Organising for change – a national approach to meet the challenge for the Australian dairy industry

A.E. Crawford, M.S. Paine[*] and T.M. Davison[**]

Abstract

The dairy industry is an important agricultural industry in Australia, but facing increasing complexity and external challenges. As an industry we were disorganised on a national scale in farming systems research, development and extension (RD&E), which meant that there was the possibility of missed opportunities. There was also a developmental opportunity to move from farmlets as the only approach for farming systems RD&E, to a broader, more comprehensive suite of approaches.

The National Dairy Farming Systems project was established to address this. Key areas of development were; integration, methodology, modelling and extension. There have been challenges to implementation, but we have gone a way to achieving cultural change and a national perspective within the farming systems RD&E network.

Foreseeable global challenges for the dairy industry include; farming systems and supply chain management, privatisation of knowledge, and risk. Farming systems RD&E is well placed to address these issues as we move beyond the farm to organise on a regional, and national, basis. A development agenda has been emerging from the work of the NDFS project that is charged with mapping a path for future farming systems RD&E that will cope with these anticipated challenges. These challenges are likely to involve stronger links between on-farm practices and innovation in supply chains, a capacity to better manage new innovations in relation to labour issues, management of critical natural resources like water, and fostering co-learning opportunities with our partners in south-east Asia.

There are also methodological and implementation challenges to be addressed – increasing our systems thinking capacity; improving extension outcomes and professionalism; and overcoming institutional boundaries, for example. At another level, the question has been raised as to whether overcoming these challenges will be sufficient, or whether it is the responsibility of the NDFS project to engage and inform RD&E policy in order to achieve change.

There is a very exciting future for dairy production which will rely heavily on new innovations that do more to extend the product quality and product differentiation opportunities in a way that ensures dairy farmers capture and retain the majority of the benefits. This may mean we will see even greater diversity in our farming systems and associated supply chains, with a focus on improving the recognition of the health benefits arising from improved land and animal management practices.

[*] Institute of Land and Food Resources, University of Melbourne, Victoria, 3010, Australia. (Email: acra@unimelb.edu.au, mspaine@unimelb.edu.au).

[**] Dairy Australia, Locked Bag 104, Flinders Lane, Melbourne, Victoria, 3009, Australia. (Email: tdavison@dairyaustralia.com.au).

Introduction

There's no argument that dairy farming in Australia has changed significantly over the past 20 years. But how well placed are we to deal with the challenges that the next decade or two will bring? The future of our industry will depend on our ability to develop farming systems that deliver adequate returns on the capital invested, and that also enhance or maintain the status of our natural resources and provide a rewarding lifestyle for dairy farmers (DRDC, 2002).

This paper reports on a distinctive and new approach to farming systems RD&E for the Australian dairy industry. An industry-funded national project, National Dairy Farming Systems (NDFS), was developed and implemented to improve integration of outputs from existing farming systems projects, facilitate the adoption of innovative learning approaches, and establish guidelines for the design, implementation and evaluation of farming systems RD&E.

Key areas of development have been integration, methodology, modelling and extension and these are briefly addressed. New challenges involving project alignment, clarity of communication of the concept, relating investment to outcomes and adapting to emerging challenges as we change the way of operating in projects in real time exist for the Australian dairy industry. Research and Learning portfolio development will also be influenced by the shared global challenges of improving supply chain management, privatisation of knowledge, and risk, as well as unforeseeable challenges.

What are the types of farming systems we will need as we enter a period of increasing complexity for land managers? How will our farming systems cope with the current and future demands for environmental certification, the impact of globalisation, issues of intellectual property rights, food safety and quality assurance, and changes in trade labelling? These are the issues that are confronting both the dairy industry as a whole, and individual dairy farm businesses, as they increasingly influence the boundaries of operation and modern farming practice.

Farming systems RD&E is well placed to address these issues as we move beyond the farm to organise on a regional, and national, basis. A future development agenda for farming systems RD&E is proposed and key criteria for new projects outlined.

