Creating teams for rural innovation?: Constraints and possibilities in operationalizing a program-team model in the Australian dairy industry

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Abstract

It is increasingly recognised that innovation involves much more than science and technology development, and is better understood as a co-production process in which people with different perspectives and contributions in a topic of innovation need to interact, cooperate and co-ordinate their activities. The incorporation of this understanding of innovation into innovation capability is increasingly recognised as a significant challenge and an important issue by researchers and managers in rural innovation. What happens though if the context in which you are trying to innovate is part of a science-centric innovation system? The Australian dairy sector is part of such an innovation system and recently, multidisciplinary and multi-stakeholder program teams are being established to build innovation capability. How do these program teams work to enhance the potential for innovation? This paper reports on an analysis of different models of innovation in an Australian dairy industry context, with particular emphasis on the recent program-team model and its strengths and weaknesses for supporting innovation. The program-team model appears to support innovation because it allows people to: a) cross organisation boundaries and enlist others; b) identify knowledge gaps and commission any necessary research; c) work with both public and private interests and roles; d) identify and pilot new initiatives or activities; and e) foster a learning environment within a community of interest. Having both clearly defined roles for program-teams and indicators to judge progress appears to strike a balance between the need for adaptation, flexibility and constant reflection in innovation whilst also meeting demands for accountability, transparency and achievement from investors. In contexts with more advanced innovation thinking, program team models may appear overly structured or even the antithesis of creativity. However, in a predominantly science-centric innovation culture like Australia, program teams may be the best option available for people in the absence of a systemic innovation culture.

1. Introduction

Innovation researchers recognise innovation at a sectoral level to be a process of co-production between engaged actors, institutions and situations (Klerkx, Aarts, Leeuwis, 2010) whereas innovation policies often reflect innovation as an adoption and diffusion process in which ideas or technologies derived from centres of research and science meet the innovation needs of expectant end-users (Malerba, 2002; Geels, 2004; Godin, 2006). This discrepancy between innovation research and policy presents serious constraints to the innovation process itself if the systems and arrangements of policy to support innovation are actually working against it.

There is growing recognition of this tension in the analysis of national-scale innovation policies that espouse a systemic approach to innovation and yet in practice focus on science and research (Dodgson, et al., 2011). Innovation studies at the sector-scale have tended to focus on how systems innovation happens, including the functions and dynamics of innovation (Hekkert, et al., 2007; Geels, 2004), the different intermediary roles in innovation (Howells, 2006; Klerkx and

Leeuwis, 2008 a, 2008b, 2009a) and case studies of system innovation (Klerkx and Leeuwis, 2009b). This would suggest that many innovation researchers have come to consider system innovation to be the predominant 'model' in which innovation is practiced. This may be true for some nations and some sectors, however, there remain situations where science and research-centric innovation systems predominate. Science-centric innovation is characterised by an institutional environment in which the investment focus is on science knowledge and technologies, or inventions as the primary purpose of innovation.

The institutional context is of particular importance when discussing issues of innovation in Australia. The Australian national innovation system, and in particular the primary industry sector, represent a science-centric innovation environment. A strategic review of national innovation policy in 2008 (Cutler, 2008) highlighted the importance of cross-organisation agreement on innovation needs, the importance of the public and private sector roles, and the need for effective intermediaries between science and the demand side of innovation. Despite this, the logic of investment in innovation since the review indicates a continued science and research focus (Dodgson, et al., 2011). Similarly, the Australian Primary Industries Research, Development and Extension (RD&E) Framework (PIMC, 2009) is an initiative of the national government to encourage greater collaboration and promote continuous improvement in the investment of RD&E resources. In this initiative innovation is not mentioned and there is a heavy representation of science organisations in governance arrangements and in priority setting (PIMC, 2009). However, innovation still appears to be happening and creativity judged to be of an equivalent quality to non-rural counterparts in Australia (Sorenson, 2011). This is particularly the case for the community-based natural resource management sector in Australia (Landcare Australia, 2012) internationally regarded as a highly effective voluntary, bottom-up movement reflecting innovation in the management of Australia's natural resources (Campbell, 2005; DSE, 2010).

