people at all levels of rural development to change, several things are needed. One major barrier is information. People need clear, appropriate, and (as far as possible) objective information to be able to make informed choices. This information needs to be provided or packaged in an appropriate way, and passed through the appropriate medium. For instance, policy makers need information in a short, digestible, actionable form. People that are not able to read very well may need information over the radio; through story-telling, song, or dance; or in pictorial form. Literate people need any sort of printed material to be in an appropriate language.

This issue of information channels is especially relevant in light of the popularity and promotion of information and communication technologies (ICTs). At the community level, while ICTs show much promise, these do not necessarily reach all rural areas, especially in Africa. This is due to topography as well as geographically dispersed populations. On the other hand, we see certain cases of people modifying ICTs to fit their unique circumstances to obtain the information that they need (Ochieng and Davis 2006). For instance, the mobile phone is being used in Africa to exchange market, health, and weather information.

In addition to information, people need capacity strengthening and education in order to change. There are many skills that are needed by change makers and by communities in order to effect beneficial change. These skills go much beyond technical aspects and include features such as critical thinking, problem-solving, decision-making and creativity. Communities also require capacity strengthening for increased empowerment, to be able to contribute effectively to their own development. And policy makers and administrators need capacity strengthening to gain a systems perspective and to appreciate the need to focus on gender, culture, and empowerment issues in creating a better policy environment and for designing and implementing prudent policies.

This section has discussed the fact that all players in rural development need to change. People in rural communities (men, women, and youth) need to change; so do change makers such as agricultural and health extension workers. In addition, the private and civil society sectors, and
government officials and policy makers need to change. Thus the examples below will highlight the fact that change needs to occur at all levels.

**How to change? Examples from Africa**

The previous section has discussed who needs to change and stipulated that people at all levels, from rural communities to policy makers and administrators, need to change. This section will use examples of extension and education initiatives that are bringing about change in African rural communities. These change initiatives attempt to be sustainable, holistic, grassroots- and demand-driven, and sensitive to culture and gender.

The examples fall into three levels: community, organisational, and institutional. The initiatives include several issues of change: empowerment issues using the farmer field schools approach at the community level, cultural and gender issues in providing rural services at the organisational level, and various institutional issues and trends in extension in Africa at the institutional (multiple organisations) level.

**Empowerment issues using the farmer field schools approach at the community level**

Farmer field schools (FFS) are an adult education and extension approach that have been around since the 1980s. FFS are ‘schools without walls’ where groups of farmers meet weekly with facilitators. They are a participatory method of learning, technology development, and dissemination based on adult learning principles such as experiential learning. The FFS approach is a method to assist farmers to learn in a non-formal setting within their own environment.

While FFS were originally set up to teach farmers integrated pest management in rice farming in Asia, the schools have drastically changed their scope as the program expanded around the globe (van de Fliert et al. 1995; Davis et al. 2009). FFS in the African region proved to be very dynamic, changing in response to outside influences. One major outcome of the FFS in East Africa has been the focus on empowerment of the participants. This comes out of the desire to make FFS ‘demand-driven.’ This means that rather than pushing technologies from the top, the FFS are enabling farmers to have the capacity to be able to demand the types of technologies that they want.

Friis-Hansen (2004, in Friis-Hansen 2005, p. 5) defines empowerment as ‘a process that increases the capabilities of smallholder farmers and farmer groups to make choices and to influence collective decisions towards desired actions and outcomes on the basis of those choices.’ Empowerment includes elements of having a voice, being able to approach authorities, to formulate and express demands, problem-solve, and whether or not one feels able to effect change.

The FFS programs build empowerment of the participants through the overall approach, as well as through specific activities and modules within the curriculum. From the very beginning, empowerment is emphasised. Because it is a demand-driven approach, the participants are first taught to prioritise and make decisions about what they want to learn in the school.

The approach of the FFS facilitation or teaching also leads to empowerment outcomes. In a FFS, the extension agent is not a teacher or a preacher, but rather a facilitator. This is a big paradigm shift for extension agents in the region, who are usually seen as the experts who tell the farmers what they need to do. Instead of a top down approach of lecturing or even giving the answers to questions, the facilitator attempts to help the participants find their own answers to questions. Through the regular agro-ecosystem analysis, designing and conducting experiments, and holding field days where the participants teach others what they have learned, the FFS build capacity of the farmers to problem solve, plan, speak in public, and to generally exercise their voice. When the farmers hold field days, they invite local government officials and other community members, who then start to realise that farmers are experts too.

Examples of empowerment through FFS can be seen in East Africa. For instance, livestock FFS in Tanzania increased the ability of participants to demand services. In Kenya, several farmers from the FFS have subsequently gained community leadership positions, such as chiefs or councillors, or have been hired by NGOs (Davis et al. 2009). De Jager and colleagues (n.d.) also saw a positive impact on knowledge, skills, experimentation, and innovation, all of which can be used as proxies for empowerment. Friis-Hansen found that the FFS led to improvement in analytical skills, ability to articulate demands and creation of trust among group members. There are also informal case studies and narratives of empowerment outcomes through FFS projects, such as building of social institutions, trust, and process skills for development (CIP-UPWARD 2003). For instance, the FAO-ILRI-KARI workshop report (2003) shows cases of strong...
and cohesive networks that have emerged in Kenya without external support, and which serve as platforms for community-based extension activities.

In summary, extension and other rural development programs cannot go about just attempting to provide information or technologies without also providing the skills and assistance to be able to make decisions, to prioritize problems, to plan and to monitor evaluate and evaluate programs. This is what is entailed in empowerment and the farmer field schools allow for empowerment to be developed through their curricula. They also show scope for changing the attitudes and approaches of extension agents and government officials through their training and field days. By changing the mindset and approach to education and technology dissemination, the FFS program is building empowerment that brings about more lasting change in farmers’ lives, as shown in the examples above.

**Cultural and gender issues in providing rural services at the organisational level**

Rural services allow the poor to make use of agricultural innovations, become integrated in markets, and improve their well-being. However, rural services such as extension and education need to apply cultural and gender lenses both in practise and in research. Extension has traditionally focused on crops, production technologies, major ethnic or caste groups and male farmers. This usually leaves out women, pastoralists, fisher folk, ethnic minorities and others who are traditionally marginalized.

One example of the need to apply the cultural and gender lenses can be seen in the Participatory Demonstration and Training Extension System (PADETES) program in Ethiopia. The PADETES program was an aggressive extension intervention that has resulted in a total number of 4.2 million participants from a total of about 10 million small-scale farmers in the country (Kelemework and Kassa 2006). While the program did reach many farmers and increased adoption and productivity, an evaluation found that:

- The majority of extension packages were on cereal crop production
- Extension was supply-driven
- Extension packages were formulated at the federal level rather than the local level
- There was a limited focus on cash crops and livestock
- There was limited participation by women farmers (EEA/EEPRI 2006).

However, in some pockets of Ethiopia, there is evidence of expanding economic opportunities for small-scale women farmers and pastoralists (Davis et al. 2009). In northern Ethiopia, producer groups composed of and led by women were producing fruits, vegetables, eggs, broilers, and other high-value products for the market. This broadening of the extension from production to marketing and high value crops, and creating space for non-traditional clientele, allowed more households to increase farm and pastoral household income (Davis et al. 2009).

Access to extension services by women was shown to be as high as 20 percent, which was reasonable, especially in comparison to Ghana and India in a recent study of rural services by the International Food Policy Research Institute’s Gender and Governance Team (2009). Ethiopia is also trying to mainstream gender through its public administration, with gender desks and focal persons at the district and village governments (Gender and Governance Research Team 2009).

Like women, pastoralists are also often traditionally left out of extension. Pastoral and agro-pastoral areas make up almost 65 percent of the total land of Ethiopia (EEA/EEPRI 2006) and include at least six million people. Due to the culture and lifestyle of these traditionally nomadic people, they are difficult to reach using traditional extension methods and topics. For many years there was no pastoral or agro-pastoral extension package; however, packages are now being developed for pastoral households, including water, feed resources, and animal health (EEA/EEPRI 2006). Among pure pastoralists, the government is promoting rangeland management and improved forage.

This case illustrates the necessity of change at the policy and administrative level. Farmers and pastoralists may be empowered to demand technologies or information, and extension agents may be trained in more participatory methods. However, without change at the administration and policy level, the current transfer of technology paradigm that focuses on production, crops, and men will never be challenged or changed.

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While there is always a temptation to focus on the majority groups that are easier to reach with greater impact, it is important that extension and other rural development programs do not leave out minority groups that tend to have fewer resources. This means applying a culture and gender lens to programs and policies for rural development, extension, health and education. In addition, it means educating policy makers, administrators and extension agents on the need to reach these people, as well as the communities themselves.

**Various trends and challenges in extension in Africa at the institutional level**

There are several ongoing institutional trends in extension in Africa. These include the development of new institutional arrangements for more sustainable extension models, methods focused on learning processes for enhanced participation and demand-drive and the development of a new profile of skills needed by extension agents.

New institutional arrangements are coming about as a result of the withdrawal of state interventions, due to the lack of budget and/or commitment by the government. This has led to new models such as privatisation of service providers to improve the quality of service provision, or decentralisation to make extension providers more accountable to the demands of local communities.

More generally there is the emergence of new arrangements between stakeholders to strengthen new service providers. These include extension services that are directly managed by farmers’ organisations or by non-governmental organisations (NGOs). They also comprise public-private partnerships that include inter-professional bodies or contracts between a private firm and the state. The ongoing trend is moving from ‘national advisory service systems’ towards more pluralistic ‘agricultural innovation systems’ where all the stakeholders (extension, research, education, private firms, producer organisations, public services) have a role to play to promote more sustainable farming systems with better access to markets. These include market-driven extension, such as the National Agricultural Advisory Services (NAADS) model in Uganda (Benin et al. 2007). The main challenge institutionally with these new arrangements is the development of sustainable institutions for service provision with the capacity to provide more market-oriented extension services.

With regards to methods, there is a new focus on learning processes. This entails a shift from top-down approaches, which proved to usually be inefficient in improving farmers’ practices, to more participatory approaches to strengthen farmers’ capacities to make their own decisions according to their objectives and resources. At the same time, based on the demand of farmers and other actors (traders, processors, exporters), there has been a progressive evolution of extension advice content, from technical to economic, from production to marketing and natural resources management and from the farm level to the collective level. The main challenge for this evolution of learning processes is the development of methods that can enhance participation and demand drive of the extension services.

The trends outlined above pose a particular problem for the existing extension staff to deal effectively with the changes that are occurring. The challenge is to develop skills to work with new types of institutions, communicate with demanding farmers and be professionally capable of providing MOAAS. As mentioned earlier, in the extension climate existing in Africa today, extension agents need more than the usual technical skills. They need soft skills, including marketing, communications and group development, as well as critical thinking, problem-solving, decision-making and creativity skills. In many countries there are few mechanisms to train or re-train extension agents, such as in-service training, refreshment courses and experience sharing between agents.

In summary, we are seeing trends in extension in Africa towards new institutional arrangements for more sustainable models of extension that are pluralistic and market- and demand-driven. This move necessitates new skills for extension agents and other extension staff, as well as their clients. As mentioned earlier, policy makers also need new skills and mindsets, such as systems thinking and the use of cultural and gender lenses.

**Conclusions**

This paper has used examples from change initiatives in Africa to show issues that are important for positive and lasting change in rural development. The paper first discussed what change is and explained different frameworks for bringing about change. Next, the author made

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the point that change needs to happen at all levels. Change is not just for ‘beneficiaries’ or clients, but for change makers such as extension workers and for policy makers as well.

Next the paper gave examples of extension and education initiatives that have brought about change in African rural communities in the past five years or so. The examples given fell into three levels: community, organisational and institutional. The initiatives included several examples of change.

The first example of change was empowerment issues using the farmer field schools approach at the community level. Here the author states that we cannot go about attempting to provide information or technologies without also providing the skills and assistance to be able to make decisions, to prioritize problems, to plan and to monitor evaluate and evaluate programs. This is what is entailed in empowerment and the farmer field schools allow for empowerment to be developed through their curricula and activities. In addition, the FFS make room for educating local government officials and other community members on more demand-driven extension paradigms and the contribution of farmers to technology development.

The second example was related to cultural and gender issues in providing rural services at the organisational level. While there is always a temptation to reach the majority groups that are easier to reach, it is important that extension and other rural development programs do not leave out minority groups that tend to have fewer resources. This means applying a culture and gender lens to programs and policies for rural development, extension, health and education. When this is done, we have seen positive examples as shown by the Ethiopian case. Again, this entails the education of policy makers and extension staff to better appreciate the need for the use of the cultural and gender lenses.

The third and last example was with regard to various institutional trends in extension in Africa. Here the author stated that trends in extension in Africa were occurring with new institutional arrangements for more sustainable models of extension that are pluralistic and market- and demand-driven. This move necessitates new skills for extension agents and other extension staff, their clients and policy makers.

These change initiatives focus on bringing about change through capacity strengthening at all levels of rural development. Important components of the initiatives include the attempt to empower clients, to be more sustainable, holistic and systems-focused, demand-driven and sensitive to culture and gender.

References


Keynote Paper

Achieving more socially sustainable communities

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Abstract. We are only too aware that the communities in which we work are dynamic environments where change is a constant. In addition, the demographics in Australian rural/regional communities are also changing. When placed on top of the big issues facing Australian society – such as those associated with adaptation to climate variability; claims for upgrading of communications infrastructure; or demands for energy, water resources ... the impact of this on our practice can become a challenge. How can extension practice draw on the strengths inherent in communities to enable change and what strategies do we need to consider when faced with the intergenerational change underway in our communities? This presentation draws on recent experience and examples from the Expert Panel on the Social Impacts of Drought in Australia Report, as well as research undertaken in the South Coast region of Western Australia, to suggest a strengths-based perspective to 21st century extension practice to enable more socially sustainable communities.

Keywords: social capital; adaptation; intergenerational change; regional impacts

It is a great pleasure to be here with you today and to share this important event with you all. The theme of the conference is Shaping change in communities – Dimensions of excellence - and I want to focus on an aspect of such a dimension of excellence – the strengths-based approach to community – with you today.

For many years I have been involved in research and development in a variety of settings – from place-based, such as Central Queensland and more recently, South Coast of Western Australia – to interest-based, such as the Natural Resource Management or human services sector.

This work has continually highlighted an important, but relatively under-realised fact, that the work of the practitioner within communities is a key to an appreciation of the strength of that community.

In this context, I consider you all to be practitioners in community development, community capacity building or community practice. Your titles may be quite different, but fundamentally, your goal is to leave your communities stronger than when you began your work with them.

You may be thinking – 'but I work with individuals – my clients are farmers, or land managers – not the community as a whole – that's a bit too big for just one person!' - I agree. My message to you today is that even if we conduct our practice with one person, we are in fact, because we are working towards building a sustainable future, working with the whole community within which that person lives, works, recreates or socialises.

It has now been established in medical research that human beings are essentially healthier, more capable and more able to deal with change when they are connected with others. Living outside of community connectedness is in fact an indicator for poor mental health. Alienation – another term for this – can result in depression, in self-harm through drugs or alcohol – and in suicide. Connection is the key to a good life, to physical and emotional health and wellbeing. As practitioners that is what we have at the heart of our practice – connection.

The other important aspect to this is that in order to achieve change, we necessarily need to work in groups. Everything is connected to everything else – and it is very seldom that an individual – working alone – achieves whole of community change. Sometimes we join together because of external forces – we want to resist change – but in the resisting we actually create something new (Trauger 2009). Sometimes we come together because we have issues in common – Landcare was an example of such a coming together. Networks – which is another way of thinking about such groupings – are also becoming virtual, rather than real, and this adds another dimension to their complexity.

As practitioners you are often required to act as bridges between individual clients and their broader communities - either of place or of interest. This act of bridge building has been identified as a key component to social capital. What is social capital? Social capital is a key component of understanding a ‘strengths-based’ practice.

Social capital provides a framework for understanding the connections between community engagement and business enterprise (Stone & Hughes 2002). Social capital can essentially be considered as the networks and norms that facilitate co-operation among groups.
Social capital at one level – is a way of trying to put back the social into the economic debate. As the pendulum swung away from community and family toward the individual – many social commentators felt powerless to enter the dominant conversation. Social capital became a way of conceptualising how our society operates. Definitions are many. The one I am comfortable with is that it is the ‘raw material of society created from the myriad of everyday interactions between people (Bullen & Onyx 2000) and another – perhaps one you have heard – is that it is the ‘glue’ that holds society together.

Wendy Stone has described it as the ‘networks and norms that allow people to work together to resolve problems and achieve common goals’. You can see from this that the ‘capital’ that is being built here – is not economic capital – not money or infrastructure – but intangible resources that enable a community to withstand pressures. Let’s look at the other forms of capital a little more closely.

- economic capital – financial resources – money/mortgages/loan/credit etc.
- physical capital – buildings, housing, roads, machinery
- human capital – what each of us knows – our skills and knowledge
- cultural capital – knowledge, skills, forms of expression that are culturally valued and distinguish some groups from others.

The concept of social capital is a layered one\(^1\) – over the past twenty years we have come to understand it as including:

- networks, ties and relationships
- advantages and opportunities that come through membership of various communities of interest or groups
- civic engagement – which in turn leads to – economic engagement.

The scholarly work undertaken by these and others moved the social capital concept beyond the individual and into community and society. As a result it has now become very popular with governments of all political persuasions (and has entered into the policy frameworks in a variety of settings) as a way of attempting to ‘measure’ the essentially, unmeasurable\(^2\) or at least very hard to measure. What is important about social capital to our practice in building strong and sustainable communities is that we are the links that enable some of the glue to stick. This is because the critical factor in social capital building is trust.

In 2005 I published an article taking this idea further – here is the model I developed in that article (Figure 1).

**Figure 1. Building trust for social capital as an action cycle**


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1 Like most ideas it has a long history which some scholars have traced back to 1961 and Jane Jacob’s groundbreaking text: *The Death and Life of Great American Cities.*

You can see that I take each of these as assisting in the trust building process. It is designed as an action cycle, which means that we can never take it for granted. It doesn’t just happen. Nor can we become complacent. So even in the longer term relationships, the building of trust continues.

It begins with **respect**. By this I mean ‘show consideration for’ each other. For me, this begins with an understanding of what each partner stands for, what goals and visions they have, and how these then impact on their communities of interest.

Perhaps some of that incipient cynicism that we are often confronted with when we attempt to develop such community partnerships comes from a lack of understanding of what such partners actually do. There can be no assumptions that we ‘just know’ what we do and what capacities we have. So the respect begins with a deeper understanding, which takes some time to develop and much good communication to enable.

It also means that we take time to learn about the history of our partners. What has happened in the past impacts on our present day relationship – even if we didn’t know of each other at that time. We should never ignore the importance of history. The relationships that our partners have with other partners is also important in this understanding that comes with respect. An understanding of the culture of our partners is also important.

That leads to our second aspect – **mutuality**. This I take to mean ‘empathy’ which is a useful and commonplace word in the language of human services. We are exhorted to stand alongside our communities, so in that mutual relationship are the principles I am suggesting here. Mutuality between partnerships means honesty, clear communication, not leaping to judgements without information. In a partnership of the kind we are talking about today, the empathy between parties enables the building and re-affirmation of trust.

The third aspect of our action cycle for trust building is **reciprocity**. This is probably the first time that the question of ‘what’s in it for me?’ has emerged in the discussion. However reciprocity is much more than simply getting what you want – it implies that we do so in a way that builds the relationship. We give because the giving is important, not because of what we are getting. Again, this is an important value which often emerges when we talk about the NRM sector so let’s incorporate it into our partnerships programs too. Just as we would not approach a community in this ‘I’ll take what I want approach’ – so our partnerships should also be based on a reciprocal arrangement. In order to ensure that such reciprocity works well, we need to understand our partners well – it goes without saying.

So in the building of **trust** these three values are crucial. Just what do I mean by trust in this context? In this sense I am talking about a trust that:

- can be sustained through both positive and challenging experiences
- enables and nurtures
- enables a management of the mistakes that may (and usually do) happen
- enables and strengthens the relationship.

As practitioners working in communities, we should be well aware of the role of trust in building social capital in communities. I am suggesting that such trust is crucial and that these three values enable such trust building and sustainability in the long term.

From these ideas and frameworks we can see how it links to some other common understandings. For example: **capacity building** which relates to a range of activities by which individuals, groups and organisations improve their capacity to achieve sustainable goals – including awareness, skills, knowledge, motivation, commitment and confidence – such capacity building activity should be integrated in all organisational practice. Also important is **community engagement** which includes all aspects of the ongoing relationship between you/your organisations and their geographic and communities of interest. Such community engagement – to work in a strengths-based way - proposes a peer-based relationship, based on trust and principles of mutuality, reflexivity and respect and involves active two-way communication.

Environmental stewardship and social action are now well understood as major drivers in changing land management practices (Government of Western Australia 2003) and the place of innovation in enabling and supporting entrepreneurial activity in communities also strengthens social and cultural capital, thus expanding impact beyond the individual enterprise into the wider community. The links between social capital, community capacity building and the importance of place (Axford & Hocking 2005) in the lives of stakeholders and the broader community, are a critical component of your practice.
Increasingly, demands are being placed on individuals and groups to be self-motivated and self-directed in terms of their planning for the future. At the local level, this demand places pressure on a few, usually volunteers, while it ignores the capacity and inherent strengths more broadly available but less likely to be included. This is not only a national challenge, but also one that has international resonances (Cahill 2005). These ideas and others can be found discussed in more detail in the following publications (Stehlik 2006a; Stehlik 2006b).