Background

The Australian dairy sector is one of Australia's leading rural industries, with an annual farmgate value of approximately AUD$3.7 billion and accounting for 16% of world dairy product exports (ADC, 2002). The sector is a cost efficient producer of high quality milk, with feed systems predominately pasture-based. Recent deregulation of the dairy sector, along with market forces, has applied pressure on dairy farmers to remain competitive (ABARE, 2001). Australian farms have generally become larger and more efficient in response to these competitive pressures. The majority of Australian dairy farms are family owned and operated, with farm numbers rationalising from 22,000 in 1979/80 to 11,000 in 2001/02, whilst herd sizes and annual milk yield per cow have increased (ADC, 2002). These performance increases were due in part to the contribution of Australian dairy RD&E, with a primary focus on achieving productivity gains through improving herd genetics, pasture management and supplementary feeding efficiency.

Dairy Australia (DA) is responsible for managing the sector's farmer-paid research levy and matching government funds, on a national and local level. DA invests around AUD$25-30M each year in research conducted by research providers, such as government departments of agriculture, universities and other research institutions (DRDC, 2002), covering all aspects of the sector from on-farm production to manufacturing, economics and marketing.

In recent years, the Australian Federal Government (and some State Governments) has emphasized a need to address rural and regional development initiatives in terms of a 'triple bottom line' that accounts for the economic, social and environmental impacts of change. The dairy sector has responded to this by using an inclusive approach to planning, design and evaluation of new project proposals.

Recognising the need to take a systems approach to dairy research and extension, farmlet research (small farms) was generally the tool of choice for farming systems RD&E, with farmlet projects established in most dairying regions across Australia. These used small dairy herds to research the impact of specific issue such as optimal stocking rate or supplementary feed levels. However, farming systems RD&E was threatened because of the escalating costs of such an approach, and questions as to the wider relevance of the research and impact of the learning. Such projects were state-based and regionally focused, with no concept of national farming systems issues (Figure 1). There were few linkages between projects other than some networking between projects leaders on a discipline basis, and no integration. It was recognised by many that this was a missed opportunity to increase the return on what was a significant investment.

The shift from farmlets to farming systems was not accidental, but driven by the key investor in dairy research, Dairy Australia (formerly Dairy Research and Development Corporation). The opportunity existed to link nationally. This could be more cost-competitive but was not going to be an easy task.

The existing suite of projects operated within different institutional boundaries, with different experimental protocols and framing of research questions, across different climatic zones and farming systems (eg rainfed perennial pastures vs. tropical grasses, year round calving vs. seasonal calving). The response to this challenge for integration was not about a traditional technical-scientific model, but can be considered within four key themes – integration, methodology, modelling, and extension. There has been significant learning and cultural change around these areas.

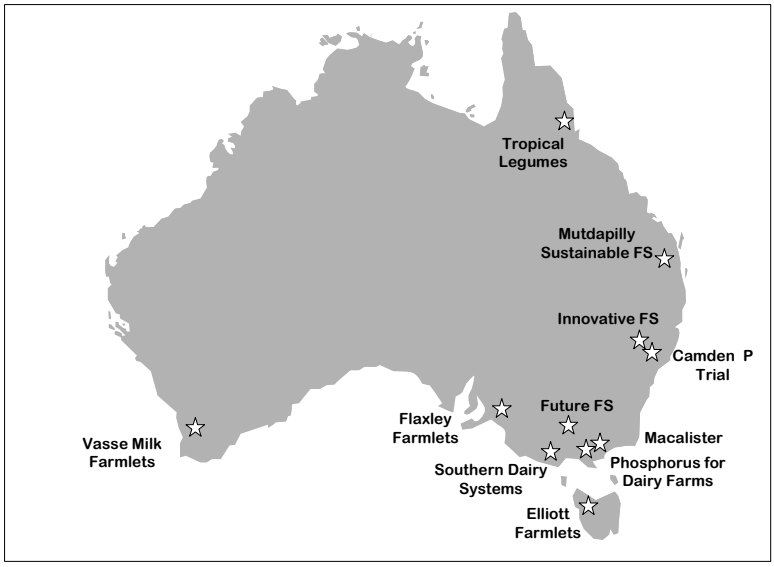

Figure 1. Location of many recent and current farming systems projects within the Australian dairy industry

Responding to Increasing Complexity

After extensive consultation with researchers, extension officers and investors, the National Dairy Farming Systems project was established, with three key objectives:

1. Identify and provide new knowledge on key national issues by cross-site integration, through the use of collective expertise and innovative farming systems tools;
2. Test new learning resources, and use existing resources more effectively, to improve productivity and environmental outcomes through advances in the design and evaluation of learning processes that operate in farmlet projects; and
3. Test a new framework for guiding investment in farming systems RD&E by real-time comparison of empirical, modelling and systems research approaches.