The co-existence of what have been termed *top-down* and *bottom-up* approaches to innovation within Australia's primary industry and natural resource management sectors is interesting because both are operating within the context of a science and research-centric national innovation system. The community-based natural resource management sector reflects more of an agricultural innovation systems (AIS) approach commonly associated with a systems- rather than research-centric approach in rural innovation studies (Hall, 2006; Hall, et al., 2006; Röling, 2009). Here, research and extension, instead of being the dominant sources of innovation, are considered part of a broader 'chain' or 'network' of actors that include practitioners like farmers and community members as sources of innovation (van Dijk and van Boekel, 2001; Jiggins, 2001; Nettle, et al., 2010; Eastwood, et al., 2011, 2012). Others are also involved like processing sector groups, agricultural traders, retailers, policymakers, consumers and civic advocacy groups (Hall, 2006).

It is apparent that different approaches to innovation are operating and that the influential role of institutions in setting the 'rules of the innovation game' (Leeuwis, 2004) do not necessarily pre-determine how innovation occurs. Given this context, important questions about the different approaches to innovation require exploration. The research questions underpinning the study reported in this paper were:

1. What are the strengths, weaknesses and risks of current and emerging models of rural innovation in Australia?

2. How is the potential for innovation (i.e. innovation capability) created within a research-centric innovation system and does this have implications for building innovation capability more broadly?

The Australian dairy industry was considered an important and relevant case study sector to explore these questions. Firstly, the Australian dairy sector is the third most important rural industry in Australia with a production value of AU$3.4 billion at the farm-gate (Dairy Australia, 2010), producing over 9bL of milk with a global market focus, exporting 50 % of production mainly to Asia, and with commercial interests in supporting food security in the Asian region. Secondly, dairy farmers invest directly in innovation capability through levies to fund research and services (PIMC, 2009). Further, the industry was actively exploring alternate models for innovation management in response to a government directive (PIMC, 2009). This included establishing multi-disciplinary and multi-stakeholder program groups to deliver to these directives and forming communities of interest to formalise previously ad-hoc arrangements. The authors considered these actions to be directed toward building innovation capability (DMF, 2010).

Innovation capability is understood to be the ability of individuals, businesses, organisations or sectors to continuously transform knowledge and ideas into new products, processes, practices and systems for the benefit of stakeholders (Lawson and Samson, 2001). Innovation capability provides the potential for effective innovation. With numerous organizations, public and private sector roles such as those within a rural innovation context, innovation capability requires negotiation, cooperation and collaboration with diverse contributors.

This paper provides a brief review of different models of innovation in the Australian dairy industry and the strengths and weaknesses of an emerging program-team model for supporting innovation within a science-centric innovation system.

2. Methodology

A review of different models of innovation currently in use in the Australian dairy farm sector, and over the previous 5 years, was conducted by the authors. The research process involved the authors reflecting on their own experience in the design, delivery or evaluation of dairy programs as well as a review of program documents and discussions with other dairy sector program leaders about what they did and what they believed was working for effective innovation. The unit of analysis was the farm program area or domain rather than specific projects or specific practices or technologies. In line with innovation studies, programs are considered to be a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually (Shaltry, 2007). The approach taken by the authors in reviewing documents and discussing situations with program leaders reflected a cooperative inquiry (Heron and Reason, 2006). The research was conducted between November 2009 and March 2010. Table 1 outlines the range of data collated by the authors and the mechanisms of analysis and reporting.

Table 1: An overview of the data collection and analysis undertaken for this study.

Data collected for the study	Analysis approach
1. Deliberative reflections by the authors from experiences in designing, delivering or evaluating programs for the Australian dairy industry.	Reflections were documented and formalised using the stated research questions as the framework for analysis.
2. Document review: Program strategies in the animal management (including animal breeding), feed-base, natural resource management, people and business domains were reviewed.	An *a posteriori* analysis was used to define the main activities and principles associated with, or important for, innovation in the 'Research, Development and Extension system'.
3. Discussions with program managers in the feed-base, natural resource management, people and business domains were documented to define: a) the practices of actors supporting innovation; b) the constraints to innovation; c) the enablers of innovation.	Activities and practices were codified to distinguish the tasks, roles and decisions associated with supporting innovation. These were developed into a model of program-team activity (Figure 2).
4. Collation of financial data on the relative investment in innovation capacity compared to the investment in science and research and services to farmers or policy-makers within each domain.	Financial investments in 2009-10 were categorised into functions that could be classified as research (i.e. generating knowledge to help the innovation process), extension (working directly with policy makers, farmers, advisers or other actors in change) and innovation capability (drawing on Hekkert, et al., 2007). (Figure 1).
5. Stakeholder responses to the authors analysis were collected as part of Dairy Moving Forward steering committee meetings in March 2010. (DMF, 2009).	A synthesis of findings from stages 1 through 4 were tested with industry stakeholders in three feedback sessions and incorporated into the analysis and interpretation of the implications of the program-team model.