Let’s run a brief ‘check list’ against our understanding of the communities in which we operate as this also assists us to understand if we are searching for ‘strengths’ or ‘deficits’ and in enabling our practice to be inclusive of social capital building. Such a check list raises some interesting (and challenging) questions:

- What do you consider to be your biases?
- What aspects would you need to consciously work on to increase your defining of community?
- How many people do you know - who knows who?
- How do you record and update this information?
- Are you confident and competent in identifying a particular "community of interest", (e.g. the local Landcare group) and then analysing some under-realised opportunities that may be possible within it?

In conclusion, those of us working at the front line in communities are well aware of the rapid change underway. This is not only from external factors, such as climate variability or price fluctuations, but from also internal factors, such as the fact that many of our land managers are reaching retirement age, and there is a transition occurring between generations³. Rural Australia is also continuing to be impacted by the growth of regional centres, by the hollowing out of young people, and by the (in some places) influx of new migrants who may be on 457 visas, and who have no history or cultural links with the place in which they are now living.

Working from a strengths based perspective, taking account of the fact that your practice can build (or destroy) fragile social capital – means that we have to think about the way we work. We need to be reflexive – that is, we should be learning as we are doing. We should take opportunities such as this conference to come together and share our experiences – positive and negative. It is important to recognise the vital role that the practitioner plays in building and maintaining strong communities. We are committed to our nation’s future, which is why we are doing what we do.

I commend you all and thank you for your attention.

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Keynote Paper
Participatory communication in rural development: What does it take for the established order?

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Abstract. Participatory approaches have undergone several waves of interest within the agricultural research and development community since the 1970s. There has been a trend from technology-oriented towards farmer-oriented outcomes to better support the requirements of sustainable change. The practice of participatory research and extension under a variety of models, all underpinned by the principles of participatory communication, has been accompanied by debates on what is “genuine participation” and how different “types” of participation suit different development objectives. Addressing stakeholder participation has slowly become the norm in project proposal development for most major funding organisations as it is perceived to increase impact. However, very little is required in terms of demonstrating, firstly, that project partners have a common understanding and are in agreement of what type of participation suits the proposed design and context of the research and development process and secondly, that the capacity and political will exist among the partner organisations to allow for and facilitate participation. It is not uncommon that participation is reduced to superficial consultation or even lip service, whilst decision making power remains in the hands of specific stakeholder groups, often those who already had their own agenda for the change process to take place. This paper will discuss the factors and conditions that enable and impede effective collaborative partnerships of stakeholder groups in the context of rural development, particularly in cross-national initiatives. Factors at the level of the individual include mentality, communication skills and facilitation capacity. At the organisational level, institutional mandates and objectives, leadership and political climate will be reviewed. The paper will particularly build on experiences in Australian government funded research for development projects in Southeast Asia but intends to provide some general input to further discussions into the debate about good participatory practice to support sustainable rural development.

Participation – so what’s new?

Participation has become an essential part of the vocabulary used in project proposals over the past two decades, since it was recognised that people - rather than technology-oriented approaches are required to find the right balance in achieving economic, social and environmental sustainability (Van de Fliert 2007). The underlying goal of participation is, in theory, to empower communities, groups or individuals to determine their own direction, objectives and options for change, make well informed decisions, take (collective) action to achieve their goals and monitor and evaluate if they are getting where they want to be. In practice, however, many ‘non-participatory’ interventions can be observed (Bessette 2004) and genuinely participatory processes are hard to come across in development initiatives. In fact, good participation is not as easy to achieve as it sounds due to a range of factors, which will be explored here.

The high requirements on human and financial resources are often mentioned as an immediate impediment to applying participatory processes, as well as a reason for not applying them. This may indicate that the benefits are not necessarily perceived worth the investment. It seems impossible, however, to assess what difference participation actually makes to the return on investment as it cannot be compared with a non-participatory approach in the same context. Many projects that do invest in participation attribute positive project outcomes to the application of the participatory approach but rarely are the indicators for successful participation clearly articulated. How do we judge whether participation was “genuine” and what do we expect in the process from each of the “participants”, including ourselves?

More often than not, we see that participatory approaches are employed as a “means” rather than an “end”, as a potentially better pathway to achieving project objectives compared to top-down methods, but not necessarily for empowerment. As a means, participation is defined as a method to increase the effectiveness of an externally introduced program via the involvement of local people (Cleaver, 1999). As an end, it is seen as a goal in itself, which is to empower people by equipping them with capabilities and providing them opportunities to their take control and give direction to the change process to improve their livelihoods (Huesca, 2003). All too often in development projects, we can observe that participatory processes have been designed to serve as an end, but are merely implemented as a means. This is typically evident in situations where participatory approaches are applied in a context driven by the traditional
The development paradigm of modernisation that emphasises economic growth rather than the multiple dimensions of human wellbeing. This paradigm is still very much embedded in contemporary mainstream development thinking, expecting those who supposedly “know” to take control over decisions on the direction of change for those who supposedly “don’t know”. Coupled with a predominantly reductionist view on research and development that tends to exist among professionals who had their training in a specific disciplinary field, many projects that attempt to apply a participatory approach grapple with the complexities that emerge when we allow all stakeholder groups to express their needs, instigating fear to lose control. In addition, academic training generally does not cater for “participatory research and development methodology” whilst facilitation of such processes is an art in itself.

The literature has captured the dilemmas in the application of participatory approaches by categorising different forms of participation. White (1994), for instance, makes a distinction between pseudo- versus genuine participation. Pseudo-participation is described as “people’s participation in development in which the control of project and decision-making power rests with planners, administrators and the community’s elite” (White et al. 1994, p. 17). Genuine participation is defined by Servaes (1999, p. 198) as a process that “touches the very core of power relationships in society”. Pretty (1995, p. 1252) describes seven types of participation:

1. **Passive Participation**: Be told and follow; information belongs only to external professionals.
2. **Participation in Information Giving**: Participate by answering questions; no opportunity to influence conclusions and decisions beyond the professionals.
3. **Participation by Consultation**: Participate by being consulted; conclusions may be modified in the light of people’s responses but professionals are under no obligation to do so.
4. **Participation for Material Incentive**: Participate by providing resources, for example labour, in return for food, cash, or other material incentives.
5. **Functional Participation**: Participate by forming groups to meet predetermined objectives. Instructions can be dependent on external initiators/facilitators or become self-dependent.
6. **Interactive Participation**: Participate in joint analysis, leading to action plans and formation of local institutions. Groups take control over local decisions.
7. **Self-Mobilization**: Participate by taking initiative independent of external institution to change systems.

Another typology of participatory research approaches distinguishes between five types of power relationships (adapted from Lilja and Ashby 1999, p. 3-4):

1. **Conventional**: Outsiders take decisions on their own based on limited communication with local people. They may or may not consider information related to local conditions and relatives.
2. **Consultative**: Outsiders take decisions on their own although there is organized communication with local people. Outsiders inform themselves about local people opinions, preferences and priorities through organized one-way communication methods. They may or may not let this information affect their decision. The decision is not made with local people nor is it delegated to them.
3. **Collaborative**: The decision is shared between local people and outsiders and involves organized communication between these two groups. Outsiders and local people know about each other’s opinions, preferences and priorities through organized two-way communication. The decisions are made jointly after a consideration of all opinions and suggestions. No party has the exclusive right to revoke a shared decision.
4. **Collegial**: Local people make the decisions collectively in organized communication with outsiders. Local people know about outsider’s opinion, preferences, proposals and priorities through organized two-way communication. Local people may or may not let this information affect their final decision.
5. **Local decision making**: Local people make the decisions individually or in a group without organized communication with outsiders. They may consult and consider the opinions or suggestions from outsiders, but the decision making process is not influenced or facilitated from the outside.

Types 1 and 5 can barely be called participatory as decision-making power is predominantly owned by one party. Type 2 is the typical example of pseudo-participation, which can be a stepping stone to higher levels of participation and empowerment but also lead to manipulative participation (Strauss 1998). Types 3 and 4 describe the range in which genuine participation can take place with an increasing level of empowerment.
Although these typologies were described a decade or more ago, they still seem very relevant in that only limited numbers of development initiatives manage to go beyond consultative participation and instigate shared ownership over processes. Mostly, these are initiatives by NGOs who establish long-lasting collaborative relationships with communities. It is becoming increasingly obvious that it is no longer the lack of acceptance that inhibits participatory approaches to achieve their full potential, but rather a lack in understanding, skills and effort of what it takes to design and facilitate multi-stakeholder engagement. Training in participatory methods of mainstream professionals is still scant and mostly inadequate to master the art. It tends to focus on tools and methods that are often presented as “blueprints”, rather than on principles, skills and requirements for flexible, adaptive application. No single toolbox can cater for all the different types of participation, each serving a different goal and requiring different processes and roles of the various actors. Training should, therefore, focus on underlying principles of development and empowerment and on basic communication and facilitation skills.

**From participation to participatory communication**

Facilitating participation does not imply “making others participate”, but engaging stakeholder groups in a dialogue, or better a “multilogue”. It requires open sharing of information and opinions in all directions, identifying areas of conflicting interests and collective assessment and testing of options that can fulfil needs while capitalising on opportunities and compromising on conflicts. This places participatory communication (rather than just participation with its various meanings and interpretations) at the core of sustainable development. Facilitation of participatory communication processes inherently implies “giving voice”, hence power, to all parties involved. These processes should be based on a thorough stakeholder analysis. This analysis helps to understand who has what stake in the process and what functional and power relations exist amongst and within the different stakeholder groups. Understanding people’s positions, interests and relations is required to design and employ the most suitable communication and engagement methods to raise interest in and initiate the dialogue. Rather than applying a standard set of recipes from a toolbox, situation specific processes need to be designed with a clear and mutually agreed objective. The process design should be based on considerations such as existing inter- and intra-group dynamics, language choice (both from an ethnic as a vocabulary perspective), access to and suitability of media or channels to be used, external noise that may occur and anticipated effects of both the internal processes and the external noise.

**What does it take for the individual?**

Participatory communication processes involve “participants” and “facilitators”. The prerequisites and desirables for each of these two main roles in participatory communication processes are discussed separately below.

**Participants**

Depending on the issue at hand and the type of activity involved, participants in a change process can be fairly homogeneous representing a specific stakeholder group or highly heterogeneous consisting of many and diverse stakeholder and anything in between. In order to achieve meaningful participation (i.e., voluntary contribution to the dialogue), people will have to have a sufficient level of awareness that there is an “issue” or in the least a need or opportunity for change. This can range from an immediate problem that occurred or a general need to keep up with a changing world around us. Awareness and attitudes towards the desire or need for change will have to be assessed and if needed enhanced before participation can be expected. Participation requires people’s time, so participants will need to be able to afford that time and be convinced that involvement is worth the investment. Involvement should contain an incentive, which may be in the form of a rewarding experience or gained knowledge but could be material, for instance a shared meal. Most importantly, methods applied to facilitate participation will need to match the capacities that exist. This relates to, for instance, language ability, literacy levels and background knowledge on the issue of concern, communication skills, and levels of empowerment. These capacities need to be assessed in order to adapt methods and activities accordingly to allow maximum contribution to the dialogue for each group with specific capacities.

There may be limited awareness and participation capacity of local people in certain situations, especially amongst marginalised groups who are not (or cannot afford to be) immediately interested in self-reliance, empowerment or the efficiency and sustainability of a project, but rather in the tangible benefits they can obtain from participating in the project at that very moment. This can bring about a dilemma and requires strong facilitation skills of development practitioners to mediate the conflicting interests and perceptions.
Facilitators
Some people are naturally talented facilitators, while others can go through any amount of preparation or training and will never feel comfortable in that role. The majority of people, however, can greatly improve communication and facilitation capacities through concerted effort, which can be by means of formal training, on-the-job learning, systematic self-reflection or a combination of the above. Most importantly, anyone acting in a facilitator’s role should have a favourable attitude towards this role and respect and process the contribution of all participants. The facilitator requires good communication skills, the ability to design and conduct suitable methods and organise a range of activities for multiple stakeholders. Support to do so is vital and deals with institutional backing, availability of adequate resources and clearly defined terms of reference.

What does it take for the organisation?
Individuals can only fulfil a specific function effectively if the institution they belong to fully supports them. It often happens that as long as there is a project and funding, individuals are supported by their organisation to do things in a different way. However, as soon as the project is over and the funding stops, people tend to fall back, or are told to get back, to their old ways of going about business as there are mostly no structures or incentives in place to continue. More often than not professionals who are committed to participatory approaches rather feel disadvantaged by doing so when it comes to ticking off the boxes of the traditional performance evaluation system. To secure and be promoted in their jobs, researchers are more valued for scientific publications in peer-reviewed journals and amount of funding they bring in for projects rather than sustainable impacts of these projects in farmers’ fields. Organisations will therefore have to change the performance evaluation criteria if real impact is what is desired.

The application of participatory approaches in traditional organisational settings founded on the principles of the modernisation paradigm of development has shown many limitations and little hope for institutionalisation and sustainability. For organisations to change to a people-centred paradigm of development, major institutional changes would need to be instigated at the levels of mission formulation, mandates and basic operations. This requires strong leadership to allow change, particularly when change implies empowerment, which can be a threat to those who have the power. Additionally, it needs to be supported by a favourable political climate that allows different funding and staffing mechanisms. The minimum ingredients for instigating such change towards institutionalisation of participatory approaches at the organisational level are: (1) collective positive experiences, (2) substantial evidence of documented impacts, (3) open-minded, creative leadership and (4) funding mechanisms that allow for flexibility and longer term engagement.

Conclusions
While participation has become the norm rather than the exception in development vocabulary, the application of participatory communication principles and practices still leaves much to be desired to effectively contribute to sustainable and equitable impacts. Some areas that require further attention of individuals, organisations and funding agencies to maximise the potential of stakeholder participation and engagement are the following:

- There needs to be more coherence in the overall goals and operations of development programs and organisations in order to enable empowerment and people-centred outcomes. The application of participatory approaches in isolated projects can set examples and create momentum but impacts are not likely to sustain if no paradigm shift takes place in the larger context in which these projects take place.
- Participatory communication is not served by the application of standard recipes for activities, as situation specific processes need to be designed to suit conditions, capacities and contexts.
- Therefore, investment in communication and facilitation skill development among researchers and development practitioners is required. Training cannot be cut short and has to contain a strong experiential component to unlearn old habits and perceptions.
- Effective application of participatory approaches requires a supportive institutional context in terms of staffing and funding mechanisms, incentive structures and mechanisms for transdisciplinary collaboration.
- Funding mechanism should allow for participatory diagnostic activities for collective agenda setting and planning, allow flexibility in processes and be longer term.
- Impact assessment should not look at immediate economic gains only, but identify human and social impact factors and assess how these contribute to sustained economic and environmental impacts.
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Decision support: Developing and delivering diagnostic information to strengthen Australia’s biosecurity

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Abstract. Rapid identification of emergency plant pest and pathogen incursions is essential to reduce the cost of eradication and impacts through rapid response. Diagnostic technology and data underpin our capacity for early identification and monitoring. Previously there was no single information resource, web-based or otherwise, to provide diagnostic information for targeted emergency plant pests (EPPs). Fast access to diagnostic information at the time of a suspected incursion is vital to biosecurity responsiveness. This project has developed an easy-to-use, web-accessible national diagnostic database known as 'The Plant Biosecurity Toolbox' (PBT) that helps users to quickly assess a suspected incursion. The PBT has a wide audience, providing information at a variety of levels – from general biology and risk analysis to detailed molecular tests. The PBT contains a collection of diagnostic protocols for EPPs and provides users with images, taxonomic and biological information as well as identification instructions, diagnostic procedures and contact details for experts and accredited diagnostic laboratories. The PBT is accessible via the Pest and Diseases Image Library (PaDIL) website (www.padil.gov.au/pbt), and provides access to other linked biosecurity diagnostic tools, such as the Remote Microscope Diagnostic Network and the Biosecurity Bank. In the next phase of the project, we are looking to develop portable pest modules for specific industries, which will be available for PDAs or as podcasts. The PBT will increase Australia's capacity and skills for plant biosecurity.

Introduction

What was the biosecurity problem?

Most countries have identified plant pests that they want to prevent from entering their country. In Australia these are referred to as Emergency Plant Pests (EPPs). The species listed involves a wide range of taxa, covering insects, fungi, viruses and bacteria. Each pest is considered to pose a serious threat to Australia's agriculture. Before this project commenced, there was no single information resource, web-based or otherwise, to provide diagnostic information for Australia's targeted EPPs. This situation was limiting since having rapid access to diagnostic information at the time of a suspected incursion is vital to biosecurity responsiveness and effectiveness.

Globalisation has put added pressure on our borders and requires us to assure our trading partners of our current pest status. Growth in human and trade movement has increased the risk of incursion, and our borders need to be equipped to deal with this added pressure. Australia's plant health workers have never had a diagnostic manual for EPPs. If diagnostic information existed at all, it has been difficult to find. In contrast, animal health workers have well defined diagnostic information and networks for exotic animal pests. For plants, much of the diagnostic information for exotic pests is hidden in the literature, is locked up as personal experience or remains unpublished in filing cabinets. Until now, no attempt has been made to gather that information and make it easily accessible. The Plant Biosecurity Toolbox (PBT) is a collection of diagnostic information, put into a web-based form so that it can be easily accessed and searched. What makes it different from other such sites is that it is devoted to providing detailed diagnostic information that relates to Australia’s EPPs. The PBT provides detailed, web-based diagnostic information to assist with the rapid identification of plant pests for the purposes of routine surveillance and in the event of an exotic pest incursion.

What were our goals?

The database needed to be easily navigable and make a vast amount of detailed information easily accessible. Due to the developing and variable potential end uses of this information, it needed to be easily repackage to suit these changing needs. Other important considerations were that the website should have no limitation on pictorial or illustrative material and be quickly and easily accessed. This flexibility needed to be built in from the beginning.
How did we develop the solution?

The PBT project was developed by the Cooperative Research Centre for National Plant Biosecurity (CRCNPB). The project team collected diagnostic information for specific pests from many available sources. Over the past few years both the Australian Government Department of Agriculture, Forestry and Fisheries (DAFF) and Plant Health Australia (PHA) have commissioned diagnostic protocols for specific pests; however these have not been widely available and vary considerably in their quality and format. State departments of agriculture and similar agencies overseas have also been developing diagnostic information but again, the quality varied considerably and there was no standard format used. The information currently in the PBT has been extracted from these sources and many others, such as published texts and scientific papers.

A template for re-organising the information was developed using the reference standards developed by the Sub-committee for Plant Health Diagnostic Standards (SPHDS) for diagnostic protocols. These standards are based on those recommended by the International Plant Protection Convention (IPPC). This format will be accepted as that required by SPHDS for a national diagnostic standard. Therefore, if a standard doesn’t already exist, information within the PBT will provide the basis for a new standard to be developed.

This template formed the basis for how information is displayed on the website. Similar information is located together. For example, all biological and ecologically related information can be found under the ‘Biology’ menu. Some more detailed sections were broken into subsections, for example, all identification related information is collated under the ‘Identification’ menu but split into subsections for morphological, molecular, biological and biochemical methodologies. This reconfiguration broke the potentially quite lengthy documents into manageable and logical sections. The web-based template was programmed using cascading style sheet (CSS) technologies to allow flexibility in the look and feel of the resulting web page. All collated information was uploaded into the web based template for display within the webpage. Each pest species page was reviewed by the original author of the document, and is reflective of information contained in National Diagnostic Protocols where they are available.

The result is that the diagnostic information is packaged under discrete, searchable categories which collectively comprise a manual of diverse diagnostic information for specified pests. A PDF on the fly option is available so that a PBT diagnostic manual can be printed for each pest in its entirety or particular section as requested by the user.

The comprehensive resources of the PBT include:

- Information on biology and taxonomy of the pest
- Diagnostic morphological, biochemical and molecular tests
- Images of the pest, host symptoms and damage.
- Pest threat and risk information where available
- Expert contacts
- Reference sources

Behind the scenes

The template through which project team members upload the information for each species is available on the web through a password protected portal. Team members can work on species and keep it viewable to content editors only, until such time as the information has undergone expert review. The template is very similar to Microsoft Word and similar programs with familiar functions of text alignment, cut, paste, bold, italics and underline (see Figure 2). Tables, figures and images are all inserted at the click of a button.

Each section of the template can be switched on or off as required for data entry. Checking the box at the top left of each section will determine whether that particular section is displayed. This feature eliminates the menu bar displaying options which have no information or where information is incomplete or currently being edited.

To prevent duplication of images within the database, images from the Pest and Diseases Image Library PaDIL are easily linked from the PBT database, retrieving the required image as needed.
Figure 1. A screen capture of rice water weevil, in the PBT, demonstrating the comprehensive resources contained within the website.

Source: Amy Carmichael, 2009

Figure 2. The PBT editor template.

Source: Amy Carmichael, 2009

Where is the PBT?
The PBT is located on the PaDIL website at http://www.padil.gov.au/pbt and can be accessed directly or via a link from the main PaDIL homepage. Direct links to species pages are also available from listed results pages within the PaDIL website.