This was a distinctive and new approach to farming systems RD&E for the Australian dairy industry, and is addressed here through four key themes. The integration theme related to linkage mechanisms required for projects with different objectives and stages of development. Project managers' use of a common methodology (second theme) was a central aspect of this integration to ensure data could be exchanged between working groups. The third theme of modelling enabled projects to explore interactions and the dynamics of system behaviour at less cost than using the more traditional experimental methods. The final theme of extension was required because the investors were relying on this project to improve the capacity of the industry to change and adapt to new challenges.

Integration

Integration has provided the glue for a national approach. Unlike other Australian agricultural industries, there was not the benefit of a 'clean sheet of paper', rather the projects that required integration were at various stages of development and implementation. Furthermore, they were all state-based. The challenge here was to integrate existing projects, rather than initiate a comprehensive new RD&E project. This provided a test for the national approach, but also opportunities as there was the chance to learn from the experiences of project teams and implement an informal continuous improvement cycle. These challenges were addressed through methodology, modelling and extension.

Initial ideas for the national approach included a common database, virtual field days, workshops and discussion groups. Whilst these ideas were all exciting on paper, and had worked in other industries (eg Scott and Lord, 2003; Simpson et al. 2003), consideration of resource availability and maximising the cost-benefit equation soon focused activity. Ideas such as a common database were discounted when it was considered that the benefits for our situation were uncertain for the substantial investment of both funding and effort into such an approach.

Developing a 'national culture' was also a key objective for the National Dairy Farming Systems project, and any level of integration was unlikely to occur without this cultural shift. A significant tool for this approach was the annual NDFS project workshops, which involved the project team, representatives from Dairy Australia, research and extension officers from dairy farming systems projects across Australia, and more recently, key dairy farmers. These workshops have been viewed as instrumental to fostering a 'national' approach and developing capacity for farming systems RD&E. These have been held in different regional locations each year with a view to allowing participants to view a specific farming systems project first hand.

Participants were responsive to these workshops;

> *I am more focused on a national application (previously more state focused). I am looking for transportability and reducing redundancy of ideas/RD&E in which I am involved (to other states and between farming systems that operate throughout the nation).*
>
> (A participant's response to the value of attending the 2003 Annual Workshop)

Fostering a 'network' of farming systems practitioners has been seen as one of the greatest areas of progress for the NDFS project and has been well supported (Mason et al. 2003).

Methodology

The methodology used by the NDFS project aimed to improve the implementation of farming systems projects. Several developments were facilitated by the project that collectively built a national capacity to improve the performance of projects operating at a regional level.

Experimental protocols

Workers identified that a common methodology, or experimental protocols, for farmlet research was essential. This would ensure that research results would be comparable on a national basis as experimental data was collected using the same methods, attributes and units. The development of experimental protocols was coordinated by farming systems researchers in the first instance, who identified the need and self-organised. The protocols were then completed, refereed and edited by the NDFS project, and presented in a folder as an output. The protocols were designed in a manner which allowed revision, as it was important that they could be readily modified as advances in methodology were made. Whilst specifically designed for farmlet projects, they are now available as a resource for all new farming systems projects which involve the measurement of biophysical attributes around a dairy farm system.

Guidelines for Farming Systems RD&E

The move to farming systems RD&E within the dairy sector has left investors, providers and users grappling with the different design, implementation and evaluation approaches required to ensure that the expectations of all involved are equally met. To overcome these challenges, it was identified that the development of a framework to guide farming systems RD&E in Australasia would advance the national capacity to design, deliver and evaluate farming systems projects in a rigorous and efficient manner. A workshop was held in New Zealand in Nov. 2001 with Australian and New Zealand participants from industry, research and extension, representing 5 different grazing industries, 23 organisations and a variety of disciplines. The workshop included a combination of plenary and small group activities, based on participants' actual experiences, to develop aspects of the framework and guidelines. These were further developed through an iterative process with feedback obtained and incorporated from a broad range of participants. The published guidelines (Barlow et al., 2002) are now available for use by farming systems teams and investors.