3. Results

3.1 Four different models or approaches to innovation were identified as operating in the Australian dairy farm sector

Table 2 provides an overview of the main features and examples of four different approaches to innovation, the processes involved and their strengths and weaknesses.

Table 2. The four predominant approaches to innovation identified as operating in the Australian Dairy farm sector prior to and including 2009-2010.

Model of rural innovation identified	Key processes and strengths	Risks, weaknesses
1. Research priorities lead the focus for innovation.	1. Identify knowledge gaps (set research priorities). 2. Draw on current 'data'. 3. Conduct research. 4. Extend research to end-users. Strength: Researchers learn about and understand needs of industry, farmers, policy or community.	• Expectation of *broad* uptake or use of the research or technology without pre-testing. • There may be many unforeseen consequences when research results are used or applied in a farm system or in new policy. • Researchers have to prescribe who is going to use and benefit from the research before it is conducted (i.e. there is lock-in to certain courses of action). • The onus of decision-making, learning and adaptation then rests fully on the farmers, service provider intermediaries, communities or policy-makers.

2. Industry issues or "bottom-up" concerns lead the focus for innovation.	1. Identify sector or industry issues. 2. Conduct research or deliver information/extension to address an issue. Strengths: A demand-pull model of rural innovation (Klerkx and Leeuwis, 2008a). Ensures the sector is working on important issues of the commercial environment and not just knowledge gaps. Has broad engagement with the community.	• Priority setting processes tend to focus on issues of a very general nature, providing limited insight for defining how issues should be addressed or change supported. • Independent investments in research or extension are made and justified as addressing important sector-defined issues without coordinated activity around what was required to collectively advance the issues. • Community-driven action often not recognised as a source of innovation.
3. Centralised research feeds into local extension processes.	1. Centralise research to create a critical mass of researchers working together on knowledge gaps. 2. Extend and translate research to different regional/location needs. Strengths: Reduces professional isolation of researchers, greater opportunity for co-location of multi-disciplinary research.	• This model, similar to approach 1, has the added complexity of requiring researchers to communicate the application of research in entirely different contexts to which the research had been conducted. • The model increases the requirement of local groups to be highly aware of research outside their region and pro-active in translating the importance of research for their regional needs. • Researchers are encouraged to market or promote their research rather than support innovation.
4. Program teams develop coordinated approaches to address change.	1. Small groups of researchers, extension people, farmers, policy and service groups are brought together with leadership provided by an area expert or champion. 2. The group takes responsibility for locating and gathering people together that can contribute to developing agreed positions on a program's objectives and outcomes and modifying these over time. 3. The group builds understanding of the commercial environment in which they are trying to innovate. 4. The group considers the environment that would support change and designs strategies for change (what would make the most difference) and pilots these strategies to inform wider delivery. 5. The group manages emerging risks and keeps on top of issues'.	• The national imperative to improve the effectiveness of the RD&E system provided the institutional impetus for cross-organisation collaboration. Without this, it was up to individuals and existing working relationships to establish and progress teams. • Establishing a large team can mean a more time is required to establish agreed positions. • The risk of developing 'Group think' – the antithesis of innovation (Weick, 2002).

The first two models were widely recognised as operating in the Australian dairy industry, with the third model proposed by consultants in the early considerations around the Dairy Moving Forward national initiative built on the theory-in-use that research could be and should be centralised, but extension, or delivery of research must be local (DMF, 2009) . The program-team model however

had not been formally identified prior to the authors' discussions with program managers and their analysis of previous programs. The definition of this model emerged from considering the practices of program managers and activities they associated with improved innovation in their field.