Who are the people who use this tool?
The users of the PBT range from inspectors in our ports and at our borders to field-based crop protection officers to taxonomists and experts in labs. They can be farmers, consultants, policy makers and regulators or just simply members of the public. So the PBT has a wide audience, providing information at a number of levels – from general biology and risk analyses to detailed molecular tests. In the 90 days to the 14th of July, 2009, the PBT received 21817 user visits.
A brief tour of the website

One of the most important features of the PBT is the functionality and navigability of the site. Users of the site can easily conduct searches via keyword in the search box, or select a species from the QuickNav drop down box (Figure 3). This quickly opens the species at the Introduction page, with all menus displayed on the left hand navigation bar.

**Figure 3. The layout of the PBT web pages.**

Once clicked, the menu items open to display submenus of information. The font size is adjustable by clicking the A+ or A- buttons on the top toolbar. Printable fact sheets are available for individual sections or as an entire manual for each species.

**Where to next?**

The functionality offered by the initial database design has ensured a wide scope of potential uses and repackage options. Personal Digital Assistant (PDA) modules are currently being developed and refined for specific industries e.g. Grain EPP’s or banana pests. Podcasts of individual species pages or particular technical procedures (including video) are also being developed.

**The big picture**

The PBT is one project fitting into a boarder suite of projects. PaDIL, the Pest and Diseases Image Library, is home to a variety of biosecurity related projects currently being developed. The Remote Microscope Diagnostic Network is a network of microscopes and experts communicating via the internet, enabling real-time collaboration between non-experts and experts to rapidly identify potentially threatening species instantly. After the identification is confirmed, management and control decisions relying on solid information about the particular pest need to be made; the toolbox fills this need. Morphological or molecular testing may need to be conduct to verify the identification. The Biosecurity Bank is a further site under construction which houses confirmed DNA data samples able to be loaned for cross checking and verification. These databases are complementary and will together provide Australia with useful and functional tools to improve our capacity and skills for biosecurity.

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Connecting the dots: What can we learn from other disciplines about behaviour change?

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Abstract. Agricultural extension evolved from, and has drawn on, the disciplines of social psychology, education and rural sociology. However, agricultural extension has not remained connected with developments in psychological, educational and sociological theory. This paper proposes that there are critical lessons to be learned by aligning extension practices to developments in social science theory and practice. The theory of planned behaviour (TPB) from social psychology proposes that behaviour is partly explained by: people’s attitudes towards the expected results of changing behaviour and how highly valued this is; norms related to the behaviour and degree to which people want to comply with these norms; and the degree of perceived control people have about conducting the behaviour, i.e. their perceptions of their ability to do it. While current agricultural extension practice already focuses on some of these areas through attempts to influence attitudes and improve skills and knowledge, application of this theory to agricultural extension may provide more rigour, more direction on the types of attitudes to influence and the way in which to do this. This could lead to improved rates of behaviour change as a result of extension programs and has the potential to be incorporated into both planning and evaluating these programs. In addition, while adult learning theory is regularly applied in agricultural extension, self regulation of learning (SRL) theory has not been implemented or trialled. SRL theory has been applied in environmental education in order to successfully increase rates of behaviour change and there may be lessons for agricultural extension. This theory also has many similarities to adult learning theory as it relates to: active involvement of learners in setting their learning goals; choices in the way they will learn; self-monitoring of achievement; and maintaining motivation to achieve goals. Three key learnings are: the theory of planned behaviour may provide some rigour to attempts to influence behaviour change in farmers; self regulation of learning theory has been successfully applied to environmental education; and while there are similarities between SRL and adult learning theories, SRL theory needs to be tested in extension.

Keywords: theory of planned behaviour, self regulation of learning theory.

Introduction

Agricultural extension originated in the fields of social psychology, sociology, education and economics. It has traditionally drawn on areas like adult education and learning, communication, adoption and diffusion theory, systems theory, participatory research, learning styles and program logic.

One of the main aims of agricultural extension is to effect behaviour change in the target audience, whether they are, amongst others, farmers, land managers or consultants. A great deal of research has investigated the factors related to the farm/farmer that influence adoption, identifying many different factors, as categorised below.

1. Education and training
2. Farming or land management experience
3. Farm financial characteristics
4. Farm family characteristics
5. Farm structure
6. Attitudes, perceptions towards and expectancies of change
7. Social and institutional contact as sources of change
8. Voluntary participation (Fenton et al 2000).

The focus in agricultural extension is often on: 1. education and training; 6. attitudes, perceptions and expectancies; and 7. social and institutional contact. Attempting to influence these factors, and ultimately adoption, isn’t easy. Agricultural extension has been searching for answers and it seems timely to look at other disciplines that are also attempting to influence behaviour change, like health education and environmental education.

Health education

Health education aims to encourage people to adopt healthy behaviours (Campbell 2001). In terms of behaviour change models, health promotion draws on, for example:

- Transtheoretical Model or Stages of Change Model
- Health Belief Model
• Consumer Information Processing Model
• Social Learning or Social Cognitive Theory
• Theory of Planned Behaviour (Campbell 2001)

The Transtheoretical Model or Stages of Change Model (Prochaska et al 1992) has six stages: precontemplation, contemplation, preparation, action, maintenance and termination. A very similar model, the adoption decision process, is used in agricultural extension: awareness of the problem or opportunity, non-trial evaluation, trial evaluation, adoption, review and modification, and non-adoption or dis-adoption (Pannell et al 2006).

While the Health Belief Model, Consumer Information Processing Model and Social Learning Theories all potentially provide some useful guidance for agricultural extension, the Theory of Planned Behaviour will be examined in more detail. It has been applied to agricultural extension in Western Australia in the past, for example conservation cropping practices in the Avon Catchment of Western Australia (Gorrdard and Nash 1992), a qualitative study on land use practices in the Avon Catchment (Toric 2005), and in the adoption of forward contracts in the wool industry (Jackson 2008).

**Theory of Planned Behaviour**

The theory of planned behaviour (TPB), from social psychology, is based on the work of Fishbein and Ajzen (1975) and their theory of reasoned action (see Figure 1). It states that behaviour (and the intention to undertake the behaviour) is related to:

1. attitudes towards the behaviour
2. subjective norm
3. perceived behavioural control.

**Figure 1. Theory of Planned Behaviour conceptual diagram**

![Diagram of Theory of Planned Behaviour]

It has been used in many different contexts - recycling (Oom do Valle et al 2005), AIDS education (van der Pligt and de Vries 1995), transportation behaviour (Dalla Rosa 2007), farmers’ use of seasonal forecasting (Hu et al 2006; Artikov et al 2006), academic performance (Manstead and van Eekelen 1998) among many others - and has shown to be robust over a long period of time. It is no wonder others have seen its potential for agricultural extension.

**Applying the Theory of Planned Behaviour**

Factors in the TPB reflect some of the constructs already addressed in planning and evaluating extension programs or activities. As an example, Figure 2 shows a comparison of the TPB with Bennett’s Hierarchy (1975) a program logic framework widely used in agricultural extension.

One contribution that the TPB can make is in providing further rationale for the link between knowledge, attitudes and skills, and practice change. Aspirations are deliberately not included as some would argue that it’s not ethical or practical to try and change people’s aspirations. Many agree, however, that it is vital to understand them. For example, Pannell et al (2006) found that farmers’ perceptions of how well an innovation helps them achieve their goals are very important in their decision to adopt.
Figure 2. How Bennett’s hierarchy relates to the theory of planned behaviour

Bennett’s hierarchy 
(Bennett 1975) 

Theory of planned behaviour

END RESULT 
(Social, Economic, Environmental) 

PRACTICE CHANGE 

BEHAVIOUR CHANGE 

KNOWLEDGE 
ATTITUDES 
SKILLS 
ASPIRATIONS 

PERCEIVED BEHAVIOURAL CONTROL 
ATTITUDES & SUBJECTIVE NORM 
PERCEIVED BEHAVIOURAL CONTROL 

REACTIONS 

ACTIVITIES 

INPUTS 

The other contribution is in the deeper understanding of the types of knowledge, attitudes and skills that influence behaviour change. Figure 2 highlights some of the parallels between Bennett’s Hierarchy and the TPB but the concepts of the TPB are explained below.

Firstly, an obvious parallel exists between practice change and behaviour change.

Secondly, while Bennett’s hierarchy includes knowledge and skills and the assumption is that if knowledge and skills are improved then the likelihood of practice change is increased; the TPB includes perceived behavioural control. This concept goes further then just a person’s knowledge and skills in relation to the practice change and includes perceptions about how easy the behaviour is, but also perceived self efficacy (belief that they have the skills to undertake the behaviour) and perceived controllability (extent to which they believe it is possible to control a situation, regardless of skills or abilities).

An example of how the TPB may be applied to encouraging the use of climate information would be to ensure that tools and information are as easy to use as possible and that this is communicated and demonstrated to farmers, that farmers are given opportunities to understand climate information and learn how to use it (self efficacy), that climate information is accurate and timely and the information source is reliable (perceived controllability)

While Bennett’s hierarchy refers to attitudes, the TPB is very clear that the attitudes to focus on are attitudes to the behaviour and subjective norm. In other words, if someone believes that a behaviour will lead to a certain outcome and they value that outcome highly (attitudes to the behaviour) and if someone believes that many people want them to undertake a particular behaviour and they strongly believe that they should comply (subjective norm), they are more likely to undertake that behaviour. So rather than a vague notion of the attitudes to focus on, this provides very clear guidance on the types of attitudes to target.

Some examples to illustrate this are that the TPB would suggest that in encouraging the use of climate information, it would be important to communicate the ways in which the use of climate information can assist in increasing profits (for those who value increased profits) and there may be ways to communicate how other farmers are using climate information on their farms which may alter farmers’ perceptions of subjective norms about the use of climate information, assuming that they value the opinions of other farmers.
A broad assessment of the TPB factors in a target audience could then inform the design of the extension program and allow evaluation of any behavior changes following people's participation in an extension activity or program.

**Environmental education**

Environmental education, or education for sustainability, is also interested in influencing people's behavior, towards more sustainable practices. The Australian government has recently moved away from the term environmental education and instead refers to 'education for sustainability', which has a focus on "equipping all people with the knowledge, skills and understanding necessary to make decisions based upon a consideration of their full environmental, social and economic implications" (Commonwealth of Australia 2009, pp.3-4).

In terms of the education processes used, various learning theories are drawn upon but one that has been researched in recent years is self regulation of learning theory. Like the TPB, it has been applied in a Western Australian context to behavior change in encouraging choices away from single occupancy vehicle journeys (Baudains 2003).

**Self-regulation of learning theory**

The theories of self-regulation of learning (SRL) and adult learning have quite a few similarities. Both emphasise the importance of the learner:

- participating in the learning process
- being involved in planning the learning experience
- feeling a need to learn
- feeling that the learning relates to their problems
- setting their own goals and having a sense of progressing towards them
- being self-directed
- undertaking a process of action, reflection, conclusion and planning
- being in a situation where learners can learn from each other.

The key difference is that SRL theory emphasises participants learning how to learn. Learners can be described as self regulated if they are metacognitively, motivationally and behaviourally active in their own learning process and use various strategies to achieve their learning goals (Zimmerman & Schunk 1989).

A diagram (see Figure 3) that is often used to explain SRL theory shows how values influence motivation (learning goals) which lead to learning engagements and, subsequently, learning outcomes (Radloff 1997). Beliefs about self and the task influence learning goals and learning engagements. In a cycle, learning outcomes also affect future learning goals by changing a learner's beliefs about themselves and the task.

**Figure 3. Diagram of self regulation of learning theory**

Self regulation of learning theory has been found to enhance learning in various applications; e.g. academic achievement (Zimmerman and Schunk 1989), on-line education (Dell 2006), transport choices (Baudains 2003), and field-based writing (Bhattacharya 2006). For these reasons, it is important that self regulation of learning theory be tested in an agricultural context, to see if it can influence behavior change as a result of extension activities.

**Applying self regulation of learning theory**

Agricultural extension activities frequently use adult learning and education principles in their design. SRL could be therefore be applied to agricultural extension in a similar way, by expanding on the application of adult learning and adult education principles and ensuring that participants are provided with some tools for how to learn. In relation to the use of climate information, an example might be in allowing opportunities for participants to set goals for their
use of climate information, to analyse or discuss the way in which they are currently making decisions, hearing how others are using climate information on their farms, discuss problems they face on their farms and ways to overcome these and to undertake a process of action learning (action, reflection, conclusion and planning).

Our research
Our research is asking "can self regulation of learning theory be applied, cost-effectively, to the design of agricultural extension to increase the adoption rate of climate risk management tools among grain farmers in Western Australia?" Self regulation of learning theory will be used, and tested, in the design of agricultural extension interventions and the theory of planned behaviour may be used as a framework to inform early interview questions and baseline and post-intervention surveys.

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Weaving diverse cultural backgrounds into the training framework: Using participatory learning in a formal training framework to help farmers produce safe vegetables

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Farmers the world over are in an industry that is constantly evolving in response to economic, climatic and consumer influences. Education and training is the conventional means by which farmers increase their capacity to cope with change and remain viable.

Industry & Investment NSW (I&I NSW) is a recognised provider of training in Australia. I&I NSW has been using participatory training for non-English speaking background vegetable growers in the Sydney Basin for the past five years and has found it to be a significantly useful approach.

Market gardening in Australia has traditionally been dominated by migrants who have settled Australia in waves. As a result of the post World War II immigration boom migrants from Italy, Greece and Malta took up farming in the Sydney Basin. In the 1970s and 80s these were joined by Asian growers predominately from South China, Vietnam and Cambodia. Recently growers of African background have taken up leases in the Sydney Basin. Many of these growers have come to Australia from backgrounds of displacement and war and view government agencies with a great deal of suspicion.

In 1998, the NSW Premier’s task force on market gardening by people of non-English speaking background recognised that these growers were disenfranchised from traditional education providers such as local technical and further education (TAFE) colleges due to language difficulties, time constraints and isolation within their communities. The introduction of chemical and environmental legislation enhanced the need to engage farmers in formal training (NSW Agriculture 2000). Furthermore it was recognised that these farmers’ primary source of information was often the agents who were selling product and whose information was compromised by vested interest in product sales.

The recommendations of the task force included comments regarding the nature of training provided for these particular farmers. The training provided for farmers should be:

- relevant to their needs
- affordable
- at locations and times convenient to them
- funded for and delivered with appropriate interpreter services; and
- provide training notes with a summary in the language of the participants.

These are also consistent with the good adult education principles.

The use of participatory approaches for engagement and training has proven to be highly valuable in meeting the criteria outlined above. A participant focused approach involves the farmer in all areas of training development and delivery. Training is delivered on a farmer’s property using a farmer field school method. Farmer field schools are essentially groups of people with a common interest who get together to study the ‘how and why’ of a particular topic (Gallagher 2003). They are particularly designed for field study, where specific hands-on management skills and conceptual understanding is required. In the case of the Sydney Basin training, farmers are able to develop an integrated pest management strategy, understand soil and fertiliser needs, undertake machinery and irrigation maintenance, develop post-harvest and quality assurance plans and use accounting packages. It is the authors experience that this is a particularly useful approach for learners with low English literacy.

As a group, the participating farmers choose several crops to grow. These can be those they are most familiar with or those they would like to learn to grow, providing a risk-free experimental opportunity to trial a new crop. The production of the crop is used as the main learning and assessment tool; it provides the classroom, the topics and the session structure. The participants are prompted to design small experimental trials, for example, application of compost, using soft chemicals or other integrated pest management tools, to answer questions they have about the crop production. As the crop grows it becomes the primary training tool for discussion as problems arise, for example, pest and disease.

The training acknowledges that, as farmers, they are the ones who are most aware of what difficulties and knowledge gaps they face. Trainers place emphasis on encouraging farmers to
learn how to trial new ideas and to develop the confidence to use these trials to problem solve. Integrating participatory learning into the formal training helps build farmer confidence in their skills. They can then apply those skills to deal with change, test technical ideas and design solutions that best suit their enterprise.

This approach provides a purposeful and relaxed learning environment, particularly for non-English speaking learners. There is less focus on texts and more focus and attention applied to experience. The farmers are more comfortable being out in the field and are often more forthcoming in a relaxed, familiar environment as opposed to being seated in a classroom situation. It is acknowledged by the trainers that the farmers are able to learn from each other and being in the field gives them an opportunity to share their experiences. Trainers can use these exchanges to introduce technical information and thus build participants learning.

In order to comply with the accredited Australian Qualifications framework, (AQF), assessment of competence must occur. Ordinarily in a TAFE or classroom setting this would be by a variety of written or oral assessment tasks. Where these types of assessment styles applied to the non-English speaking participants, they would not fit the fairness and validity tests required within the AQTF. Therefore we have had to develop assessment tools that met the criteria above but were also reliable. Primarily the assessment tools we developed were based upon physical demonstration of tasks, participation in group’s discussions, presentations of results of plot experiments to the group and verbal responses to questions. The production of the crop was also used as the main demonstration of competence. Photographs were taken of learners carrying out operations as evidence that they were able to meet assessable outcomes. These approaches avoided the need for written tests where low English literacy prevents fair and reliable assessment.

Another assessment tool that develops over the length of the training is a farm management map. This participatory tool uses maps drawn by the participants of their farms which are overlays of soil, infrastructure, water and environmental noise and waste maps. This tool allows farmers to apply knowledge learnt during training directly to their own properties and produce an environmental management tool that can be used for both long and short term planning. The farm maps are also used as an assessment tool particularly for the outcome - 'carry out simple physical and chemical analysis of soils’ and outcomes related to recording chemical spray applications and pest and weed management. Furthermore the introduction of basic farm mapping during this training will make it easier for growers to extend the concept in other areas of training they may undertake in the future such as the produce quality assurance program, Freshcare.

On completion of training farmers are awarded a nationally recognised qualification under the AQF. This is highly regarded by farmers and further helps to integrate them into the wider community. Although formal qualifications are important for many reasons, the real value of this training is that it gives farmers the capacity to solve farm problems themselves. Problems such as the ‘big issue’ questions:

- How do I use resources (water, chemicals, fertilisers) efficiently?
- What do I need to put in place to meet government legislative requirements?
- How can I develop new crops for changing markets?
- What impact is climate change and possible impending Australian greenhouse gas taxes going to have on my business?
- How do I remain economically viable in an urban environment?

Whilst most farmers are unlikely to consider these sorts of issues on a daily basis, they are the issues the farmers face in the long term and form the basis of the changing nature of farming. By encouraging farmers to link technical knowledge with real life problems they are able to develop skills that can be applied to these situations as they arise over time.

**Barriers to participatory learning in a qualification framework**

There are a number of elements critical to a national accredited training system, such as we have in Australia, that provide difficulties under a participatory-based training program. These include a lack of flexibility, a rigid framework conflicting with individualised training ideals and treatment of competencies as discrete training entities and not a portion of a continuum of learning.

The training delivered to farmers in NSW is partially funded by the NSW Department of Education and Training. This funding is given contingent upon delivery of units of competency as stipulated in the training packages. The units of competency being delivered in the training, whether that is the Certificate III in Agriculture or a short course program, have to be
nominated at the outset of the program. Here lies the first major confrontation with a participatory approach to training. In order to secure funding for delivery, which is essential for the disadvantaged migrant farmer groups, competencies that will be delivered have to be nominated upfront. This is before any opportunities arise for discussion with potential trainees, so there is no opportunity for the learners to decide what they will learn and which competencies they think are most suited to their business or education needs. As this is one of the primary elements in a participatory approach it restricts the scope of the participation and limits the ownership the participants have of the whole process.

Usually the first day of a farmer field school or similar participatory program involves a discussion of learning needs which frames the program of the school. We still do this, but in such a way as to meld the pre-ordained competencies into the identified learning needs. Where needs arise that are clearly not going to be met by the defined competences we identify additional competencies and work them into the learning program. This is an advantage for the learner, however, what this means for NSW DPI is that we are delivering more competencies (as we are still required to deliver and assess the nominated competencies) than are being funded, and this is not sustainable in the long term. Under the present funding arrangements with NSW Department of Education and Training’s strategic training program (STP), there is little way of avoiding this. The system of funding only particular, pre-defined competencies and no others does not provide for flexible, customised participatory training.

The second area that presents difficulties is the rigid, tiered framework. The AQF levels represent certain levels of responsibility within a workplace:

- AQF I – entry level farm hand
- AQF II – farm hand
- AQF III – leading hand
- AQF IV – supervisor
- AQF V – manager
- AQF VI – business and financial manager.

The difficulties lie, in that most of the farmers are sole owner-operator enterprises with one person operating across all these levels. A certificate qualification at any one level does not adequately provide the skill range required to meet the needs of the participants. For example a small area vegetable grower might need basic grounding in safe tractor use (RTC2309A Operate tractors), technical skills in safe chemical use (RTC3704 Prepare and apply chemicals), technical irrigation management skills, (RTE4605 Schedule irrigations), skills in producing the crop (RTE5014 Manage agricultural crop production) and business skills (RTE6901 Analyse business performance). It is not possible under the present AQF system to provide one qualification that addresses the range of skill level described here. At most two units of competency can be from a level other than the one described by qualification level.