Modelling

The increasing complexity of farming systems is likely to result in greater investment in confounded systems RD&E. The response to modelling varied from 'no place' in farming systems RD&E to 'the tool to solve all problems'. The potential identified by the investors and others has encouraged the exploration of using modelling to enhance learning processes (Weatherley et al., 2003) and assist with

the associated planning, understanding and interpretation of project outcomes. There are also epistemological issues raised when introducing modelling into farming systems projects - there are different ways of knowing and this can be confronting for people working in knowledge industries.

One approach has been to support the use of DairyMod, a comprehensive biophysical model, within current farming systems projects, providing a stimulus for more innovative, intellectual and informed discussions about farming systems. DairyMod (Johnson et al., 2003) was a research tool developed as a parallel project in the dairy industry. Workshops with farming systems researchers provided a process to apply the model and allow people to identify opportunities within their own research projects. There has also been strong endorsement from investors that desktop studies to explore a specific research question are now integral to the planning and design activities for new farming systems RD&E. This ensures that modelling approaches are influencing both design and experimental protocols.

Extension

Historically, extension and learning has been viewed as the weakness in farming systems projects. A core objective of the National Dairy Farming Systems was to counter this, and ensure that extension and learning opportunities were maximised. One approach has been to standardise the development of extension strategies, using a facilitated workshop process which identifies objectives, key messages, resources and timelines for development and delivery.

Research undertaken on research farms has often been questioned as to the relevance to commercial farms due to the real, and perceived, differences in resourcing and business focus. It is also difficult to undertake true measurements of the impact of new technologies on business management, labour and social issues. To address these concerns, a popular extension methodology has been the use of 'companion' farms – commercial farms aligned with the farming systems project. There are a number of developmental issues to be addressed which include defining the role of the companion farms (farming system vs. management) and refining its place in extension strategies and research design, and contribution to the development of broader principles. This will be approached as a joint initiative between the National Dairy Farming Systems project team, investors and farming systems research and extension workers.

Other issues to be resolved include a greater understanding of the selection of extension instruments (the underlying drivers, principles and ethics, and the benefit-cost analysis of change management), and the role of researchers in extension, and how extension influences research questions. Extension skills, leadership and capacity are all important drivers for increasing the professionalism of the extension profession.

It is likely that there will continue to be a coordination role for the National Dairy Farming Systems project, to ensure that developments in the areas of integration, methodology, modelling and extension amongst farming systems projects in the dairy industry continue. However, we are now well placed to build upon existing achievements to further build capacity and innovation within the sector. Before expanding on these proposed initiatives, we'll firstly outline some foreseeable new challenges for the Australian dairy sector.

New Challenges for the Australian Dairy Sector

Changes in the agricultural sector have occurred as a result of increasing competition, the privatisation of information sources, and the move towards a risk society. So how might this affect the future of the Australian dairy industry?

First, increasing competition. We are starting to see some changes in dairy production whereby the industry was once cooperatively organised and farmers helped other farmers out in times of need. In recent years the demand for greater efficiencies at the farm level has seen some erosion of this cooperative approach between some producers. One way farmers gain an advantage over others is to adopt innovations before others. It's common knowledge that the biggest gains come early in the life of new technological innovations, but in the end the long term beneficiary is the consumer or the supermarket. This process has been described as the 'Technological Treadmill', which means that farmers have to adopt more and more technology and intensify just to maintain their business profitability. It is not uncommon to talk with farmers who say they will need to be running herds of over 300 cows just to stay in the business. We know that the pressure on managers is not going to be just about feeding more mouths. It will also mean milking more cows per labour unit and utilising more feed per cow etc.

A European response to this increasing pressure has been to differentiate products in a way that ensures distinctive product quality features capture a price advantage back to the farm.

Privatisation of knowledge has been observed in a recent national study of the Australian dairy industry (Joly, 2003; Paine et al., *this conference*). The past two decades have seen an increasing trend for information to be supplied by the private sector, with the State Departments having to take more responsibility for services and issues relating to the management of natural resources. Private sector services are usually specialised and relate specifically to the shareholders' interests of those companies. Farmers are increasingly required to provide informed views on information preferences.