3.2 The strengths of the program team model

The benefits from the program-team model were reported to be:

- Growing understanding of how research or technologies are relevant to particular farming styles (Waters et al., 2010) and systems and what would hinder or support the interest of farmers or policy in the findings.
- Changing focus to integrate new technologies with existing ones, rather than pushing new technologies for being 'superior'.
- Generating knowledge about the practical aspects of applying any recommended changes in the commercial world.
- Opening up opportunities for collaboration with businesses.
- Being able to work 'across silos' (across different technical platforms, organisations) and coordinate and align their activities.
- Research is highly valued for establishing the evidence of potential of new technologies or products and services, as is direct engagement with farmers, communities or policy groups (e.g. extension and education). The program team model suggests that both these areas are less effective without investment in innovation capability. Innovation capability was considered to include the activities that engage appropriate people, considers processes involved in supporting change and builds networks, whilst allowing for ongoing adaptation.

What we found however, was that for many people, these activities were happening intuitively and were described as *"things we just felt we needed to do"* by the teams involved. In addition, these activities were not recognised to any degree by stakeholders or investors as being central to their innovation and could be described as 'ad-hoc', although highly effective, in some situations.

3.3 Leadership of program teams was important

Individuals and small groups were taking the lead to ensure important activities for innovation proceeded. This was under-recognised but ensured progress continued to be made, stalling points were being recognised and worked through, and the activities were contributing to a vision. Without a good leader, the development process was inherently vulnerable. Leaders had emerged in areas because they had worked for many years to understand the issues in a particular domain, had developed depth knowledge and/or had established considerable networks. This depth understanding of the 'rules of play' (Paine et al., 2004) could not be considered a *once-off task* nor just a function of depth scientific understanding.

The leadership capacity included an ability to a) have respect in and be able to cross organisation boundaries and enlist support, b) identify knowledge gaps and commission specific research, c) work with both public and private interests and roles, and d) identify and pilot new initiatives or activities.

3.4 The investment in innovation capacity was low

The analysis of investment in activities that were not 'research' and not 'direct engagement with farmers or policy makers' suggest a lower relative investment in program-team activities such as intelligence gathering, program leadership and innovation capability (activities defined in model 4) (Figure 1). Our intent was not to articulate an ideal investment, but to understand the proportional investment in innovation capacity. In addition, discussions with program managers revealed that some of the innovation capability activities were going on but were not allocated to a particular budget.

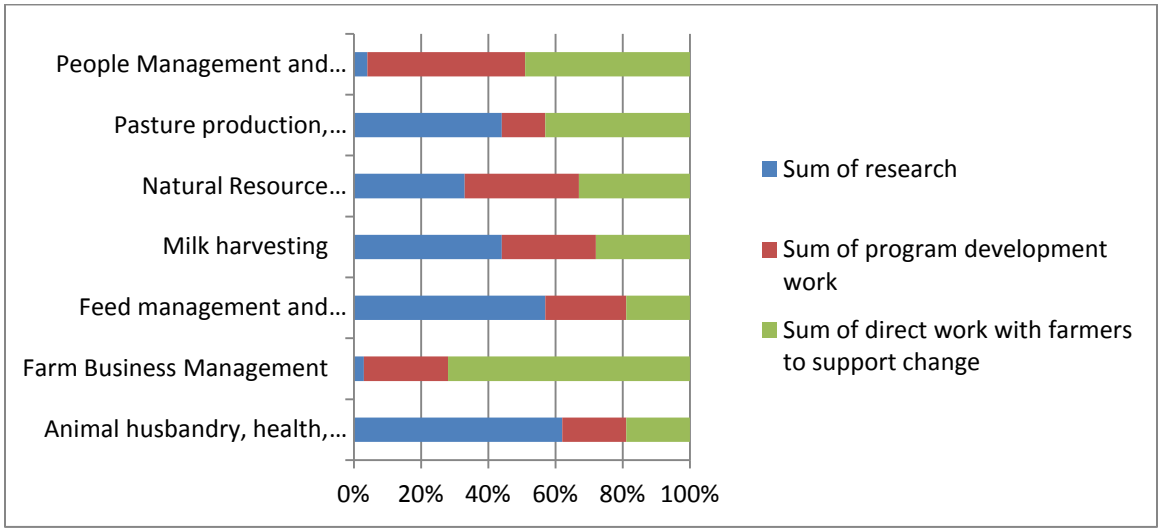

Figure 1: In the farm investment portfolio of the main dairy innovation support organisation, there was a lower relative investment in activities directed to innovation capability and program leadership compared with investment in research or direct work with farmers in most program areas (2009–2010). The total investment across all Dairy Australia's pre-farm gate programs was approximately AUS$19M (Source: Adapted from information in Dairy Australia, 2010)