The third area of difficulty is the treatment of units of competency, with both the funding systems and the AQF framework as discrete training entities. There is an expectation that there is a clear delineation between one unit of competency and another in the delivery. That one ‘topic’ follows another with individual assessment events marking progression into a new topic. ‘Today we are doing soils and fertilisers, tomorrow we are doing irrigation’, where as in reality, particularly in participatory training such as a farmer field school, there is no delineation between competencies as topics of study. The learning progresses along with the crop and as issues arise, crop nutrition for example, they are discussed in a holistic manner along with connected issues of irrigation and soil fertility. Assessment is continual, observational and practically demonstrated by the advancing crop. Marking a point in time where each competency is delivered is not possible, only at the completion of the entire participatory process is competency achieved.

Overcoming these difficulties require novel approaches in training delivery and assessment. The approaches described above have been developed to overcome these difficulties. What brings assessment and learning together into a consistent approach, over the course of a number of years and courses is the ‘learner profile’ strategy. This has been developed to track each learner through the participatory process and provide consistent method of evidence gathering and recording. The profile consists of personal information and individualised assessment sheets. Certain learning targets are agreed to and written into the learning plan and signed off by the trainer and learner when they are achieved. The targets involve particular questions being answered correctly and the demonstration of particular activities and skills addressed by the competency. The competencies are clustered into groups that make production sense and are assessed when circumstances in the crop production cycle allow.
Together, the field based work, hands-on experiments, reporting to the group, mapping, class discussion and assessment by demonstration make up the participatory approach in the farmers field school model. It is a method successful in overcoming language and literacy difficulties and really engaging participants in their learning. At the same time it provides credible evidence of learning and competence. Participatory approaches in training, particularly for non-English speaking participants, provide real and measurable skill development. It is a legitimate approach to use within the AQF, provided assessment can be tailored to suit the needs of the client group. Problems arise with the degree of flexibility allowed by funding arrangements and the framework itself, however, these can be overcome to a satisfactory, but not perfect, extent by novel assessment approaches and a capable, experienced trainer. Greater attention needs to be given to incorporating participatory principles into program flexibility when formulating funding arrangements, so as not to limit the participatory experience for the learner.

Plate 1. Farmers measuring root depth of field school crop

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Using a ‘levels of decision making’ framework in extension

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Abstract. A new farming systems extension approach was developed as part of the dairy industry extension program in Victoria. This approach was the outcome of collaborative work undertaken by the Department of Primary Industries and The University of Melbourne, funded by Dairy Australia. The project was instigated in response to a growing concern that dairy farm businesses were confronting complex challenges which in turn challenged extension staff to use a systems approach when servicing these businesses. Challenges arose from the increasing need to adjust to changing terms of trade and also respond to the drought conditions. Together, this had farmers questioning their farming system. This paper focuses on one aspect of the project, the emergence of a decision-making framework that proved useful in understanding farm management issues, designing extension programs, and building staff capacity to support decisions around these issues. The decision-making framework is comprised of five levels that progressively encompass a more expansive scope of the farming system considerations. The decision levels are: 1. product choice decisions, 2. component decisions such as grazing management, 3. sub-system decisions, 4. farm system decisions and 5. beyond-farm decisions. Implications arising from the use of these levels relate to the focus of the extension approach, the associated methodology, and the skills required to deliver at different levels. An overview of contemporary developments in Victorian dairy extension strategy is provided, outlining the evolution from a single topic focused extension program such as grazing management 15 years ago, to now where a more integrated feedbase management approach is used. This shift in farmer needs over the past two decades has challenged the previously successful programmed learning approaches and called for a new extension approach. Three key lessons arising from this work are that the ‘Levels of Decision Making’ framework can improve:
1. the targeting of extension services to achieve desired outcomes.
2. the design of extension programs, activities and tools.
3. the planned approach to professional development of extension staff.

Introduction

Agricultural extension practitioners, working one-on-one with farmer clients or in broad-scale program delivery, deal with a wide range of enquiry extending from specific queries about a particular aspect of the farm operation to broader questions about the farm system as a whole. Driven by challenges associated with changing terms of trade, climatic fluctuation, and expectations from markets and community, farmers are seeking support for an increasingly diverse and complex range of decisions. This paper discusses the role that a ‘levels of decision making’ framework can play in understanding farm management issues, designing extension programs, and building staff capacity to support decisions around these issues.

The evolution of farm systems extension in Victorian dairy extension

Establishment of the dairy industry’s grazing management project, Target 10, in 1992 signalled the introduction of a project-approach to Department of Primary Industries Victoria (DPIV) extension services, and was set up with regional delivery teams and with similar extension products delivered across all regions. The first Target 10 product was the grazing management program incorporating a three day training course, with several on farm discussion group meetings and an individual farm visit, all designed to support practice change in relation to grazing management. Evaluation of the program showed that it was highly successful in achieving its specific goals, but farmers recognised that many farm management issues were not being addressed in this single-issue program and, through their regional representatives, requested similar products to address feeding and fertiliser components of feedbase management. Like the grazing program, these new programs utilised a ‘programmed learning approach’ (Coutts et al. 2005), and also met with success and supported a similar degree of change.

Prior to this, much of the government extension in dairy involved district-based extension delivered one-to-one with farmers on an on-demand basis, and via discussion groups. Requests for fertiliser advice, feeding advice, or more specific information about chemicals or pasture species were common, as were discussions about the overall direction of the farming business,
and extension officers were free to address the issues they perceived as important using a one-to-one advisory approach.

During the mid 1990’s Target 10’s product offering expanded even further with the dairy version of the Farm$mart/ national property management planning initiative, Dairy Business Focus (DBF), that focused on strategic business planning. Dairy Business Focus complemented the enterprise benchmarking product Dairy Farm Performance Analysis (DFPA) released a few years earlier to help farmers analyse and discuss whole farm performance issues. In contrast to the technical feedbase component, both DBF and DFPA utilised structured questioning more akin to a ‘group facilitation/empowerment model’ (Coutts et al. 2005). The business planning approach continued to be sought by investors leading up to dairy deregulation in 2000, resulting in the development and trialling of business improvement groups, and dairy learning groups called syndicates.

Since 2000 farmers have questioned their farming system due to changing terms of trade, concerns about water security and experiences in the drought. In response, a more practical and holistic feedbase management product, Feeding Pastures for Profit began as a programmed learning approach around activities to build skills and confidence, and is being delivered to provide integrated feedbase management solutions. However, the types of decisions required are at a whole of farm level, and it was considered that methodologies for this level of decision making needed to be reviewed.

Over the past two decades the DPIV dairy extension team has moved from ad hoc delivery to projects which support farmers across various topics and levels of decision making. This experience has shown that extension methodologies need to be tailored to each situation. Staff capacity was highlighted as a challenge, requiring the development and maintenance of skills that span discrete technical issues through to farm systems issues.

Farming systems action research

In 2004 the DPIV dairy extension team and researchers from The University of Melbourne began working together in an action learning approach on a pilot study to develop a new farming systems extension approach. Each of the seven DPIV advisors worked closely with a farm for the first twelve months to better understand the issues and decisions processes being used on farm and to offer advice. In the following year the advisors applied the techniques developed to a learning group model. Lessons from this practical ‘in the field’ experience were drawn out through facilitated group meetings on a bi-monthly basis.

During the first year of the research, four main stages in the advisory relationship were identified - engagement with the farmer client, identification of issues, assessment of options, and action plans with support for implementation. This was represented as a model that was termed the ‘Vortex’ (Markham et al. 2006) (Figure 1).

In addition, it was noted that the advisory relationship dealt with decisions that ranged from those relating to a product or cultivar choice, to single issue management decisions such as grazing, whereas other decisions were about integrating across issues, changing the whole farm system, and beyond the farm at times. So, in an attempt to more clearly articulate the range and scope of decisions being addressed, the ‘levels of decision making framework’ was conceived. The framework recognises that changes around one aspect of the farm are likely to have implications for other aspects. In addition to the ‘level’ aspect to this, indicating complexity and impact across the production, economic and social domains of the farm business, there is also a time dimension (Leeuwis 2004) whereby decisions can also be classified as ‘operational’, ‘tactical’ or ‘strategic’, which line up with short-term, medium-term or long-term consequences respectively.

This framework enabled the advisors to more clearly describe the decision being made, and consider which extension tools and processes would be most appropriate to assist the farmer. In some cases, however, it was recognised that staff did not have the particular capability, tools or processes to support a particular type of level of decision which highlighted the need to match methodologies and capabilities to different levels of decision making for the issue at hand.
Description of the decision making framework

The ‘Levels of Decision Making’ framework created from the shared experiences arising from the farming systems case studies and pilot work, sought to describe and categorise the types of farm management decisions made by farmers, and create a platform upon which to plan extension delivery (Table 1). It contains five key levels of farmer decision making that can be targeted by extension services. Each level has different implications on the extension focus and methodology, particularly the balance of technical information versus the people and management aspects. At higher levels the decision has greater potential to impact on the business.

Table 1: Levels of Decision Making Framework

<table>
<thead>
<tr>
<th>Levels of Decision Making</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product choice decisions</td>
<td>Expert advice sought regarding product choice decisions, e.g. fertiliser blend.</td>
</tr>
<tr>
<td>Farm system components (e.g. feeding, grazing management)</td>
<td>Focus is on best management practice of a single component to achieve an improvement in profitability, e.g. cow nutrition.</td>
</tr>
<tr>
<td>Sub-system decisions (e.g. integrated grazing and supplements)</td>
<td>Focus is on managing the interactions between components to achieve an improvement in profitability, e.g. integrating fodder crops with pastures and grain.</td>
</tr>
<tr>
<td>Whole farm system decisions (involving significant resource management implications)</td>
<td>Involves significant change to the farm resource base to improve farm profitability and/or risk management.</td>
</tr>
<tr>
<td>Beyond farm decisions</td>
<td>Decisions extend beyond the farm enterprise and take into account the goals underpinning the entire financial portfolio.</td>
</tr>
</tbody>
</table>

The levels are now described in more detail:

Level 1. Product Choice decisions: this level of decision relates to product choice recommendations. Examples include: advice on pasture varieties and herbicide/pesticide chemical recommendations. Due to the commercial/privatisation of product development, this realm is now dominated by the commercial sector who service this area by providing one-to-one advice, published brochures and field day demonstrations.

Level 2. Components of the farm system: Level 2 decision making/knowledge is focused on the acquisition of best management practice of a particular skill (e.g. ration formulation, nutrient budgeting, feed budgeting, forage planning). For example the Target 10’s ‘Feeding Dairy Cows’, program has been specifically designed to allow participants to develop a balanced diet which matches their production goals and source best value for money feeds, but does not extend to overall enterprise profitability.
Level 3. Farm sub-systems decisions: Level 3 decisions focus on managing the interactions between sub systems to achieve an improvement in profitability. ‘Feeding Pastures for Profit’ is an example of a DPIV feedbase program that provides farmers with the confidence to manage and change their feedbase as required because they understand the impact of their changes on the overall profitability of their dairy enterprise.

Level 4. Whole farm systems: Level 4 involves a substantial change to farm resources to improve the profitability and/or risk management of their business, either now or in the future. Level 4 decisions may involve buying additional land/water, investment in capital infrastructure, changes to stock policy, changes to labour availability etc. Due to the wide breadth and depth of knowledge, skill and experience required in assisting farmers making decisions at this level, this area of work has traditionally been supported by private farm consultants, working on a one-to-one basis.

Level 5. Beyond-farm decisions: Level 5 takes into account the entire financial portfolio and personal goals/aspirations of the individuals involved. Level 5 decisions may involve areas such as off farm investments/income, superannuation, taxation, debt level etc. This area extends beyond the expertise of most agricultural science graduates. Although the importance and impact of Level 5 decision making is acknowledged because of the impact on all ‘lower order’ decisions, it is not a direct focus/target area of our work. Decisions at/or impacting on Level 5 should be directed to financial and legal professionals with the appropriate expertise.

A strength of the framework lies in its ability to help extension staff and farmers to appreciate the linkages between specific technical enquiries and higher order whole farm or whole of business issues. For example, an initially straightforward nitrogen fertiliser decision is likely to have flow on implications to other aspects of the farm operation and needs to ‘fit’ with the whole farm system.

An initial Level 1 issue might involve an enquiry regarding the comparison between liquid nitrogen and urea based on price per unit, cost of application, management and outcome. Nitrogen as an issue would focus on the best management practice in regards to environment considerations and dry matter yields. Advice may cover the rate applied, timing of application, area to be applied, and/or animal health considerations. Implementation will involve minor disruption to farm management to accommodate the best management practice of nitrogen. Once the appropriate expertise is sought the answer is straightforward, the decision is clear and the best option is easy to implement with little disruption to the farm management.

A Level 2 enquiry about how to graze and manage the pasture may also encompass the role of fertiliser, thus linking it to the Level 1 decision about the nitrogen fertiliser product. At the feeding sub-system Level 3 the role of nitrogen still has a part to play but now the challenge is to integrate pasture management, fodder conservation, and brought-in supplements into a cohesive management system. The role of nitrogen to boost silage harvest, to supply more supplements in autumn, in order to allow farmers to extend their autumn/winter pasture rotation is important, but only part of the picture at this level.

A Level 4 the feeding sub-system may be so successful that it may lead to a review of current stocking rate levels and intensification of the forage system, infrastructure consideration, consideration to the exposure to risk and the need for expansion of the business. Decisions at this level are likely to have a significant impact on farm management. At Level 5 the enquiry might extend to equity and taxation considerations, as potential changes to the resource base are further investigated. As alluded to earlier, this level of decision making is not currently serviced by government extension and therefore outside the scope of this study.

A single dairy farming issue can be analysed at different levels of the decision-making framework. The depth and breadth of the analysis really depends on the nature of the farmer’s enquiry. The job of extension is to gauge and service the enquiry at the appropriate level.

Using the levels of decision making framework

In applying the decision framework to the design and delivery of extension we ask the following questions:

- What is the relationship between the decision framework and stages in the advisory relationship?
- What skills are required of the extension practitioner to deliver at each level?
- What are the attributes of effective extension methodologies to support decisions at each level?
We start with the advisory relationship and refer again to the Vortex work discussed earlier (Markham et al. 2006). In this paper we have simplified the four stages in the Vortex to three: identify issues, assess options and take action. This simplification focuses on tasks that are fundamental to decision making. The first stage in the Vortex (engagement) was critical to managing relationships but only indirectly related to decision making. By aligning the stages of the advisory relationship with the levels of decision making it becomes apparent that the relative emphasis on each stage in the relationship may differ with the level of decision being supported. For example, with product choice decisions the farmer client has already typically identified an issue and the main role for the extension operator is an advisory role to recommend options, perhaps with advice on a typically straightforward action plan. In contrast, with farm system decisions (Level 4), the problem definition or issue(s) needs a considerable degree of fleshing out, including generation of options, and formulation of action plans. We have represented this difference in task requirement in Figure 2. If we think of the effort to perform a task as some combination of time and intellectual effort then the bar graph is an attempt to show that little issue identification effort is required at Level 1 relative to Level 4. We can also see that the relative effort varies across the stages of the advisory relationship, with the higher level decisions requiring more effort in the issue and option exploration relative to taking action.

The extension skills needed to support each level of decision making also differ. For example, decisions involving farm systems issues require considerable engagement skills and processes around needs analysis, options selection perhaps with economic analysis, and planning processes to support actions by the management team on farm. These skills are more aligned with a coaching role as compared to technical expert. A learning coach becomes a confidant and co-developer with the decision maker, a valued partner with whom one can experiment with ideas and play with possible options before committing oneself to a particular course of action. This is a very different role to that of the technical expert who has minimised the effort that a farmer needs to expend to access relevant information. This is because the expert has already pre-processed much of the information the farmer requires and organised this in a way that is most amendable to the issue at hand. To use a learning coach role at Level 1 would be highly inefficient and likely frustrate the farmer.

Conversely, the advisor who jumps immediately to a technical solution without adequately exploring the issues and options when dealing with Level 4 decisions will be perceived as ‘a superficial salesperson’ to discerning farmers. How often have we heard, ‘I just want you to tell me answer!’? As higher level decisions are addressed it will be increasingly difficult for the advisor to possess all of the technical skills required to make the decision. To cope with this situation the advisor needs to draw on principles and processes to undertake a role more akin to coaching, forming a learning partnership with the farmer and perhaps collaborating with other service providers as well.

Pulling these ideas together in conjunction with the five extension delivery models (Coutts et al. 2005) assists us to understand the place of current products in the delivery range, including the capacity building required for staff, and appropriate sign-posting for farmers, illustrated in the following examples.

Historically, dairy program staff have provided support for product choice decisions via personalised consultancy as a farm visit or phone call, as agribusiness technical and sales staff now do. Product choice decisions also lend themselves to an information access model via the web or written materials.

Our experience suggests that the middle levels of farm decision making are extremely well suited to a programmed learning model. This model has been applied successfully with component (Level 2) decisions in areas of cow nutrition, soils and fertiliser, and pasture management, and with the Level 3 Feeding Pastures for Profit program which helps farmers integrate grazing and feeding management. In these programs, consultancy support has also provided useful assistance to help farmer clients incorporate these skills into their management routines.
Not surprisingly, as the dairy extension effort has moved from support for product choice decisions to programs at component and sub-system level, so has staff capability. Preliminary results from a dairy team capability survey in 2009 (G Drysdale, pers. comm.) revealed that less than 40% of respondents believe they are competent to make product choice recommendations whereas around 60% rated themselves as competent to support component and sub-system decisions.

As the levels of decision making moves from a narrow to broader and higher level, the emphasis shifts from providing information as a technical expert to a role that is more akin to a learning coach focusing on process. Property Management Planning, operating at a strategic planning level for the whole farm (Level 4), and beyond farm (Level 5), focused almost exclusively on working through issues and options, and used a process-driven facilitation/empowerment approach. Clearly staff needed high level facilitation skills to deliver this program. A personalised consultancy model is also used by private consultants to address these higher level business questions; however we would argue that the opportunity to address complex issues with support from a group can also be valuable. Within the dairy team less than one third of staff currently rate themselves as competent to support whole of business decisions, and only 45% believe they are competent to support whole farm decisions. Staff training and mentoring in business management, and support around understanding whole farm systems is being provided to address these gaps.

**Summary and conclusions**

The development and use of the ‘Level of Decision Making Framework’ has been useful in providing clarity around the focus of extension projects and the problems they aim to address. In particular it has highlighted the need to customise extension approaches to address problems at different levels, and raised challenges in building capability to deliver across different levels of decision making.

Three key lessons arising from this work are that the ‘Levels of Decision Making’ framework can be applied to:

1. improved targeting of extension services to achieved desired outcomes; it seems that participatory and collaborative approaches may be required to target complex whole farm and whole of business decisions which require appreciation of a range of issues and options
2. design of extension programs, activities and tools; it is our experience that lower levels of decision making can effectively be serviced through individual technical support or information access, whereas the middle levels of decision making lend themselves to programmed learning, and higher levels can benefit from a group facilitation/empowerment model. Personal consultancy is useful at all levels particularly in association with other extension approaches.
3. a planned approach to professional development of extension staff: the skills required to support higher level decisions are quite different to the more traditional technical role that
extension staff have played, leaning more to coaching and facilitation and requiring greater skills in business management

It is anticipated the 'Levels of Decision Making' framework will increasingly be used to focus project work, inform the design of interventions, and focus professional development and staff training. Initially this may involve its use as a mapping and explanation tool to describe to new staff where extension projects fit, and then allow new staff to design a training pathway in extension that is suited to their goals, and to know when to signpost and collaborate with others to address a complex issue which need solutions at a number of levels.

References


Using soft systems methodology to support extension program development in the dairy industry

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Introduction: levels of decision making and implications for developing change management programs

Decision making on dairy farms can be viewed as a hierarchy (Drysdale et al. 2009). These ‘levels of decision making’ provide a platform for understanding what appropriate interventions to support change might be. Table 1 summarises these levels.

Table 1: Levels of decision making framework

<table>
<thead>
<tr>
<th>Level of Decision Making</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Beyond farm decisions</td>
<td>Decisions extend beyond the farm enterprise and take into account the goals underpinning the entire financial portfolio.</td>
</tr>
<tr>
<td>4. Whole farm system decisions</td>
<td>Involves significant change to the farm resource base to improve farm profitability and/or risk management</td>
</tr>
<tr>
<td>3. Sub-system decisions</td>
<td>Focus is on managing the interactions between components to achieve an improvement in profitability</td>
</tr>
<tr>
<td>2. Farm system components</td>
<td>Focus is on best management practice of a single component to achieve an improvement in profitability e.g. cow nutrition</td>
</tr>
<tr>
<td>1. Product choice decisions</td>
<td>Expert advice sought regarding product choice decisions.</td>
</tr>
</tbody>
</table>

Source: Adapted from Drysdale et al. 2009

To date the Dairy Extension Centre (DEC), through its Profitable Feeding Systems (PFS) project, has worked to provide farmers with the capacity to adjust their feeding systems to optimise efficiency. Programs such as Feeding Pastures for Profit (FPFP), dairy cow nutrition and soils and fertilisers, has focused extension work on providing farmers with the underpinning knowledge to make the most of their resources (i.e. land, water, cows and labour). Using the levels of decision-making framework we can say that such work has been targeting levels 1-3 of the decision-making hierarchy. However rapid change within the dairy industry, brought about through factors such as deregulation and ongoing drought, has highlighted that working at these levels of decision making though important for providing base skills and knowledge, is inadequate for supporting farmers making critical resource allocation decisions into the future.

The key question driving development within the PFS groups was therefore: What does an extension program targeting level 4 decision making look like? More specifically we were interested in what the role of government extension is in supporting farmers to design, develop and manage new responsive feeding systems. Given that we were operating in a relatively new developmental space, existing approaches to project development were deemed inappropriate. Hence the project team looked to develop a new approach that would encourage us to think beyond what we had always done and explore opportunities for extension from alternative viewpoints.