We will also see more property rights exerted over technologies in the future. For example, Monsanto controls 80% of the market for genetically modified plants. The economic and environmental impacts of such changes and the concentration of power among a few large global companies maybe quite far-reaching and we do not fully understand how this will work itself out. What is clear is that there will be increasing standardisation of farming practices and more dependence of farming systems on external technologies that are often controlled by patents.

We are entering the era of the risk society. What this means is that people are more aware of the costs of making errors in food industries, and that the consequences of errors are far greater than in previous years. We now need policy regulators to work with industry leaders and community representatives to develop more cooperative and reasonable solutions to manage the principal risks to our industry and society. A failure to work together will result in increasing conflict and division between sectors of the community such as 'those who are for' and 'those who oppose' bio-technologies, or who advocate more environmental protection as a basis for building a more sustainable future, or who view organic farming practices as the ideal (Joly, 2003).

In terms of the future of the dairy industry, one view is that farmers will have less control over their farms than at any time in previous history. Increasingly, decisions about the direction and development

rates of farm businesses will be made by finance companies, processing companies, marketing groups and supermarkets, environmental policies, urban development interests and so on.

An alternative view is to say that there is a very exciting future for dairy production which will rely heavily on new innovations that do more to extend the product quality and product differentiation opportunities in a way that ensures dairy farmers capture and retain the majority of the benefits. These developments will require a form of branding and labelling that gives evidence of the care and skill involved in producing milk and dairy products to specifications that satisfy consumer expectations.

We are, and will remain a low cost commodity based industry, but a drive for increasing efficiencies from improved logistics management and through advances in food processing technologies need not conflict with the idea of *terroir*[1], as already demonstrated in the Australian wine industry. This may mean we will see even greater diversity in our farming systems and associated supply chains, with a focus on improving the recognition of the health benefits arising from improved land and animal management practices.

A Development Agenda for Farming Systems RD&E

A development agenda has been emerging from the work of the NDFS Development Group (including farmers, researchers, advisors and investors) that is charged with mapping a path for future farming systems RD&E that will cope with the anticipated challenges outlined above. These challenges are likely to involve stronger links between on-farm practices and innovation in supply chains, a capacity to better manage new innovations in relation to labour issues, management of critical natural resources like water, and fostering co-learning opportunities with our partners in south-east Asia.

Farming systems and supply chain innovations

In order to grow a sustainable dairy industry, we must continue to be innovative and responsive to new opportunities. This includes identifying real opportunities to value add, develop new markets, differentiate our businesses and respond to international directions and influences. A project planning activity was initiated in early 2003 to build on findings from a study tour and the European Farming Systems conference in 2002. These experiences identified new possibilities for Australian dairy farming systems that focus on the relationship between geographic location, farming system and supply chain innovations. This work is at the pilot study stage, working with the Atherton Tablelands, a well defined dairying region of Australia, and has considerable commitment from all participants involved in the relevant supply chain.

The Grow Malanda strategy, developed in 2000-2001, provides a strong foundation for identifying the future for the Atherton Tablelands dairy industry. An industry forum and specialist workshop was designed to assess the variety of opportunities that exist for the region. These opportunities included everything from niche branding to designer milk and specific breeding programmes, and presentations considered the market potential for each option, the costs of implementation and change, and how it fitted with the Atherton Tablelands dairy industry. These options were prioritised and further

[1] The mix of agro-climatic factors, local knowledge and specific genetic resources that create a unique product that is branded and protected.

development considered by industry partners such as Dairy Farmers (the local processor) and the Atherton Tablelands Sustainable Region Advisory Committee (ATSRAC).

A rural development view of the NDFS project recognises that among many stakeholders, farmers play a strategic role in the initiation and further elaboration of land management practices (van der Ploeg and Renting, 2000). Not surprisingly, modernisation trajectory (continual growth and scale unsustainable), access to available resources, and increasing work satisfaction were identified as key rural development drivers (van der Ploeg and Renting, 2000). Under Australian conditions we were interested in identifying new opportunities that did not over-expose farm businesses to further risk. Observing developments in European farming systems suggested some opportunities may arise from product specialisation. Concepts such as '*appellation controllee*' are not as well developed in Australia as Europe, and for the dairy industry, likely to occur on a smaller scale through individual farm businesses rather than regional organisation. Dairy farm businesses are essentially orientated to the production of a single product (milk), and for many farmers, dialogue and initiatives around multi-product development, regional specialisation or niche marketing is only a diversion from their key concerns of securing a higher milk price and a more adaptable and profitable farming system. Unsurprisingly, therefore, that key project areas identified as investment possibilities at the Advancing Grow Malanda workshop were essentially about improvements to the current farming systems to increase milk production, development opportunities to encourage young people to enter and stay in the industry (thereby increasing the longer term viability of the dairy industry in the Atherton Tablelands) and manipulating milk production to increase protein content as identified by the milk cooperative.