Planning for change using Soft Systems Methodology

Soft Systems Methodology (SSM) (Checkland 1981; 2000) has a theoretical position that classical reductionist methods are incapable of improving complex problem situations on their own. Without both analysing the social, cultural and historical context within which problems are embedded, purely technical or ‘hard’ systems analysis will never bring about adequate responses to highly complex issues. To do such analysis requires those interested in a problem area to operate in both the concrete and abstract world and acknowledge that socio-technical systems (Kline 1995) are a complex mixture of classical facts and social constructions. Checkland (2000) suggests that the methodology has four fundamental tasks:

1. Finding out about the problem situation
2. Formulating models of potential activity to address the problem
3. Debating the situation using the models to test ideas against the real world
4. Taking action to improve the problem situation
The key task in 1 is the development of a ‘rich picture’ of the problem situation. In most cases this takes the form of a literal picture or ‘map’ of the problem setting. In task 2 the idea is to develop conceptual models of what purposeful activity in the midst of such a problem setting may be. A critical element of this is the development of ‘root definitions’ for activity models using the structure of: what needs to be done (P), how to do it (Q) and why do it (R). This provides focus to the brainstorming task. Task 3 is the critical element of the methodology where thinking in the concrete and abstract world meet. It is in effect the reality test of the thinking that has gone before. The mnemonic CATWOE (Customer, Actors, Transformation, Worldview, Owner, Environment) is often used to ensure the social and political elements of a problem and its possible solutions are examined. Task 4 is action planning that is built upon the now expanded view of the problem area and potential activities to improve it.

These four tasks have traditionally been described through the seven stages of SSM diagram shown in Figure 1. The attraction of SSM lay in its ability to enable abstract thinking. Since we hadn’t developed formal projects that supported level 4 decision making there was a chance that ‘lock in’ could occur around the methods used at levels 1-3. However the language used to describe SSM meant the methodology would have been inaccessible to our development team. Therefore we developed the approach and language to make it more useful for our purposes.

Figure 1: Seven stages of SSM

The approach taken for our planning workshop using SSM was as follows.

**Task 1 – Develop a rich picture of the problem situation**
- Describe the current ‘feeding systems principles’ as have emerged through the FPFP program to date.
- Develop a detailed description of the situation we are working in through ‘mapping’ the environment.
- Describe the ‘problem situation’ that is demanding an extension response.

**Task 2 – Brainstorm potential responses**
Capture ideas around ideal areas of activity using the P. Q. R. technique that could contribute to improving the problem situation.

**Task 3 – Test these ideas against the real world**
Analyse these activity systems using an adapted CATWOE method.

**Task 4 – Action planning**
Develop initial action plans to be used as a basis for future action strategies.

**Developing the rich picture – outcomes from task 1**
Central to engaging the group and contexting our discussion was a presentation from the project leader articulating the difference between level 3 and level 4 decision making in the feedbase area. Fundamentally this relates to the farmer moving from optimising their current set of resources employed on the farm to designing and implementing new systems that enable
appropriate risk exposure for the situation the farmer currently faces. From an extension point of view this represents a significant step up in competency.

In discussing the challenges associated with this several key issues emerged:

- Where would any extension product fit relative to others? Will it just add to the mess?
- Is there a shared view of what ’profitable feeding’ is in the industry?
- Developing business management skills is time consuming. Can we afford to do this on a large scale?
- Worldviews associated with increasing milk production clashes with the view of much of the industry around maintaining viability and managing risk.
- ”Due diligence” is required by the extension provider on a farm by farm basis when working at ‘level 4’. This is a costly exercise. Is it a legitimate role for extension?
- There is a big difference between someone ‘understanding’ this to then imparting principles to others. Who trains the trainer?

A discussion was also had around whose objective it was to see farmers design and implement systems that enable appropriate risk exposure and what assumptions underpin it. It was concluded that key stakeholders were: RD&E investors such as Dairy Australia and Governments, DEC staff, and a small number of farmers who would be demanding it. It was seen as a desirable goal given that it could result in sustainable growth of milk flow, sustainable communities, votes for governments and farmers being more in control of their business.

The group was then asked to take these thoughts and use them as a foundation for creating a ’map’ of the problem situation. To aid this process, participants were guided to think in terms of the following: who are the key players? What resources, tools and activities are employed in this domain? What are the limitations to change? What worldviews underpin/thwart action in this area? The rich picture is shown in Figure 2.

Figure 2: rich picture of the problem situation facing the PFS development group

Through developing this rich picture the group recognised that we were not facing a shortage of tools or resources to help farmers improve farming systems design - the rich picture highlighted a well-serviced industry. We concluded that given the relatively poor financial performance of the industry over the last 15 years (ABARE 2005), the issue related more to the quality of dairy farmers’ risk management strategies captured in the following problem definition:


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The industry is not enabling an acceptable standard of risk management at the farm level through the use of appropriate feeding systems.

Key elements of this definition are underlined:

- **The industry as a whole** - pockets are enabling this, but over all, the standard of risk management occurring at the farm level is not seen as high enough.
- **Enabling** - recognises that there is an enabling environment that supports the farmer. It is not just all about the farmer. In fact the majority of ‘the industry’ is made up of people other than farmers.
- **Acceptable standard** - highlights that it is not that services aren't currently available purporting to do this. The issue is around quality. If there wasn't an issue here we wouldn't be thinking about a ‘problem situation’ that needs ‘improvement’.
- **Risk management at the farm level** - we are not focusing on risk management at the industry level around market security or pest and disease etc. We are focused on the viability of the farm.
- **Appropriate feeding systems** - this again bounds the focus to the feed management area, rather than looking at areas such as off farm investment.

**Formulating relevant activity systems – outputs from task 2**

In light of this, the question was asked:

“Given our understanding of the problem situation, what are the key ‘areas of activity’ (activity systems) required to improve it?”

To explore this question we developed an initial conceptual model of what might be required. This was captured in the ‘focusing eye’ concept diagram (Figure 3).

**Figure 3: Focusing eye concept diagram to guide development of activity systems**

Using the framework of what (P), how (Q) and why(R), the descriptions of activity systems were developed (Table 2), each being prefaced by the statement: An activity system that.......  

**Task 3 - Test activity systems against the real world**

Once we had developed a ‘wish list’ of potential activity, it was time to test these against the real world. To do this the following aspects of each system were explored. These were derived from the SSM ‘CATWOE’ approach but adapted for our own purposes:

1. Who might the beneficiaries of the system be?
2. Who are the key players/actors?
3. What are the inputs and outputs of the system?
4. What are the worldviews that make the activity system meaningful?
5. Who owns it? Who could kill it off?
6. Real world constraints
7. Efficacy - What would we need to measure to know the job was done?
8. Efficiency - What would we need to measure to know we couldn’t have got the same result easier and cheaper?
9. Effectiveness - How would we know the job was worth doing?

An example of the output from this process is shown in Table 3.

**Table 2. Descriptions of activity systems developed using P, Q, R framework**

<table>
<thead>
<tr>
<th>What</th>
<th>How</th>
<th>Why</th>
</tr>
</thead>
<tbody>
<tr>
<td>...develops an agreed set of feeding systems principles and a process for their refinement....</td>
<td>...through the establishment of a bridging mechanism between research and extension....</td>
<td>.....to develop a ‘shared language’ and improve the efficiency of the RD&amp;E process.</td>
</tr>
<tr>
<td>...challenges current feeding systems....</td>
<td>...by delivering a series of workshops....</td>
<td>.....to create demand from farmers for more information, skills and practices.</td>
</tr>
<tr>
<td>...changes the way farmers manage their grazing/feeding practices...</td>
<td>...by delivering a series of principles, skills and practices...</td>
<td>.....to improve operational efficiency and develop a shared language between the farmer and the deliverer.</td>
</tr>
<tr>
<td>....develops a generation of feeding systems experts...</td>
<td>...by providing structured training, practical experience and mentoring....</td>
<td>.....to support the industry in enabling an improved standard of risk management at the farm level.</td>
</tr>
</tbody>
</table>

**Task 4 – Action planning**

Having tested the ‘hypothetical’ activity systems against the real world the group was then encouraged to move toward a more concrete action planning stage. The process used for this step was to list between 5 and 9 activity statements central to making the system ‘work’. These were then listed in a logical flow and linked in model form. Appropriate monitoring and control elements were then included. The project team then took this activity models and used them as a basis for developing project plans which the PFS team is now in the process of developing into delivery plans.

**Discussion and conclusions**

Designing extension programs to support level 4 decision making is something the PFS team had not faced in the past. SSM was looked to as an approach that would enable some ‘out of left field’ thinking to occur and ensure that approaches used to support decision making at levels 1-3 were not automatically applied to more complex decision making. However SSM is not the easiest of methodologies to understand and apply in relatively short time frames and had to be adapted for our purposes. The four tasks that are central to SSM – problem definition, scenario planning, testing and action planning - are in many ways obvious elements of good project planning. What the methodology did provide the development team was a level of analysis within these tasks that was new. In particular the use of the P Q R framework for describing potential activity systems and the adapted CATWOE approach meant that the team added a layer of depth to its thinking that otherwise would not have occurred. These tools will be applied further in ongoing development work within the Dairy Extension Centre (DEC) as a whole meaning that this experiment using SSM will leave a legacy for other development teams in the organisation.

The description above shows how SSM can be taken and adapted for project development purposes, something which is in keeping with the theoretical underpinnings of SSM. Through doing this the PFS team managed to develop a program of work that would not have otherwise materialised. A clear ‘supply chain’ of change has been identified and the role of government extension in improving level 4 decision making has been articulated. This formed the basis of an investment prospectus that went to investors and was signed off in May 2009, providing evidence of its success.
Table 3: Example output from adapted CATWOE analysis for potential actions to address the problem situation

**Activity system 1**: An activity system that develops an agreed set of feeding systems principles and a process for their refinement through the establishment of a bridging mechanism between research and extension so as to develop a ‘shared language’ and improve the efficiency of the RD&E process.

| 1. Beneficiaries | Key researchers  
|                  | Key extension agents  
|                  | Feeding systems practitioners/experts  
|                  | Major investors – DA, DPI  
|                  | Farmers  
| 2. Key players | Key researchers  
|                | Key extension agents  
|                | Feeding systems practitioners/experts  
| 3. Inputs | Current knowledge and experience  
|            | New knowledge and experience  
|            | $$$  
|            | Peoples time & commitment  
|            | Value proposition for all involved  
| 4. Outputs | Agreed feeding systems principles  
|            | An established process for the CI&I of the principles  
|            | Improved extension/research alignment through the process  
| 5. Worldview | A formal bridging mechanism between research and extension is required to improve the efficiency of RD&E investment activities  
|            | Research and extension need to lead the industry through developing a clear position on what ‘profitable feeding’ is.  
| 6. Ownership | Funders – DPI & DA  
|            | Key players – if they don’t commit to participating and following through  
| 7. Constraints | Lack of appreciation of the value associated with a formal bridging mechanism  
|            | Time  
|            | Ability to ‘agree’ on principles  
|            | Distance/geography – travel = time, $$$  
| 8. Efficacy | Evidence of a shared language = a documented set of agreed principles  
|            | A ‘club’ that regularly meets to progress/refine principles  
| 9. Efficiency | B/C analysis in relation to: speed of response by RD & E to emerging issues, more targeted research, bigger pool of investors with buy in.  
| 10. Effectiveness | Extension & research seen to ‘hit the mark’.  
|            | Researchers feel that their work is valued  
|            | Extensionists feel that the research work is relevant and helps them meet the needs of farmers  
|            | Extensionists have an improved capacity to apply research insights to their work area.  

**References**


Asking the hard questions – has our extension approach had impact on Integrated Pest Management implementation?

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Setting the scene
Critical reflection is integral to the action learning cycle (Kolb 1984) which underpins much present day extension theory. How often, however, do extension programs conduct an impact analysis to formally evaluate achievements against desired outcomes and so gain insights into the effectiveness of different extension strategies used? In 2008, two Integrated Pest Management (IPM) project teams working in the Queensland vegetable industry commissioned an external consultancy to evaluate project impact. By subcontracting independent evaluators, the project teams hoped to improve the quality and rigor of data obtained, make more efficient use of time and resources, and provide a more objective measure of how to improve future IPM project work. Needs analyses conducted at the start of both projects helped shape the extension approach for achieving project objectives. Both projects included a research component.

Western Flower Thrips (WFT) (Frankliniella occidentalis) This project aimed to transfer technology and information gained from research projects based in southern Australia to two vegetable production regions in Queensland. WFT had caused significant damage in one locality (Gumlu) and crop (capsicum) in 2002 but was not considered a major threat to crop production. The research component aimed to modify technology and information to suit regional conditions. Extension strategies were based on a regular newsletter and other information products as well as seminars, workshops and farm walks. Two established crop consultancy firms were included in the project team to fast-track the commercialisation process. One of these serviced growers in the target region of Bowen/Gumlu/Burdekin in North Queensland, the other serviced growers in the target districts of Bundaberg in SE Queensland.

Silverleaf Whitefly (SLW) (Bemisia tabaci Biotype B) This project focused on developing and promoting systems, technology and information to assist industry with effective management of an insect pest that had been causing significant damage to crops in some regions of Queensland. It included a substantial research and development program. Extension strategies were based on a regular newsletter, leaflets, seminars and research station farm walks as well as intensive IPM systems development work on a number of North Queensland farms by Queensland Primary Industries and Fisheries (QPIF) entomologists. This consisted of regular farm visits, advisory support and targeted parasitoid releases.

Getting started
The consultants and project teams negotiated a set of key questions for each project from which to develop the survey questionnaires. We chose to use a telephone survey to collect data as we wanted to obtain a statistical sample but had large distances to cover with limited resources and time for travel. Getting the questions right and setting up good contact lists from which to sample the population was therefore critical to obtaining quality information.

Key questions
The key evaluation questions for the WFT project were: What level of commercialisation was achieved? Which strategies achieved technology transfer? What didn’t work so well? Are growers and their service providers using the tactics promoted by the project?

For the SLW project the key questions were: Was there a change in SLW damage to crops compared to previous years? What level of IPM practice had been achieved to reduce chemical inputs? What chemicals were being used? Which chemicals does industry most rely on? Are growers managing insecticide resistance? What is the attitude to natural enemies?

The questionnaire Questions were arranged in sets to produce four distinct modules (i) background information, (ii) preferred sources of information for managing pests and diseases, (iii) specific questions on WFT, and (iv) specific questions on SLW. The modules on WFT and SLW were structured to explore awareness and understanding of key messages of the extension campaign, determine if practice change had occurred and what factors may have influenced this change in practice. Questions were either prompted (closed questions) or unprompted (open questions) depending on the type of data we were aiming to collect. Two separate but similar questionnaires were developed – one for growers, the other for service providers (agribusiness).
The sample
We used existing QPIF lists of growers, agribusiness and agency contacts (recipients of newsletters and seminar notices) from which we took a stratified sample based on regions, crops (growers), and occupation (service providers) to generate 328 potential respondents. The focus of the survey was to obtain information across a variety of categories rather than to proportionally sample the population across categories.

We achieved an interview success rate of 38% for growers and 43% for service providers. Just over 40% of non-respondents were not interested in completing the survey, were not affected by SLW or WFT (growers) or not involved in either project (agribusiness). About 15% of potential respondents could not be contacted. A total of 90 vegetable growers and 40 agribusiness contacts were interviewed. Of these, 72 vegetable growers and 35 agribusiness contacts took part in the SLW module and 24 growers and 23 agribusiness contacts took part in the WFT module. Some respondents were interviewed for both SLW and WFT.

The interview
A professional interviewer with experience in agriculture conducted all interviews. A notice about the survey and what it was aiming to achieve was sent to potential respondents (by email, fax or post) at least a week prior to the interviewer making first contact. Questionnaires took 15-20 minutes to complete on average.

Main sources of information
The graph summarises the main sources of information on pest and disease management for respondents (Figure 1).

Figure 1. Sources of information about managing pests and diseases.

Agribusiness respondents rated their own experience, QPIF officers and crop consultants as most important. There were some minor differences between regions with QPIF officers and chemical companies rating more highly in North Queensland; seminars/farm walks and websites/internet featuring more strongly in the Bundaberg district; and growers/peers (particularly for WFT) and chemical companies important in the Lockyer Valley.

For grower respondents, their own experience featured strongly. This is similar to the result from the WFT needs analysis three years earlier (Heisswolf and Kay 2007). Crop consultants, when mentioned, rated highly indicating that they were a valuable primary source of information for some growers. QPIF officers, agricultural distributors, other growers, seminars/farm walks and newsletters/leaflets were mentioned frequently but growers rated them as only moderately useful. They are perhaps a primary source of information for those growers that do not use crop consultants. In general terms, industry publications, websites, the internet and chemical companies featured least strongly as sources of information for growers. In the Bundaberg district, seminars/farm walks and industry publications rated more highly than elsewhere.

The project newsletters (SLW and WFT Updates) were well received, particularly by agribusiness and appear to be an important communication mechanism. It is clear that growers continue to prefer post for written information while agribusiness is content with e-mail. Only 15% of respondents had visited the SLW website; although respondents frequently mentioned websites/the internet as a moderately useful source of information. Perhaps this reflects the
type of information respondents look for on the internet with up to date specific information on an insecticide registration being a good example.

Over half of respondents had attended one or more pest and disease management seminars run by QPIF with no significant differences between growers and agribusiness respondents or localities. These activities clearly play an important role in information sharing and skill development.

**What works for IPM implementation?**

Both projects used regular newsletters, leaflets, booklets, other information products (Plate 1a) and a series of seminars, workshops and field walks to promote best practice. Newsletters were either posted or emailed. Their primary aim was to raise awareness and build understanding of improved practices for SLW and WFT. They also served to maintain a profile of the projects within the industry.

Seminars provided a venue for discussion and information sharing amongst service providers, agribusiness, the project team and interested growers. They were not designed as a primary source of information for busy vegetable growers but as a support for the commercialisation process. News on other key pests and diseases was often included to add value.

Two crop consultancy firms provided more intensive interaction with growers for the WFT project as part of the project team while on-farm IPM development work by QPIF entomologists provided it for the SLW project. An effort was made to involve agricultural distributors and other service providers in activities, not always successfully. The aim of these strategies was to achieve practice change.

**Western Flower Thrips project**

*Awareness and understanding* Overall 78% of respondents were aware of the WFT project and 74% had seen the newsletter ‘Western Flower Thrips Update’ giving it a usefulness rating of 5.9 out of 10. After reading the newsletters, 90% of agribusiness respondents filed them away with just under half referring to them regularly and just under a quarter taking them out to growers as a business tool.

Overall 57% of respondents said they were aware of a 3-spray insecticide strategy for managing WFT, a cornerstone for managing WFT insecticide resistance. Most were able to describe the strategy in some detail. The top three descriptions for keeping WFT at low levels were good farm hygiene (96%), monitor/check crops on a regular basis (93%) and spray with insecticide (67%). To a specific question for agribusiness, 57% of respondents said they were aware of the broadleaf weeds that harboured WFT.

*Practice change and commercialisation* Thirty percent of enterprises now use a 3 spray strategy on detection of WFT, 40% monitor for WFT and 26% rotate insecticides to reduce resistance. Good farm hygiene (controlling weeds, getting rid of old crop) and planting strategically (avoiding hot spots, getting rid of old crop) were also mentioned. Sixty percent of respondents had not made a change in how they manage or recommend management of WFT over the last few years.

Both agribusiness and grower respondents, on average, rated their own research/information seeking/trials (agribusiness 8.1, growers 8.3 out of 10) and experience (agribusiness 8.1, growers 8.3) as the top two factors prompting practice change for WFT management. Agribusiness respondents next nominated information about WFT that arrived on the farm from QPIF (8.1) and discussions with crop consultants (7.4) as prompts of change while growers next rated Pest and Disease seminars (7.8) and discussions with crop consultants (7.4) as reasons for making a change.

**Silverleaf whitefly project**

*Awareness and understanding* For SLW, 87% of respondents said they were aware of the project run by QPIF. Three-quarters of respondents had seen the newsletter ‘SLW Update’ giving it an average rating of 6 out of 10 for usefulness. In contrast, only 10% of growers and 17% of agribusiness contacts interviewed had visited the web site at least once. Three percent had visited it more than twice and no-one had used the web site more than five times.

Sixty percent of respondents said they were aware of the insecticide resistance management strategy for SLW with those that use it able to describe its requirements in some detail. Almost 50% of the respondents were aware of the SLW clean up strategy (70% in North Queensland). However, of those who used the strategy only about half described options within the strategy in detail. The top three strategies most often identified by respondents as important for slowing down SLW movement from crop to crop were:
spraying with insecticides (53%)
monitoring/checking crops on a regular basis (37%)
getting rid of/slash off/chop in crop straight after harvest (35%).

Overall 83% of grower and agribusiness respondents were aware of a program to release parasitic wasps that attack SLW in their district. Unprompted responses on how to protect and preserve them on farm were to avoid use of broad-spectrum insecticides (56%), only spray at risk planting not the whole crop (16%), plant a small refuge area to allow them to breed and disperse within the farm (14%) and accept a low level of crop damage (9%).