A development agenda is now emerging for the project that has attempted to address the issues and experiences described above. This agenda includes a conventional productivity focus accompanied by concerns for improving natural resource management.

Technology and new innovations

The 1.6% annual rate of growth in productivity (outputs over inputs) in the Australian dairy industry is a concern to the investors and leaders in the sector. The sector aims to increase this rate to 3%. One way of achieving these gains is through efforts to reduce labour and feed costs which account for over 50% of the total costs for milk production. This issue of labour efficiency relates to both the management of labour and the availability of skilled labour.

A new project is being established to address these issues. Though located in New South Wales it will be national in its focus and delivery to the sector. The design of this project recognises the interdependence of technical and social research studies. Investigations of new forage, feeding and milking options will focus on innovative technologies to address the efficiencies of labour to contribute to increased productivity. Developments will integrate technical, economic and social issues in the establishment of a national extension network. Support for learning between the research farm and farmers will be provided using an appropriate framework for the design and evaluation of technological innovations. These innovations need to be negotiated on a regional basis, and therefore are dependent on advances in the social research part of the project. Consequently, learning and adaptation processes are topics of research in their own right within this project.

Water

Recognition of water as a valuable resource has increased many fold within Australia during the past few years (The Wentworth Group, 2002). This has been exacerbated by recent drought across the country, increasing competition for water resources and changes in public attitudes to the allocation of water resources (Fullerton, 2001). This will increase the pressure on the dairy industry specifically as it is seen as a high water user, and low water use efficiency, enterprise.

The issue for farming systems is therefore to generate more productivity using less megalitres of water per hectare in a way that does not degrade soil, water or biodiversity. To date, most work in this area has involved the measurement of water use efficiencies of alternative forage species and modelling of biophysical and economic changes as a consequence of reduced water allocation. These studies are providing a basis for the design of field experiments. These experimental designs will form part of an inter-disciplinary study on water policies and farm management decision making.

Building dairy farming systems capacity in south-east Asia

We believe that we are sitting within the livestock revolution in south-east Asia, with an increasing demand for animal protein, driven by independent wealth, urbanisation and demographics (Steinfeld, 1998). To date, we have been focused on taking a national approach in Australia, but can now begin to look beyond the Australian shores. The ability to provide farming systems knowledge across a continuum of climate and farming systems ensures that we are well-placed to help develop the south-east Asia dairy industry, and also justifies investment in developing science capacity in more marginal areas of dairying here in Australia. This would provide the opportunity to utilise the intellectual property around the now well-coordinated Australian dairy farming systems RD&E and also provide opportunities to other researchers and assist with the integration of states, with growing interdependence within the farming systems network of researchers and extension specialists. For this to be successful, the Australian dairy industry would have to view our farming systems RD&E as critical to developing new markets and not just about improving productivity locally.

Moving from Agenda to Action

We have identified a number of challenges that must be addressed to increase the capacity for farming systems RD&E in the Australian dairy industry.

The development of systems thinking skills amongst researchers and extension officers is a significant challenge. We need to develop research and extension personnel with an ability to incorporate knowledge from experts into systems in a balanced manner and require experts with specific expertise to contribute in a context that is useful to farming systems RD&E.

Whilst a national approach has been encouraged through the vision and funding of Dairy Australia, around each individual farming systems projects exists a variety of funding partners. Each of these will have specific objectives and policy which can result in a mis-alignment of expectations. There are also power issues involved here, with conflicting objectives at a state and national level, and between private and public sector. Traditionally, research and extension personnel have also had different line management which hinders communication and collaboration across the RD&E continuum.