**Practice change and commercialisation** The top four ways that growers and agribusiness respondents said they have changed how they manage or recommend management of SLW in the last two or three years are:

- Use of softer chemicals to protect parasitoids (27%).
- Monitoring crops for SLW levels/employ a consultant to monitor (17%).
- Injecting or drenching Confidor at planting (as a preventative approach) (16%).
- Good farm hygiene: control weeds around the farm (14%).

However, 42% indicated that they had not changed practices. Years of experience was the most important factor given by respondents for prompting them to make a change (average rating of 7.8 out of 10 for both growers and agribusiness). Respondent’s own research/information seeking (growers 7.4, agribusiness 7.2) also featured strongly. For agribusiness respondents information arriving on the farm from QPIF (7.4) also made an impact while growers said discussions with crop consultants (7.3) and direct contact with QPIF (6.7) prompted practice change.

**The end result**

The set of interrelated extension strategies used to promote IPM was successful in achieving practice change. We achieved a high level of awareness and good level of understanding of the key messages for each project and this led to a very credible level of improved IPM practice. This is particularly gratifying for WFT as this pest has not been a management problem since 2003 in the target districts and so placed no pressure on growers to change practices. There was high degree of congruency between the factors which led to practice change and the main sources of information for growers and service providers on pest and disease management. During the life of both projects, there has been a perceived decrease in damage caused by SLW and WFT across susceptible vegetable crops in Queensland. When compared to data for other crops and districts, insecticide resistance levels in SLW (biotype B) and WFT have been largely contained.

The evaluation highlighted several areas where further improvements could be made. For WFT, more could be done to increase the uptake of the 3 spray strategy by growers from the gains already made. However, a lack of realistic insecticide rotation options make this difficult. There was a low level of awareness and adoption of strategic planting and farm planning as an IPM tool and more could be done to promote the messages of “no new crops next to old, new crop upwind of old, avoid hot spots”.

For SLW, collaborative work with chemical companies to include project recommendations on product labels worked well for Confidor soil applications. This is perhaps one avenue for promoting specific IPM information that could be better utilised. More could be done to clarify and promote messages for the SLW insecticide resistance management and “end of crop” clean up strategies, however, SLW migration from weeds and old crops has become somewhat less critical as the impact of parasitoids on SLW populations has increased. Spraying out old crop with broad-spectrum insecticides may in fact be detrimental to local parasitoid populations illustrating that extension messages need to change as the situation evolves and changes.

In general terms, the WFT project achieved a higher level of awareness and understanding of the key messages the project was trying to convey (e.g. “Get mean, keep clean”) than the SLW project. Perhaps the messages from the SLW project were not as clear and consistent. However the SLW project achieved a higher adoption rate than the WFT project and this may reflect the greater risk of crop losses through SLW when compared to WFT as well as the substantial on farm R&D program contained in the SLW project.

The WFT needs analysis (Heisswolf and Kay 2007) and follow up monitoring confirmed that activities and newsletters needed to be short, relevant and timely. It also confirmed that growers preferred one-on-one contact to access information on pest and disease management hence working with growers, either directly or indirectly, was an important part of the technology transfer strategy. This occurred via several key service providers: consultants,
agricultural distributors or a QPIF staff member, the mix of which was probably influenced by the specific individuals available within a district, and the relationships formed to access timely information for day to day decision making.

It is clear that personal experience and observation are major factors in prompting change by both growers and agribusiness. This is particularly true in the absence of a pest management crisis. Growers continue to rely on personal interaction with key people to obtain information and advice for day to day decision making on managing pests. This advice comes from a number of avenues and directly influences how growers integrate new approaches into their own experience.

QPIF officers remain a significant source of pest and disease management information for agribusiness and continue to play a critical role in the information system. Growers rely more on crop consultants as their primary information source and this highlights the impact of the commercialisation route. On some larger farms, in house agronomists fill this role while QPIF entomologists supply consultancy type support when developing IPM systems on farm with grower co-operators. Agricultural distributors continue to play a role in influencing decisions.

Both growers and agribusiness highlight the importance of field demonstrations, on farm trials and local case studies for individuals – growers and service providers - to gain confidence in new approaches for managing pests so adapting research and information to local conditions, systems and situations. This extension strategy, however, is time and resource intensive.

What have we learnt from the evaluation experience?

There is little doubt that the external evaluation process added value to both projects. It provided sound data on the level of awareness, understanding and practice change that each project is likely to have achieved in the field. It also supplied some very practical suggestions on how to improve in the future. There were some unexpected benefits, some insights and also a couple of concerns that an in-house evaluation may not have unearthed.

Developing the survey was a balance between:

- The information required and the size of the questionnaire - governed by the length of time a professional interviewer could reasonably ask for input from a respondent via the telephone.
- The quality and accessibility of contacts used (the frame) impacted on the time it took to complete the survey as well as how well the survey represents the target population. There is likely to be some bias in the data due to non-responses and individuals not captured by our contacts lists. This needs to be kept in mind when interpreting the data.
- The budget and time available – there is potential to augment survey results with focus group interviews, in-depth interviews with key informants, secondary data (for example, insecticide use data) and other mechanisms to tease out and better understand survey results.

It quickly became obvious that good planning is essential for maximising survey effectiveness. This starts with clarifying what information is wanted, developing the questions so they are easy to answer, summarise and interpret and the drawing up of a sampling schedule. The project leaders had little experience in evaluating extension impact and were a little surprised by the level of thinking and detail required to complete the planning process for the surveys. Two issues stand out:

- The project teams were perhaps not as clear as they had assumed in the key messages and practices that had been promoted and some lively discussions took place prior to finalising the questionnaire.
- There is some concern that several of the survey questions may have been misunderstood by the respondents and that the interviewer may not have picked up on this and clarified the question sufficiently. This is a limitation of the external evaluation process that could be minimised by the interviewer “piloting” the survey tool with team members.

A structured, independent evaluation can provide defensible results, clear trends and greater confidence to act on findings. Some other benefits are a different perspective and discipline for working out project aims, messages and practices that are to be implemented. We highly recommend thinking about evaluation at the project planning stage and to use it as a project management tool by periodically asking: What is it that we are trying to achieve? What are the messages we are trying to send out?
Designing future IPM extension strategies

The evaluation results highlight and reinforce some key learnings for IPM extension. They are:

**You can’t beat experience**

When it comes to pest and disease management, one on one interaction with service providers remains important for day-to-day decision making and directly influences how growers integrate new approaches into their existing production system. Extension strategies that build on the experience of growers and target agribusiness through practical on-farm research and demonstrations are likely to be the most effective. However, this approach is very resource intensive. One way of overcoming this constraint is to design strategies that involve crop consultants, agricultural distributors, key farm staff and other service providers alongside growers in the testing and trialling process.

**Targeting relevant service providers**

Public extension is only one player in the information landscape and, with vegetable farming enterprises becoming larger and ever busier, private "extension" in its various forms is filling the gaps. It makes sense to shift focus by firmly including service providers alongside growers as the extension target. Some points to consider in this approach are:

- Develop consistently clear and unambiguous “messages” for distribution within the industry network. This is an interesting task as the project team itself first needs to ensure it agrees on what specific IPM practices it wants the industry to adopt so that individual team members are more likely to promote the same clear and unambiguous messages to growers and service providers - or at least not conflicting messages
- Engage agribusiness. What are their needs? How can your message add value to their business?
- Consider including service providers as collaborators in projects as this provides ownership, formalises interactions, recognises their importance and provides another perspective – all part of a sound adult education approach.

**Walk the tight rope**

Finding the right balance between resource intensive and broad brush approaches can be difficult. A good first step is to be realistic about what different extension strategies might achieve. While newsletters and seminars are useful for raising awareness and understanding; to achieve practice change, projects need adequate resourcing for on farm collaborative trial work. Timing is also important. A crisis tends to help the change process along. Use the 80:20 rule – 100% impact is not needed for the program to be highly effective.

**Does it work?**

Does a robust collection of IPM strategies exist for the crop in question? Have they been thoroughly tested on farm in your locality? Do they increase or decrease risks, costs or complexity for the farmer? Is local, timely expertise available at a reasonable price to support the testing and implementation process? Is a big gun available in case things go wrong? Would you put your house on it? The best way to answer these questions is to demonstrate the IPM system on farm under commercial situations.

**Acknowledgements**

Many thanks to respondents for their time and cooperation in completing the questionnaires. Our thanks also to Amy Samson for organising contacts and Barbara Simes for contacting individuals for sampling and completing the questionnaires with eligible respondents. The SLW and WFT projects were facilitated by Horticulture Australia Ltd, in partnership with AUSVEG and funded by the vegetable levy. The Australian government provides matched funding for all HAL’s R&D activities. State government funding was provided through Queensland Primary Industries and Fisheries.

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Planning extension activities for impact

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What, when, why?

We all want our extension to have an impact. This paper presents an approach to planning activities to deliver impact, by outlining simply the types of activities congruent with identified levels of change.

The approach is most applicable to planning discrete projects with, for example, one to three year planning cycles. It can be used in forward planning or to review the suitability of existing project activities. It is designed to be useful for those with little extension knowledge, as well as a check for the more experienced extension planner. The approach is not limited to the field of extension; it should hold for project planning generally, as long as there is a component of intended change for a target audience.

The approach was developed in response to an observed constant lack of congruency between project objectives and activities when reviewing the logic of numerous agricultural and natural resource management projects (mainly Department of Agriculture and Food WA projects, but some others as well) in the past 5 years. It is highly unlikely for example, that a journal paper, 2 field days and an article in the rural media will deliver significant practice change in a rural community. There are two issues of (lack of) congruency involved; the proposed suite of activities not having the capacity to deliver stated objectives, and also the objectives being overstated and not achievable within the project funding and timeframe. This paper will focus only on the issue of activities not being congruent with project objectives or level of intended change.

Levels of change

In order to outline the types of activities congruent with identified levels of change, it is first necessary to be familiar with the options for the level of change. Four successive levels of change (evolved from Bennett’s hierarchy of outcomes (Bennett 1975; Bennett and Rockwell 1995) are described (see Figure 1) as a guide to identify the level of change a project is aiming for. Level 1, change in awareness, is the smallest suggested level of change, moving up to level 4, improved environmental, economic or social conditions as the highest level of change. Each successive level generally requires greater resources (time, money, expertise) to achieve. Levels 1, 2 and 3 refer to change relating to people.

Figure 1. Four successive levels of change

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Change in awareness</td>
</tr>
<tr>
<td>Level 2</td>
<td>Change in knowledge, understanding and skills at a generic level</td>
</tr>
<tr>
<td>Level 3</td>
<td>Change in practice or behavior (small or large scale)</td>
</tr>
<tr>
<td>Level 4</td>
<td>Improved environmental, economic, social conditions</td>
</tr>
</tbody>
</table>

There is rarely just one level of change associated with a project. There will be an overall identified change (or impact or outcome), which reflects the highest identified level of change for that project. There will also be a suite of other changes of varying levels that together deliver the overall change. When looking for congruency between project objectives and activities, it is best to start by considering the highest level of intended change for the project.

Intended change for a project is much more complex than simply choosing a level of change. Understanding the extension situation, and exploring and making decisions about the target audiences for change, scale and complexity of the change, adoptability of technologies related to the change and potential influence your project has on effecting the change, are all elements of rigorous extension planning. This paper however, is not an adequate forum to consider all these complexities, and is focused only on congruency between activities and level of change.

Activities for Level 1 - Change in awareness

Activities congruent with changing awareness centre on attracting the attention of your target audience to the point they are aware your message, product or technology is relevant to them. As with all extension activities, it is necessary to first identify and prioritise your target audience individuals and groups, consider their characteristics and needs, and develop packages and processes targeted to these characteristics and needs. The next step is to ensure your target...
audiences are exposed to the message, product or technology. Mechanisms are potentially endless, but examples include:

- Use of mass media, such as locally relevant newsletters, rural newspapers, rural TV and radio, Farmnotes, and Agmemo. The key to success is setting up lines of access to the sources, and allocating staff to be responsible for particular sources ahead of time to make submissions quick, easy and a regular part of project activities. In this situation, target audience identification and segmentation, and understanding the characteristics and needs of the target audience will be necessarily broad.
- Targeted individuals or groups, such as a particular consultant, grower group or reference group. In this situation, clearly identifying and segmenting the target audience, and understanding their characteristics and needs will be a process unique to that individual or group. A relationship between your project and the target audience will be the key mechanism for ensuring the package is right for the audience, and the audience are exposed to the product.
- Use of websites. This could be a website developed specifically for the situation, or strategic use of existing websites. Please note that making something available, for example placing on a website, is only part of awareness-raising.
- Targeted activities. These could be whole activities aimed at raising awareness, such as field days, field walks and product launches. It could also involve ‘piggy backing’ on bigger events such as workshops and training courses with something like a short promotional presentation as part of a bigger day.
- Physical cues such as signage, stickers, badges, hats, stationery and T-shirts. These provide a cue or link to the message, product or technology rather than provide information directly.
- Value-add by placing the same material in a range of distribution points.

**Activities for Level 2 - Change in knowledge, understanding and skills at a generic level**

The key focus for activities congruent with changing knowledge and understanding is that they must allow in-depth information exchange, clarification and discussion between the target audience and those recognised as holding key knowledge and understanding, and between target audience members. Where generic skill development is the aim, activities need to demonstrate the skill and provide opportunity for hands-on practice of the skill in conjunction with gaining knowledge and understanding. Example activities include:

- Workshops, training courses, seminars, some field days. Note most field day formats do not allow sufficiently in-depth exchange, clarification, demonstration or practice to easily support change at level 2, and are more suited to level 1. A series or sequence of workshops or events which support a cycle of workplace action and review by participants between modules would be congruent with a higher level practice change - level 3.
- Networks that allow information exchange and discussion across a range of stakeholders, for example farmers, researchers, extension officers and others. These could include interactive web-based educational learning groups, web-based communities of practice, email networks and regular face-to-face meetings.
- Use of and access to experts, peers and information that are credible and most relevant to target audience.
- Expert or peer demonstrations, show-casing strong and/or locally relevant case studies.
- Tools to support more informed decision making, including running interactive group sessions with the target audiences in the use of those tools. Economic modelling tools, for example ‘STEP’ (Peek and Abrahams 2005) are useful in supporting discussion around changes in economic position of a farming enterprise resulting from new technical innovations or practices.
- Some ideas to encourage commitment to action at end of level 2 activities, such as workshops, include next steps and available support clearly outlined; target audience/participants write down, or verbalise intended actions in presence of others; suggest/request follow up on intended actions after a period of time; suggest/request setting up support networks such as grower groups, learning sets, and mentor-type partnerships to take next steps together.
- Application of adult learning principles and theory (Knowles 1990; Mumford 1993; Malouf 1994; McGill and Beatty 1995; Burns 1998) is particularly valuable when planning extension events that lead to increased knowledge, understanding and generic skills.
- When aiming for a level 2 change, activities for level 1 as well as level 2 would generally be necessary.
It is important to remember that a well-informed decision not to initiate a particular practice change is just as valuable as a well-informed decision to make the change.

**Activities for Level 3 - Change in practice or behavior (small or large scale)**

For target audiences to initiate a change in practice or behaviour, they need to have the confidence and motivation to initiate the change, access to situation-specific knowledge and skills, and the necessary physical resources to act. Activities or actions supporting a change in practice or behaviour need to focus clearly on these three elements, including:

- Small-scale trialing on the target audiences own site, or for their own situation or business. A positive experience on a small scale can result in increased (site-specific) knowledge and skills, increased confidence, and potentially greater motivation or desire to adopt on a large scale. (A negative experience could equally lead to a decision not to adopt on a larger scale.) Skills practice at a small-scale trial site has greater relevance compared to (for example) a regional workshop where skills demonstration and practice is more generic.
- Financial incentive, for example money to establish and manage trial sites, free trees, free soil sampling, training subsidies, devolved grants.
- Where a trial site is being established (in part) for research and development, formal recognition of (or payment for) the farmer's experience and knowledge (intellectual property) could provide an additional incentive to take part.
- A series/sequence of workshops, technical modules or other activities which support a cycle of workplace action and review by participants between the modules.
- Innovation/practice specific peer networks which support technical learning, action, reflection.
- Working as a group or part of a team can motivate action in itself, as individuals feel more supported, and often have a greater sense of commitment and responsibility in a group.
- Personalised technical support. Some examples could be: a list of contact details with that little bit extra, such as after hours numbers (as appropriate); information packages tailored to the specific property, site, situation, individual needs; password protected websites that only ‘project members’ can access.
- Providing evidence that technical support will still be ongoing after initial trial establishment. Some examples could be longer term project websites with site data and updates and a designated local resource area, for example in the local Shire.
- As previously mentioned, some ideas to encourage commitment to action at end of level 2 activities (to support level 3 change) are to: have next steps and available support clearly outlined; have target audience/participants write down, or verbalise intended actions in presence of others; suggest/request follow up on intended actions after a period of time or suggest/request setting up support networks such as grower groups, learning sets, and mentor-type partnerships to take next steps together.
- Whilst not an activity as such, negative incentives, including regulation or policy instruments may be a vital tool in some situations.
- When aiming for a level 3 change, activities for level 1 and 2 as well as level 3 would generally be necessary.

**Comment on community level practice or behaviour change:**

Where you are aiming for practice or behaviour change on a community level, the key is for individuals within that community to develop ownership of the change.

- Invite the community to be involved in the process of change, particularly in planning and decision-making. This could be through formation of community/industry steering committees, advisory groups, reference groups, community consultation. Be transparent about the process from the start, so individuals know how they will be involved and how their involvement could influence change. Check that community members aren’t there to ‘push their own barrow’.
- Keep the community informed through relevant awareness-raising mechanisms for that community. This needs to be ongoing – and right from the start of any change process.
- Investigate the potential impact of the change, on individuals and on the community generally, and keep in mind for all planning and implementation activities.
- Always provide some level of feedback on how community comment/feedback has been utilised (never waste community time by consulting as a ‘tick the box’ exercise).
- Publicly recognise and acknowledge community members for their involvement in community change activities – things for the good of the community - rather than them
as individuals. It takes time and effort to be on involved. This could be via the local newspaper or local awards etc.

Exploring and making decisions about scale and complexity of the intended practice or behavior change are key elements to address in the development phase of project/extension planning. This paper does not attempt to discuss the issues of scale and complexity at all; instead providing a simple decision aid listing types of activities congruent with practice change generally.

Activities for Level 4 - Improved environmental, economic, social conditions

Outcomes relating to change in environmental, economic and social conditions will result from achieving change at levels 1, 2 and 3. The focus at this level is consequently on monitoring and evaluating expected change, rather than on actual extension activities. The two key areas to plan for and implement at this level are:

- To clearly describe the program/project logic that theoretically supports expected level 4 changes occurring. This takes place in the project development phase, and identifies the expected cause-effect relationships between activities and intended change from level 1 through to level 4.
- To evaluate whether identified elements of the improved environmental, social or economic conditions have been achieved. Do this by developing a rigorous monitoring and evaluation plan in the project development phase, clearly linked to the described project logic. The plan should include monitoring of inputs, activities and outputs for all identified levels of change, as well as evaluating against agreed intended impact/outcomes at levels 2, 3 and 4.

Summary

Two key messages from this paper are:

- It is essential when planning extension projects to identify what change, or impact, is intended, and with whom.
- The suite of extension activities planned for any project should be clearly congruent with the overall intended level of change.

Activities for Level 1 (change in awareness) need to be focused on identifying the target audiences and distribution mechanisms for greatest impact. Activities for Level 2 (change in knowledge, understanding and skills at a generic level) need to be focused on facilitating information exchange and discussion, and as relevant, skills demonstration and opportunity for practice. Activities for Level 3 (change in practice or behavior) need to be focused on increasing confidence and motivation to initiate the change, access to situation-specific knowledge and skills, and the necessary physical resources to act. Activities for Level 4 (Improved environmental, economic, social conditions) are not extension activities as such, but are focused on clearly describing the program logic, or cause-effect relationships, that theoretically support the change occurring, and developing a congruent evaluation plan.

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Education in Landcare groups: social learning aspects of adaptive management

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Abstract. Social learning in promoting natural resource management (NRM) can be characterised by collections of practices. Education for sustainability practices have unique structures, which can be analysed to provide insights into the social aspects of learning. Drawing on Schatzki’s theory of social practices consisting of collections of sayings and doings, I examine the social learning practices found in Landcare. This paper describes the experiences in conducting case studies in several Landcare groups in the Murray-Darling Basin, Australia. The research is contributing to the understanding of the social learning practices in community-based groups of environmental volunteers, using Landcare groups as an example. Discourse analysis is used to explore data created from semi-structured interviews with landholders, participant observation of Landcare groups, and historical document analysis from the Landcare groups. The results highlight characteristics of informal adult education in natural resource management – and demonstrate potential contributions to capacity building in environmental groups, practice, theory and to inform policy. Three key issues are: (1) important informal education processes occurring in Landcare; (2) implementing new practices in education for sustainability (EFS) at the grass-roots level; (3) encouraging policy developments to promote NRM learning

Keywords: informal adult education, community-based volunteer, NRM, practice change

Introduction and background

Climate change is predicted to add to the degradation already occurring of agricultural land in the Murray-Darling Basin (MDB), creating further reasons to address the sustainability of agricultural practices. Brundtland (1987) introduced and defined "sustainability" as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The United Nations (UN) has declared the UN Decade for Education for Sustainability (2005-2014) explaining that education is “…humanity’s best hope and most effective means in the quest to achieve sustainable development” (UNESCO 2003). Australian and international educators are emphasising the need for new and urgent developments so as to be able to meet the challenges of sustainability and sustainable development in a timely manner (e.g. Fien 2003; Stone and Barlow 2005). Fien proposes that education for sustainability (EFS) can increase the world’s capacity to "confront and master change”.

The Landcare movement has been an important part of grass root efforts to combat and reverse land degradation Australia-wide (e.g. Curtis and Lockwood 2000) and its importance could grow as the impacts of climate change increase. Landcare is a particular manifestation of a broader class of community-based environmental volunteer groups (CBEVG). Various implementation models for administration and funding CBEVG have been utilised over the almost twenty-five years of Landcare (e.g. Pannell, Marshall, Barr, Curtis, Vanclay & Wilkinson 2006). However, the processes of education and learning within these community groups, composed largely of adults, are under-researched and under-theorised. This paper explores informal adult education as evidenced in four Landcare groups based in the MDB. Key questions that guided the exploration were: what are the defining characteristics of EFS in a Landcare context and how does learning occur? Hence, before exploring the case studies a word on EFS is needed.

Education for sustainability and practices

EFS has a set of practices that are different to the practices used in normal ‘education’ (Kemmis, Adlong, Cooke, & Mutton 2008). The EFS practices identified by Kemmis et al. 2008 are organized as sets or bundles of sayings, doings and relating, where the bundles have distinct purposes together with “...moral and emotional commitments that shape and structure practices” (Schatzki 2002, cited in Kemmis et al. 2008, p 1). Wenger (1998) uses the notion of communities of practice (CoP) to describe structures of social learning in different practice settings. Table 1 orients the sayings, doings and relating - with examples of these - in the dimensions of natural resource management (NRM) activities within the Landcare groups.
Table 1. Evidence of actions and meanings of practicing EfS

<table>
<thead>
<tr>
<th>Actions - bundles</th>
<th>Dimension &amp; medium</th>
<th>Practice architectures (mediating preconditions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sayings, knowledge: “Thinking green”, “thinking sustainability” and speaking about relevant topics</td>
<td>The cultural-discursive dimension (in the medium of language)</td>
<td>Cultural-discursive preconditions: Eg. discourses of sustainability (like discourses of ecology, environmental science)</td>
</tr>
<tr>
<td>Doings: “Acting green”, “acting sustainably” and doing relevant things</td>
<td>The material-economic dimension (in the medium of work)</td>
<td>Material-economic preconditions: Eg. natural conditions that constitute ‘environmental problems’</td>
</tr>
<tr>
<td>Relating: “Relating to the world in a ‘green’ or sustainable way” and changing relationships to others and the world</td>
<td>The social-political dimension (in the medium of power)</td>
<td>Social-political preconditions: Eg. social relations involved with ‘active citizenship’ or ‘environmental stewardship’</td>
</tr>
</tbody>
</table>

*After Kemmis et al. 2008.

Case studies

A multiple case study approach was used to characterise EfS in the groups (e.g. Yin 2003; Stake 2006). The research was conducted with four Landcare groups geographically adjacent to Wagga Wagga; three rural-based groups and one urban group located in a small regional town. The data were collected in 2008 and 2009. The data comprise transcripts of semi-structured interviews of Landcare group members, field notes from participant observations of regular meetings, and the groups’ historical documents such as meeting agenda and minutes, project descriptions and reports. The size and the activity levels of the groups are summarised in Table 2. Note that activities were defined as specific on-ground works.

Table 2. Summary of the activities of four Landcare groups in the MDB (2008, 2009)

<table>
<thead>
<tr>
<th>Number financial members*</th>
<th>Meeting frequency</th>
<th>Median attendance</th>
<th>Regular Newsletter</th>
<th>Activities/ year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landcare Group 1</td>
<td>102</td>
<td>Monthly</td>
<td>7</td>
<td>Yes</td>
</tr>
<tr>
<td>Landcare Group 2</td>
<td>28</td>
<td>2008: 2-monthly, 2009: -monthly</td>
<td>9</td>
<td>No</td>
</tr>
<tr>
<td>Landcare Group 3</td>
<td>32</td>
<td>Dormant (no meetings since 2007)</td>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>Landcare Group 4</td>
<td>15</td>
<td>Monthly</td>
<td>6</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Note that membership is often paid for as a family group

Only Landcare Group 4 organised regular on-ground work such as tree planting in the twelve months period 2008-2009 (Table 2). Landcare Group 1 (LG1) and Landcare Group 2 (LG2) continue to have regular meetings. However, observations of those meetings reveal the basic meeting procedures are followed (i.e. the members present are recorded; apologies, the last meeting’s minutes are read; matters arising are discussed; correspondence in and out; treasurer’s report; and general business) and action outcomes or decisions are rarely needed. This provides evidence of the functioning of a community of practice (CoP) as defined by Wenger (1998, 2008a, b, p 1) where participants “share a concern… for something they do and learn how to do it better as they interact regularly”. In this case the members are continuing the connection to the CoP to preserve the practices as ‘sayings’ and ‘relatings’. When the groups are still meeting regularly, even though there may not be any planned projects (‘doings’), they are enacting the practices of ‘Landcare’ – in continuing to enact practices they are ensuring that the historical meaning of Landcare meetings in their group is perpetuated, until such time as there actually are new projects to do. This may be when appropriate funding becomes available for a project, or there is some significant rainfall for tree planting.

A number of themes related to how learning is occurring emerged from the data, which have been analysed using the themes in Table 1.
The occurrence of learning

How is learning occurring within these groups? Table 1 suggests that, if EfS is occurring, it should manifest firstly as individuals in the groups adopting new ‘sayings’ (discourses) which contain new ideas and perspectives about their world. Secondly, they develop new ways of ‘doing’ things in response to the needs of sustainable agriculture. Thirdly, they develop new ways of ‘relating’ to each other and to the landscape in the course of their activities in the groups. That is, it is anticipated that people in the Landcare group – and others around them – will begin to relate in new ways to each other, to those people ‘external’ to the groups, and to the environment. These are seen in the relationships to both one another and the world. Such changes do appear to be happening in the groups of this case study, as discussed below. Different Landcare groups have different areas of activities that evolve over time and are influenced by factors such as drought or government policy directions.

Table 3. Examples of how practices are transforming

<table>
<thead>
<tr>
<th>Actions – ‘bundled’</th>
<th>Then</th>
<th>Now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sayings, knowledge, thinking</td>
<td>Salinity, erosion, acid soils – ‘simple’ problems</td>
<td>E.g. Ecology, biodiversity, soil carbon – as ‘complex’ issues</td>
</tr>
<tr>
<td>Doings, activities</td>
<td>Fencing, tree-planting</td>
<td>E.g. Dung beetles, changing soil management</td>
</tr>
<tr>
<td>Relatings, interacting</td>
<td>Government funding projects, reports</td>
<td>E.g. More non-government organisations, new ‘experts’ - biologist, agronomist</td>
</tr>
</tbody>
</table>

As might be expected when new discourses enter the sustainability debate (such as when soil carbon is being discussed, e.g. Table 3) further key relationships are created as group members learn to talk the talk and walk the walk.

Social learning / informal learning

Using the matrix of sayings, doings and relatings provides a space for demonstrating transformations of practices over time, as they change due to forces such as policy, environmental concerns, or climate change (see Table 1). Taking a then and now scenario, based on the data from the case studies (using as a baseline 1990-91 for ‘then’ and 2008-09 for ‘now’), I find that there are changes in tasks associated with practices (see Table 3). When a farmer adopts a new practice of pasture cropping with minimum tillage, s/he modifies the practices, the bundle, associated with sowing a crop. Previously for example (then), there was often a series of soil preparation stages such as scarifying and ploughing. Now they have a modified seeding set-up to direct drill the seed in the pasture. There are new, different chemical and fertilizer rules now. The farmer is dealing with different consultants for advice, and while this is occurring the farmer’s thinking has changed as they see perhaps better yield, an improvement in the soil, some remnant vegetation regenerating, or the return of bird species.

Groups may have particular bundles of practices that they require to carry out sustainability activities. Practices involved in knowledge development have particular sets of ‘sayings’ around an activity, for example when a group meets to discuss a project like revegetation work along a creek. The discussion may be initiated by a new round of funding that has been advertised, and the group members meet to decide whether there is an opportunity within their sub catchment to take up the funding. From this discussion a tract of degraded creek might be identified. The members will need to assess the area – e.g. measure the length of fencing required, and the area required to be planted for trees, as well as use their knowledge of their landscape to nominate the types of vegetation to be ordered. These are the sayings as in Table 1 that presupposes knowledge of someone of the various elements of the discussion. It is important to note that the knowledge required to complete the evaluation will probably be distributed among the members – not all have detailed knowledge of the varieties of trees that will be planted in that particular section of the creek, not every member may have detailed understanding of the number of trees required to be ordered and so on. The relevant knowledge is distributed among members, and the members themselves may have networks of relationships (‘relatings’) outside that particular group where they access particular information. The networks are essential in the social dimension, as evidenced by the fact of them participating in the Landcare group, as they are all demonstrating their shared values in carrying out sustainability activities (see also Kemmis et al. 2008). This can be demonstrated in the same manner for ‘doings’, where the
action (the on-ground work) has distinctive features related to sustainability practices. Collectively the group has the skills for preparing the area to be planted, carrying out the fencing activities, and planting and later monitoring and reporting on the site, but not all individuals have all the skills.

In practice there is a spread of skills and knowledge levels among participants that relies on the social aspects of the groups to bring together all those ‘knowledges’ and skills into the particular practice being developed or transformed. The use of practice architectures can demonstrate some overlapping and interdependencies thus suggesting that they are social products.

**Practice architectures**

Considering that the bundles of practices are not then solely the products of the individuals in groups, Schatzki (2003) introduces site ontologies as being locations of where practices occur in the social contexts. Uncovering the structure and relationships of practices within Landcare is aided by the use of the site ontology examples by Schatzki to elicit the nature of the social settings (Schatzki 2003 pp 177-179). Taking his example of bank loan practices, the practices involved with sowing an autumn crop can highlight some agricultural practices (p. 192):

- Meetings with agronomist, other consultants
- Prepare machinery
- Purchase seed, chemicals, fertilizer
- Communications such as telephone calls to arrange a cartage contractor.

The activities forming the practice are linked by three phenomena:

1. Understanding – that is knowing how to carry out an action / task, under a given set of conditions (e.g. prevailing seasonal conditions)
2. Rules – such as those controlling the application of fertilizer or weed chemicals
3. Combinations – the guidelines of the task/project that signify meeting targets such as crop yield and earnings.

Table 4 gathers together the overlapping bundles of practices to demonstrate how NRM activities in a Landcare group can be interpreted in a larger social context. This framework can be used to link the practice bundles associated with the domains such as soil, water and air.

**Table 4. Activities as practices and bundles: examples of domains and types of NRM practices**

<table>
<thead>
<tr>
<th>Domains</th>
<th>Practice ‘Bundles’</th>
<th>Landcare Activities</th>
<th>Landcare Discourses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>Organic agriculture (include soil testing) e.g., permaculture, organic farming courses</td>
<td>Monitoring, dissemination of information</td>
<td>Soil quality</td>
</tr>
<tr>
<td></td>
<td>Salinity and gully / water erosion control</td>
<td>Guest speakers</td>
<td>Soil carbon</td>
</tr>
<tr>
<td></td>
<td>Salinity, e.g. saltbush planting</td>
<td>Distributing dung beetles</td>
<td>Biodynamics</td>
</tr>
<tr>
<td></td>
<td>Water quality, e.g WaterWatch</td>
<td>Planting trees</td>
<td>Community action</td>
</tr>
<tr>
<td></td>
<td>Water environments, eg wetland development</td>
<td>Fencing</td>
<td>Biodiversity</td>
</tr>
<tr>
<td>Water</td>
<td>Salinity and gully / water erosion control</td>
<td>Piezometers – auditing</td>
<td>Ecology</td>
</tr>
<tr>
<td></td>
<td>Salinity, e.g. saltbush planting</td>
<td>Planning &amp; participating in program of water conservation</td>
<td>Water</td>
</tr>
<tr>
<td></td>
<td>Water quality, e.g WaterWatch</td>
<td></td>
<td>Waste</td>
</tr>
<tr>
<td></td>
<td>Water environments, eg wetland development</td>
<td></td>
<td>Recycling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Conservation</td>
</tr>
<tr>
<td>Air and air quality</td>
<td>Dust/ wind erosion</td>
<td>Minimum &amp; no-till Direct-drilling</td>
<td>Conservation</td>
</tr>
<tr>
<td></td>
<td>Stubble burning</td>
<td>Native pastures</td>
<td>Soil carbon</td>
</tr>
<tr>
<td></td>
<td>Revegetation, e.g. landscape restoration, indigenous seed collection, propagation, planting</td>
<td>Planting</td>
<td>Ecology</td>
</tr>
<tr>
<td></td>
<td>Biodiversity</td>
<td>Monitoring pest weeds</td>
<td>Biota</td>
</tr>
<tr>
<td></td>
<td>Weeds and pests, e.g. Weed Warrior programs</td>
<td></td>
<td>Biodiversity</td>
</tr>
</tbody>
</table>

*After Kemmis et al, 2008

**Discussion**

To advance sustainable agricultural practices in the face of climate change requires individual farmers and their related communities to learn as they manage, an approach that is often referred to as adaptive management. Allan and Curtis (2005) note that active adaptive
management (as opposed to the evolutionary or passive categories), acknowledges the complexity of issues by encouraging the involvement of multidisciplinary and multi-stakeholders combined with a “strong emphasis on social learning”. In addition, Allen and Jacobson (2009) emphasise that types of learning needed for adaptive management may not necessarily have greater importance over each other, rather that they may all be utilized at various phases. If we overlook the informal learning processes, there is a risk of losing the structures that support and enable this social learning – and we will have lost the opportunity to harness a valuable benefit of CBEVG. Allan and Curtis (2005) point to the inadequacy of leadership at organisational levels in providing support for implementations of adaptive management. They also note cultural issues and prevailing values in NRM that constrain success in adaptive management – could this be a result of lack of insights into the social learning aspects?

This article has drawn on research into the learning practices of Landcare groups to highlight some of the changes that are taking place in the groups studied, and to provide a possible framework for future discussions with professionals who are responsible for facilitating development in NRM, and policy makers who are able to evaluate current administrative and funding structures and their role in supporting the development of the groups. Dealing with the need to use the knowledge of social learning by the individuals in future strategies and policies can improve rural sustainability outcomes.

References


Development of an innovative extension model for small landholders – an experiential learning journey

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Abstract. The Western Australia Small Landholder Information Service (SLIS) is an extension program that has grown out of a series of spatially focussed extension projects that sought behaviour change in areas given over to small landholdings. These projects highlighted that small landholders represented specific risks to agriculture and the environment. The small landholder has specific extension and information needs that differ from the needs of 'traditional' farmer clients engaged by agricultural extension programs. The Department of Agriculture and Food Western Australia recognised that there was a need to respond to the unique risks represented by small landholders and established an extension program to reduce the potential of these risks. The assumptions that underpinned the program in the planning phases were later confirmed by social, landuse planning and environmental impact research in a range of different locations (interstate and local). The SLIS employed a number of strategies to confirm assumptions and test efficacy of the extension campaign. The approach to continuously improve the extension model has been largely iterative and current social research investigating small landholders has been utilised. By necessity, the extension model has been reliant on the development and modification of a suite of tools and strategies for small landholder engagement and these are now being shared with national partners. The development of innovative partnerships for delivery has been integral to the program’s success. The program has engaged more than 5,000 participants, many of whom had not previously sought support from the Department of Agriculture and Food. Most past participants in the program report that they have changed land management behaviours and moved to recommended land management practices. This paper describes the development of an innovative model for small landholders and explores the implications of this work in future program delivery. Key learnings:

1. A willingness to truly understand the client – the small landholder is different from mainstream farmers.

2. Where necessary, adapt and tailor an extension model(s) to suit the specific client group.

3. Be open to explore opportunities to synergistically deliver the extension package.

4. Have the courage to openly evaluate and then respond to resultant signals – back your judgement.

Introduction

In 2004, the Department of Agriculture and Food established the Small Landholder Information Service (SLIS) to provide an extension program targeting the burgeoning number of small rural lifestyle landholdings in Western Australia and the resultant challenges that they create. Prior to the SLIS program being implemented, any agricultural and environmental engagement with small landholders tended to be ad hoc and was incidental to other extension programs. The clear focus of the department was on the broadacre, commercial farmer.

In Western Australia, a small landholder is defined as the owner or manager of a rural property of between 1 and 100 ha in size. In the past decade, the number of small landholder properties in WA has increased by more than 20 per cent to over 55,000. These properties occupy around 650,000 ha of what was formerly agricultural land. Small landholdings are especially prevalent throughout the south west of the state and in the peri-urban ring around Perth, but also occur in coastal areas from Geraldton to Esperance.

Their characteristics typically include: their main income being derived off-farm, a range of highly varied agricultural activities (often on the same property) and strong ‘lifestyle values’. Small landholders also tend to have a poor understanding of agricultural, environmental and biosecurity practices and lack the rural networks to build their capacity to manage these issues better. Associated with their expansion throughout traditional farming areas are elevated biosecurity (potential spread of pests, weeds and diseases) and natural resource management risks. Reinforcing department concerns about small landholders, Hollier (2006) also reported that small lifestyle landholders pose considerable biosecurity risk to Australian agriculture as well as create significant animal welfare concerns.

Recognising that typical departmental engagement with small landholder clients was ad hoc, incidental and inadequate to address the growing issue, the SLIS was established.
The extension task ahead

At the time of the establishment of the SLIS there was no clearly articulated extension model for small landholders and many of the initial assumptions that were made about how to engage with the small landholder needed to be based on anecdotal evidence. The department was responsible for delivery of the property planning component of the spatially-targeted “Swan Canning Cleanup Program” from 1999 to 2006, so this gave a useful (although limited) basis to test assumptions (Guise et al. 2005).

With a potential client group of over 50,000 with different characteristics, needs, capacities and extension requirements, a challenge lay in store. Additionally, minimal staff numbers and a tiny available budget (2.6 FTE and only $10,000 operating) added to the challenge for the SLIS.

If the SLIS was going to effectively deliver a program whereby small landholders would pose reduced biosecurity and natural resource management risks, as well as contribute more positively to agricultural production, then nothing short of behavioural change would be acceptable. This became the core goal of the SLIS. Key desirable behaviour changes were planned for and program logic was used as a means to plan for the desired outcomes.

Developing the “Experiential Learning Model”

In the absence of definitive social research focussed on the small rural landholder sector, the SLIS team took the view that the desired approach was to combine the experiences of the team members, information collected through the Swan Canning project, and extensive “picking the brains” of whoever would discuss the issue with us, then document a series of assumptions about the characteristics of the client group. This allowed development of a behavioural change extension program to deliver the desired outcomes.

Importantly, a comprehensive evaluation strategy has been built into the program to allow for a process of continual review and improvement. Weiss (1998) refers to evaluation as social research designed with specific use in mind, so this gave some confidence that the planned approach was valid. Clements (2004) suggests that “evidence-based decision-making” is considered to consist of judgements informed by best available evidence, which may include research, organisational or political evidence. With virtually no funding to conduct social research, the SLIS experiential learning model has necessitated a boldness to back experiential judgements whilst constantly evaluating to increase the available evidence.

The most comprehensive Australian social research into the characteristics of the small landholder farmer group is that reported by Hollier et al. (2004, 2005, 2007) from Victoria. The authors describe the characteristics, values, attitudes and land ownership aspirations of small landholders as very different to mainstream commercial farmers. Diversity within the sector is the most striking characteristic of small landholders. Hollier et al. (2007) suggest that small landholders strongly value their rural lifestyle and have strong land stewardship ethics. Unfortunately, they often lack the skills, capacity, time and means to best manage their properties to achieve the desirable outcomes that they seek. The assumptions of the SLIS are consistent with these social research findings.

Kollmus and Agyeman (2002) argue that linear models of environmental education that simply provide information about issues and problems on the basis that people will change their attitudes and behaviour are profoundly inadequate. Unfortunately, there are many examples of so-called “extension” programs that use this approach. This is not a desired approach, especially for a client group with such diversity.

Coutts et al. (2005) define extension as the process of engaging with individuals, groups and communities so that people are more able to deal with issues affecting them and opportunities open to them. After an extensive review of agricultural extension in Australia, they then describe the five different extension models that are in practice: group facilitation/empowerment, programmed learning, technology development, information access and the additional individual consultant/mentor model. The authors noted that the different extension education models work well together as a suite of complementary capacity building avenues. They describe the “capacity building ladder” as a synergy of the five extension models. Arguably, the SLIS experiential learning model has incorporated elements of all five extension models either directly, or by positive referral. Interestingly, the SLIS model was developed in parallel with the Coutts et al. (2005) research so did not directly utilise the models, but still achieved a similar position – that a combined approach would be most effective – and importantly it is all about people.
The experiential learning model in action

The SLIS employs a “Stages of Change Model” of behavioural change (Prochaska et al. 1992) that aims to attract small landholders to the program, raise their awareness of appropriate practices, build their capacity to respond and then stimulate adoption of those practices. An operating premise is that small landholders are generally unaware of their responsibilities as rural land managers and that they lack the skills, resources and networks to implement good land management practices.