To date we have focused on a 'ground-up' approach, aiming to achieve national objectives through working with regional teams. However, there is debate as to whether this approach is sufficient to achieve the desired outcomes, or whether a greater voice in RD&E policy is required (Joly 2003). As a national coordination effort, the policy question is unavoidable, with respect to setting the agenda for RD&E. If we chose only to listen and respond to regional views, then it denies a national perspective across what is happening. This includes positioning with respect to other institutions. Agenda setting for RD&E within Australia is undertaken by a number of institutions, including Dairy Australia, the state Departments of Agriculture, and Regional Development Programs (RDP's). Meaningful consultation and engagement with these institutions is desirable.

The project design essentially employs a Constructive Technology Approach (CTA) perspective to accommodate both regional and national technology development expectations (Schot, 1999). This, however, provides additional challenges for the resourcing of the project, and employment of a multi-disciplinary approach, where different roles and responsibilities require negotiation. Achieving consensus through a negotiation process with key stakeholders is also difficult in the area of technological innovation for the dairy industry as there is mixed agreement on the value of the innovations suggested. Project design, implementation and resourcing also requires flexibility to allow for the required anticipation, reflexivity and social learning (Schot, 1999) to occur in a meaningful way.

Wide engagement in the NDFS project has been difficult to achieve. Greatest success has been with researchers and extension practitioners embedded within regional farming systems projects, reflecting the 'ground-up' approach. Developing an appreciation for a project such as this one to allow effective participation for other stakeholders has been more difficult, and in part, relates to its breadth of scope and intangibility. The project team tried several initiatives including: a steering committee, which was effectively disbanded due to lack of interest in the very early stages of the project; and a 'product development' group - convened after the demise of the steering committee to include farmers, researchers and extension specialists (over time this transformed to be less about product development and more about 'guiding' the development of the project). Whilst an appreciated role, this assumed a level of representation back to the regions which was inappropriate. In the future this provides a challenge back to the NDFS project to interpret its role in industry as new entrants come on board.

There has long been a willingness to fund researchers with specific technical expertise with the expectation that they will develop a research program. This opportunity rarely extends to professionals with extension and learning expertise. Subsequently, the researcher may be in the position of developing a research proposal in the absence of appropriate extension and social research support – second guessing the extension requirements for a specific project. This also relates to the professionalism of the extension professional and how we address this (eg a cooperative Centre for Change is at proposal stage). There is a need for equivalence in professional status (with respect to science) if extension is to be a real partner in the development of future farming systems projects.

Maintaining an ongoing capacity for extension is also problematic, with a high turnover in extension staff. Lack of capacity and strength in this area can compromise a farming systems approach, as traditional science continues to be the dominant paradigm. This provides the challenge to more fully engage with private enterprise and consultants, but can add additional costs and complexity to project development and delivery. Addressing the issues of professionalism could go some way to maintaining an ongoing experienced extension capacity.

We suggest the following as a key attributes for the development of new farming systems projects:

- Core business focus and a target of 10% Return on Investment;
- Desktop analysis from outset;
- Interstate and cross-disciplinary project linkages identified and resourced;
- Extension methodology (learning and practice) integral to project design; and
- Best environmental practice embedded within on-farm research.

Conclusion

The National Dairy Farming Systems project is a distinctive and new approach for farming systems RD&E in Australia. It has been instigated in order to improve integration of existing farming systems projects, facilitate the adoption of innovative learning approaches, and establish guidelines for the design, implementation and evaluation of farming systems RD&E.

Improving our capacity for farming systems RD&E within the dairy industry has been a process of incremental change. The establishment of the National Dairy Farming Systems project has supported this progression, with advances in the areas of integration, methodology, modelling and extension and a concurrent culture shift amongst researchers and investors. However, by its very nature, a farming systems approach must transcend funding disciplinary and institutional boundaries which have provided practical barriers to the successful implementation of farming systems RD&E. Opportunities to further develop the farming systems capacity for the Australian dairy industry have been identified to meet the new demands and complexity of RD&E issues.

There is a very exciting future for dairy production which will rely heavily on new innovations that do more to extend the product quality and product differentiation opportunities in a way that ensures dairy farmers capture and retain the majority of the benefits. If these elements were incorporated at the design and planning stages, then the likelihood of meaningful and significant outcomes from the research and learning would be maximised. This will go a long way to assisting with future complexity and challenges to ensure a viable Australian dairy industry.

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