The model is designed to provide a continuum of specially tailored information, advice, a comprehensive workshop and field day series based on a “tiered-learning” approach, plus local area demonstration properties to establish new norms. Additionally, support is provided in engaging partners across agri-industry, community and landcare groups to help build local area networks. SLIS has now refined the 3 plus 1 which is, in effect, when small landholders progress through the existing SLIS learning event series, then move on and are comfortable seeking advice from the rural and industry networks that they have now become a part of.

Figure 1 represents the SLIS extension model. The first three stages (Introductory workshops, property planning and topic-specific field days) engage the small landholder on the learning continuum, taking them through awareness, knowledge and skills development, and leading to implementation of new practices and behaviours. Information, advice and support materials are designed especially for the small landholder audience and are aligned to help the learning process. Clearly, traditional rural information and extension processes were not readily applicable to the small landholder audience because their needs, understanding and capacities were totally different from typical mainstream broadacre farmers. This “stepped” learning model has been adapted by our Victorian colleagues who refer to it as the “ladder of learning”.

Figure 1. Model of small landholder information service

Importantly, it is recognised that “best practice” for small landholder extension is not necessarily the same as for existing commercial farmers. Typically, the commercial farmer has studied in agriculture, has grown up in an agricultural environment and often employs a private consultant. As such, and because the small landholder is usually only seeking a supplementary income, the SLIS model aims to take the client through to step 4 (3 plus 1) and sees this as the valid “best practice” level for them to realistically achieve.

3 plus 1 is also about establishing new collective social norms through local area demonstrations on key properties. Both the workshop series and the demonstration sites utilise social learning theory (Bandura 1977) which depicts learners as more active participants in the learning process, who are influenced not just by intellectual facts and information, but also by social interaction. Many participants in the SLIS training relate that they are most excited about building their local area networks. This enables the demonstration of desired behaviours and practices to be modelled which are important parts of achieving social change.
Getting down to business

The SLIS has adapted the traditional tools of agricultural and environmental extension – the field days, technical information products to be attractive to the small landholder, tied to awareness raising campaigns that create a call to action – to engage participants further with the program and its networks. As there was no "ready-made" extension model for dealing with small landholders, the SLIS model was designed to cater for experiential learning – both for the participants and the program. The plan was to engage, deliver, test effectiveness, modify, improve and do it all again.

In parallel with setting up the enquiry line, specific website and determining typical information needs, it was crucial to roll out the workshop series beyond the initial Swan Canning area to enable the social learning aspect of the program to function. External funding was accessed to take the workshop series throughout the south west of WA by ensuring that the topics and delivery would be attractive to a range of potential funders. As the funders had different themes and were seeking different outcomes, it was important to demonstrate how a holistic series of workshops would be able to deliver multiple outcomes. The attractions of this approach are in the efficiency of sharing costs, ability to market the workshops as offering “that much more”, and for the time-poor small landholder – a bonus way to access a number of learning opportunities all at the same time and place.

SLIS principles

Whilst the development, basis and content of the SLIS experiential learning model have been discussed, it is also worth understanding the principles that underpin the SLIS as they not only shape the design, delivery and outcomes, but form the core values for the delivery team.

Understand the client

Apart from developing an initial understanding of the small landholder client sector as described earlier and reinforcing this with the findings from Hollier et al. (2006, 2007), the SLIS approach has been to never miss a chance to find out more and then use that information. Over 5,000 small landholders have participated in the 150 SLIS workshops held during the past five years. How did we achieve such a high attendance? Almost all of these events were held on weekends because that is when clients were available.

Employ marketing tools for engagement

"What’s in it for me“ (WIIFM) is a well known marketing question that the SLIS employs frequently. Training activities and information products are targeted to appeal to the aspirations of the small landholder. If a program can help them to achieve the idyllic rural lifestyle without all of the property management challenges, then why wouldn’t it appeal? Likewise, in exploring potential partners and sponsors, the same question is asked to determine what the advantages are for them and thus, the best way to approach them. Products are given a certain appealing style so that clients can become familiar with the "SLIS look" and recognise it when further events are promoted. Promotional techniques such as targeted mail-outs, electronic promotion of flyers through regional partner advocates, and a negotiated regular spot in the Farm Weekly (a major WA rural newspaper) are some of the tools employed.

Make information appropriate

It was quickly realised that small landholders don’t generally understand the “language of agriculture”, so the existing information available to commercial farmers was not seen as applicable or it was too complex. All written information that is generated must pass the test of being relevant, simple, concise and interesting – and it should look good too! The innovative Noteworthy factsheet series has been especially developed by the SLIS in partnership with Kondinin Group (a national agricultural information, design and publishing company). Likewise, all presenters at the SLIS events are selected for their delivery ability and given specific directions on the type of information and message that is expected.

Build networks and relationships

This successful behaviour change program could not be delivered to such a broad audience as the WA small landholder sector without relying on networks. The SLIS has invested significant resources, time and energy on building relationship networks throughout the regions and with other programs. Crucially, enabling pathways for small landholders to become part of these existing networks is fundamental to their social learning.

The importance of absolute integrity in building these relationships can not be understated.
Flexibility is the key to innovation

Much of the success of the SLIS approach has been due to a willingness to be open to investigating new approaches to delivery and new ways to achieve desirable ends. When we needed to create a series of exciting information products we looked for a reputable private rural publishing partner keen to break into the small landholder market – the Noteworthy relationship with Kondinin Group resulted – and recently Landmark (a national rural industry company) have also joined forces so now we can distribute the factsheets far wider.

Plan and seek evaluation then be prepared to use it

Experiential learning must have a combination of evidence and judgement in how to use the gathered evidence to continuously improve. We recognise that the initial SLIS learning model was based on an “educated best guess”. However, we needed a clear, robust system of evaluation to allow us to answer a number of questions: Did it work? What could be done better? Are new behaviours being adopted? What difference are we making? What are the next issues/opportunities?

Every event that the SLIS delivers has a formal evaluation plan built in. The desired behavioural changes that the event is targeting are linked to the planned evaluation to determine effectiveness. One of the challenges of evaluation is time-scale, but that can be planned for too. For a comprehensive discussion of the SLIS evaluation methodology, see Gannaway et al. (2009 in press).

A word of warning – you must be prepared to act on the evaluation evidence that is gathered and interpreted for the experiential learning process to work. There may be a temptation not to ask the hard questions because you may not like the answer, but be bold because if you truly trust and follow the cycle then the results will continue to improve. Even a good thing can get better.

There are many examples of how the SLIS has used evaluation feedback to modify and improve. The example of tailored information such as the Noteworthy series was created during 2007/08, based on at least two years of feedback. The workshop series has been a continual evolution, with a particular emphasis now placed on accessing as many quality local presenters as possible. This delivers both the key learnings as well as the social networking element that is becoming increasingly important to participants.

3 plus 1

Apart from the tailor-made model, SLIS recognised that the extension and education program including information products and learning events can only get the small landholder so far down the pathway of implementation. Importantly, as SLIS resources were constrained, it was necessary to design a model that could engage service providers beyond SLIS to help with extension and to provide on-going capacity – this is the 3 plus 1. SLIS has been working with traditional agricultural and environmental service providers to create a linkage from the activities facilitated by SLIS to those networks. This has involved educating rural service providers about how to engage with the small landholder as well as providing an introduction to these landholders as a way of developing networks. Many rural suppliers are now co-presenters at the various workshops and field days.

It was necessary for SLIS to delve into marketing concepts to help engage the rural service providers as well as the clients. Many service providers were conscious that small landholders were potential clients, but they were nervous that they were “high demand – low profit” (spend a lot of time asking questions then don’t buy much). They did not appreciate that the small landholder client could become a valuable customer and take up much less of the provider’s time if they were part of the SLIS program. However, they are well aware of the large number of potential new clients. A number of rural providers (led by Landmark) now are keen to engage with both the SLIS extension program and increasing numbers of small landholders. This demonstrates the value of 3 plus 1.

How effective is the SLIS approach?

This question can be answered thanks to the comprehensive evaluation data that has been collected. The SLIS has had more than 5,000 participants through just over 150 workshops during the past five years. Annually 60-80 per cent of these participants are new to the program reflecting effectiveness of promotion and engagement. It is estimated that participants are responsible for managing at least 47,000 hectares of catchment, but this has been under-reported, as not all events gathered this data. Annually, the SLIS is engaging around 1,000 landholders through its workshop series as well as fielding upwards of 900 enquiries.

Those workshop participants who have been previously engaged with the program are asked at workshops to provide information on any new behaviours arising from their exposure to the program. In 2007/08, 35 per cent indicated they had some previous engagement with the program. Eighty per cent of these past participants described positive new behaviours; while more than 95 percent of all participants described new actions that they intended to implement following a workshop (i.e. 15 per cent hadn’t quite got to the task yet). In a separate post workshop random survey of 10 per cent of participants in the 2007/08 program, 90 per cent described new behaviours that they could attribute to their engagement with the program.

**Applicability in the broader practice of extension**

The test of the SLIS approach has been its adaptability to the national level. In April 2008, a national forum of small landholder extension practitioners was held which culminated in the forming of a National Network for sharing of ideas, information, resources and methodologies. This group has been endorsed by the federal Primary Industries Standing Committee. The SLIS approach received wide interest and acclaim through national partners and there is much interest in applying similar approaches in various states. There is increasing interest in how the SLIS approach could be adapted to some “mainstream” agricultural extension projects as well.

The small landholder rural and peri-urban sector is a growing sector that will continue to provide challenges and opportunities for extension delivery. If future agricultural extension policy and practice does not adequately cater for this sector, the combined consequences of increased biosecurity risks, poor land management and the continued loss of productive agricultural land capacity could be dire in terms of cost, lost food production potential, and lost opportunities to help build resilient communities.

A positive alternative is to foster cross government and industry networks to provide complementary learning resources and pathways to improve the engagement of small landholders leading to the adoption of behaviours that respond to community natural resource management and food production expectations.

The SLIS experiential learning model and the value-adding 3 plus 1 extension to the program provides a suggested model that can be shared and adapted to facilitate these outcomes.

**References**


Intentional Innovation Communities: A strategy for radical improvement of Australia’s innovation performance

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Introduction

Contemporary thinking on encouraging innovation within firms has converged on the concepts of “Open Innovation”, “Knowledge Creation” and the proposed democratising of innovation (Bessant and Venables 2008; von Hippel, 2005; Chesbrough, 2006). Within R&D, the generational development of research, that is 1st to 5th generation research models (Table. 1) follows the same evolution towards open innovation, carried by the contextualisation of science through society and industry pressures (Nowotny et al. 2001).

Table 1. Generalised description of the development of research management practice characterised in “generations” of R&D.

<table>
<thead>
<tr>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
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</thead>
<tbody>
<tr>
<td>Technology as Asset</td>
<td>Project as Asset</td>
<td>Enterprise as Asset</td>
<td>Customer as Asset</td>
<td>Knowledge as Asset</td>
</tr>
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<td><strong>Core Strategy</strong></td>
<td>R&amp;D isolated</td>
<td>Link to Business</td>
<td>Technology/ Business Integration</td>
<td>Integration With Customer R&amp;D</td>
</tr>
<tr>
<td><strong>Change Factors</strong></td>
<td>Unpredictable</td>
<td>Inter-dependence</td>
<td>Systematic R&amp;D Management</td>
<td>Accelerated Discontinuous Global Change</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td>R&amp;D Overhead cost</td>
<td>Cost-Sharing</td>
<td>Balancing Risk/Reward</td>
<td>'Productivity Paradox'</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Hierarchical; Functionally Driven</td>
<td>Matrix</td>
<td>Distributed Coordination</td>
<td>Dimensional' Communities of Practice</td>
</tr>
<tr>
<td><strong>People</strong></td>
<td>We/They Competition</td>
<td>Proactive Cooperation</td>
<td>Structured Collaboration</td>
<td>Focus on Values and Capacity</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td>Minimal Communication</td>
<td>Project to Project Basis</td>
<td>Purposeful R&amp;D/ Portfolio</td>
<td>Feedback Loops and 'information persistene'</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Embryonic</td>
<td>Data-Based</td>
<td>Information-Based</td>
<td>IT as a Competitive Weapon</td>
</tr>
</tbody>
</table>

Adapted from Amidon (1996)

The reason for this shift is that it is well understood that the innovation process is creative, dynamic and opportunistic. It follows that an environment that encourages active, spontaneous and ongoing contributions is required to cater for and support this creative process. Isolated examples of firms that encompass this open management ethos (e.g. Gore) demonstrate a shift to Mode 2 type research management models (Table 2), which create an innovation-friendly environment.

However, acknowledging that the source of innovation is not fixed within firms and in fact can be unaffiliated individuals, customers, other users, manufacturers, suppliers and other unexpected actors, leads to the realisation that there is an opportunity to create new institutional forms in the wider community devoted to the production of innovations. The new institutional forms need to be both “hothouses” and “safe houses”.

Table 2: Mode 2 Knowledge Production; Evolution of modern management concepts indicating the overlap with Generational Research (Table 1) management development.

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Research Generation</td>
<td>1st</td>
<td>2nd to 4th</td>
<td>4-5th</td>
</tr>
<tr>
<td>Management Attributes</td>
<td>Data</td>
<td>Information</td>
<td>Knowledge</td>
</tr>
<tr>
<td></td>
<td>Product</td>
<td>Solution</td>
<td>Innovation</td>
</tr>
<tr>
<td></td>
<td>Accounting</td>
<td>Strategic Planning</td>
<td>Strategy</td>
</tr>
<tr>
<td></td>
<td>Moving something from one place to another i.e. “creator to receiver”. e.g., from engineering to manufacturing; labs to industry</td>
<td>Management of technology focus with a growing recognition of value of research partnerships.</td>
<td>Knowledge network: beyond the confines of a company, laboratory, or place.</td>
</tr>
</tbody>
</table>

Adapted from Amidon (1993)

This is an intentional integration process which will take full advantage of the industrial and societal contextualisation of research that as pointed out by Nowotny et al. (2001) is occurring now. In so doing, the intention is to fully utilise this new entrepreneurial environment to make best use of finite non-renewable natural resources, while maintaining and improving our living conditions.

The aim here is, through this mechanism, to create value for Australia from new knowledge and improve our international ranking on innovation performance (Powering Ideas, 2009). This paper introduces and explains the concept of an Intentional Innovation Community and outlines a proposal for implementation of pilots for a demonstration project in a rural / regional setting in Australia.

Rationale

It is a self-evident truth that a bright future for Australia depends on our international competitiveness, which relies on high levels of productivity, which in turn rely on Australia achieving and maintaining a world-class innovation system that has outstanding performance in producing innovations. Within the reports Venturous Australia and Powering Ideas it is noted that Australia currently ranks in the third and bottom quartiles on most significant international measures of innovation performance. This is more than a surprise and a disappointment to those who have worked long and hard to improve Australia’s innovation performance over the past 20 years; it is a clarion call to change and improve the way we innovate. Our relative decline is masked by the resources boom, but it would be foolish to imagine it isn’t a fact of life.

What is proposed here is innovation in innovation -- new thinking about institutional and social organisation “for innovation”. We recognise that as a nation we have talent, energy and creativity to burn, but we (and the talent) just have not worked out how to use it. Some organisations are beginning to tap into this vast pool of talent (e.g. games developers) and it’s time to experiment with new forms of social organisation that go directly for the jugular, to radically improve our innovation performance so we can improve our productivity and hence to maintain and improve our international competitiveness. It is clear that more of the same is unlikely to “cut the mustard” and that we need to strike out in new ways to tap Australia’s huge latent ability to innovate.
Intentional Innovation Communities (Atlatls4)

In this paper innovation is defined as the process that creates new knowledge and uses new and existing knowledge to develop new things that work and are useful and of value in society.

Australia’s poor performance relative to our competitors as measured by international innovation rankings is due, in part, to us not yet having found the way to build a critical mass in our innovation effort in our wider community and, in part, to not yet finding the way to fully exploit the strengths of our national peculiarities.

Atlatls address both these challenges. They will be new places to assemble critical mass for innovation in Australia and to build on the strengths of our peculiarities. Their design is based on three key propositions:

1. The largest untapped resource in Australia able to produce innovations is the largely unorganised cohorts of individuals who have the skills, aptitude and ability – or latent ability - to produce innovations.
2. These individuals, in the main, live, work and operate outside universities and research institutes.
3. The most direct way to improve our innovation performance as a nation is to transform innovation from being an essentially private process to becoming an essentially social process. (In a private process new knowledge is created by an individual or a small group and held very close-to-the-chest; in a social process innovations may be initiated by one or several individuals, but from the very earliest stages it is more open and welcomes and thrives on collaboration).

The objective here is to radically improve Australia’s innovation performance and our international rankings within a manageable time frame.

The plan

We plan to design and implement two sets of pilot projects to establish, operate and evaluate the performance of communities of individuals who, as a cohort, have the skills and experience required to take ideas from their creation through to becoming innovations and that have as their sole and deliberate purpose, the production of innovations.

The communities will be set up as formal structures, possibly as legal entities. It is envisaged that:

- Two pilots will have 7-10 members and a similar number of participants; and
- Two will have 20-30 members and 15-20 participants;
- The run-time for evaluation of the pilots will be 18 months – 6 months for their establishment and 12 months of operation. This should be sufficient time for the pilots to demonstrate they are on the path to showing how to achieve improved innovation performance through institutional innovation and be within the scope of current policy and budget allocations/processes to respond to.

Each community is to be constituted with registered members and registered participants. Registered members will be: unaffiliated individuals (sole operators, independent people, etc.); and individuals affiliated with small, medium-sized and large corporations, universities, research institutes and government agencies, but who operate in a community as individuals and not on behalf of the affiliated organisations that engage them. It is anticipated that only a minority of members will be drawn from existing universities and research institutes and that most will not be affiliated with these institutions or engaged by very small companies, Small to Medium Enterprises (SMEs), larger firms and/or public sector agencies.

Members of a community will be stakeholders who have voting rights for decisions related to establishing and maintaining good governance of the community. They will be recruited from talented and skilled individuals who live or work in the region, in local universities and research institutes, in very small companies, SMEs and larger corporations, and in local, state and Australian government agencies in the region that have a stake in the region.

Registered participants will be: very small companies, SMEs, large corporations, universities and research institutes (and their constituent laboratories, centres, etc.), consulting and related service organisations, public agencies and other bodies and individuals with the skills, experience and ability to add value to the members’ ideas and abilities and the products of these qualities. Participants will play a range of roles in working with members in facilitating and

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4 An Atlatl is a launcher – the Australian aboriginal woomera is a form of atlatl. Pronounced at.lat.il.
assisting in implementing the innovation process, ranging from advancing early stage ideas through to direct participation in prototyping, testing, commercialisation and funding.

For each pilot and demonstration, community members and participants will be carefully and systematically recruited to form a cohort of individuals with the synergistic skills and abilities to create new ideas and to work in groups of individuals and as groups with participants and actors in the wider community to transform their ideas into innovations. The cohort of individual members in a community will have a diversity of skills, capabilities and experience. Some will be inventors and initiators; some will be entrepreneurs; some will have specific business skills, e.g. in developing business models; others will have specific skills in human resource management and in non-business organisation; still others will bring with them a rich network of contacts and alliances capable of adding value to the work of the community, and so on.

Place is important. The pilot and demonstration projects will draw members from the geographical region in which they have a primary interest as this will provide relevant context. Specialisation will also be important, within limits, recognising that innovation is often serendipitous and can lead innovators into unfamiliar territory where they did not intend to go at the start of their journey.

Communities will gain greater definition by: having a sector-specific focus that might include but not exclusively, health, rural health, primary industry and agribusiness, manufacturing, climate change, food production, local government services, financial services, fashion, sporting goods, community welfare; and/or focusing on either commercialisation as the means to create value (for new market-driven products and services) or non-market mechanisms and processes (e.g. for social and institutional innovations).

Focus decisions will include having creation, adoption, adaptation or a combination of these as their starting plan; initially defining the stage of the innovation process in which they will focus their attention, for example earliest idea generation, project emergence, early value-adding, partnering and later stage transformation and realisation with the possibility of a matrix of these foci being likely. In addition it is recognised that in some cases a community may shift its stage-focus away from its initial plan.

It is a perquisite that members and participants interact with each other; achieved through face-to-face and cyberspace communications. Web 2.0 tools will be tailored to appropriately enhance collaboration between members of a community, between members and participants and between members and participants in the community and the wider world.

Each community’s management team will assemble and maintain cohorts of members and participants with a mix of skills and capabilities matched to the community’s needs in advancing ideas and transforming them into innovations. In addition, the incorporated body will own some equity in all intellectual property brought into and generated in the community. However, all inventors, initiators and contributors who add value to an idea/project will acquire equity in the resulting innovation as a function of the quality, quantity and value of their contributions.

**Conclusion**

As Einstein observed, it is insane to continue to do things in the way that we have before, and expect better outcomes. In Australia this observation seems extremely pertinent, because we are currently benefiting from the exploitation of our limited natural resources, have a demonstrated but fragmented capacity to innovate, and are now experiencing and adjusting to the worldwide trend of socialisation and industrialisation of research.

In order to take advantage of our socio-economic position and particular national peculiarities, a different approach to innovation is clearly required. The approach proposed in this paper is aimed at taking best advantage of our current opportunity; that is to utilise the strength of our innovators and industry, community structure and research capacity to create and maintain contextualised and productive Intentional Innovation Communities.

**References**