4. Discussion

Given the science-centric innovation system in Australia it is not surprising to find research priorities providing the focus for innovation as the predominant model 'in-use' in the Australian dairy sector or that there was relatively less investment in innovation capability when compared with investment in research or direct engagement with farmer, policy makers or service providers. The risks identified from models in which research or sector needs alone provide the central platform for innovation to proceed included the lock-in to a particular benefit from research and activities that try and take research direct to delivery, bypassing any alignment with suitable systems or preparatory work. Further, the reliance on a single or narrow group of organisations for innovation and the coordination problem in matching research to regional needs presented further risks for innovation.

The study found, however, that some individuals and groups were intuitively doing things to create the environment for innovation, minimise these identified risks and actively lead and coordinate responses that were neither research driven, nor involved direct extension. Broadly defined as providing innovation capability, these people and teams were providing the engine room for innovation in their areas. That individuals and groups were found to be working actively to support innovation with limited funding or formal recognition of this as innovation practice is an important insight. Firstly, it shows that despite a particular innovation system many people do

have a sense of what they need to do to better allow innovation than what the current system might support. Secondly, it demonstrates the importance of leadership in innovation.

Articulating the central activities of these individuals and groups was seen as important for explaining the contribution of this capacity to better innovation but also provide a mechanism for investment or a way to operationalize innovation capacity. The examination of the practices of these groups and individuals led to the articulation of a 'program team' model of innovation.

4.1 Defining the program team model for sectoral innovation

A conceptual diagram of the program team model for innovation is provided in Figure 2. The program team model involves:

- A formally recognised program team leader and establishing a team: Ideally the Program leader would be an accepted authority (domain expert) who has the capacity to analyse situations and establish the current state of affairs, and inspires the confidence and approval of stakeholders. Other team members would depend on their level of interest in the area and reputation for following through. A program-team provides a formal forum for interaction across organisations and disciplines in a program area. The aim is to not 'cast the net too narrowly' or rely too much on an established knowledge-base where the thinking will revisit the same places. Governance arrangements would need to ensure group members would have the authority to act on behalf of the organisation or businesses they represent in order to champion the program activities within their businesses and sphere of influence. They will be able to do this most comfortably if the program aligns with the objectives of their own organisation. The quality and significance of the engagement between stakeholders directs the program's success. An edict to work together does not automatically build the sense of connection and develop the trust necessary for a truly collaborative effort (Paine and Nettle, 2006).

- The design of an approach that progresses the program area (e.g. animal management, Feedbase, People, Natural Resource Management or Farm Business) toward desired improvement by developing the case for intervening in change. This includes:

    - Understanding the businesses of key players to make good decisions. An accumulation of knowledge about how agencies operate, collaborate and the issues they truly face is as much about enlightenment as it is about immediate action. A knowledge-base built by teams ultimately results in fewer uncertainties, provides the sector with a rich source of ideas for future directions and enables accelerated action. The design of strategies that are likely to be commercially feasible relies on people working with their business and professional interests at heart, be they public or private. The program-team model enables agencies to focus on their area of speciality rather than trying to operate independently across all parts of an innovation continuum.

    - Decide the nature of the desired change. Develop program outcomes that represent the change and the benefits to farmers, or policy groups or consumers. Usually the objective for a program of work is stated in broad terms. It is entirely appropriate to have a 'plausible promise' that is imperfect and incomplete as it provides more scope for stakeholders to form something consistent with their situation and ideal.

    - Identify features of the enabling environment to establish what capacity is needed by the people and systems involved.

- Design a ‘route to change’ strategy. The design must consider the roles of the people involved and aim for simplicity in implementation.
- Pilot in the target audience and refine the approach. Testing the design in the ‘real world’ enables it to be refined according to how well it ‘meshes in’ to existing systems. It is also valuable to observe how people adapt and how learning that takes place in order to improve approaches.
- Build the knowledge base if required (commission necessary research).
- Justify appropriate broader action (evaluate, improve and extend).

Fundamentally, the program team model is a formal mechanism of collaborative action to deal with uncertainty whilst taking relevant action in a program area without falling back into a science or technology ‘push’ mental model.

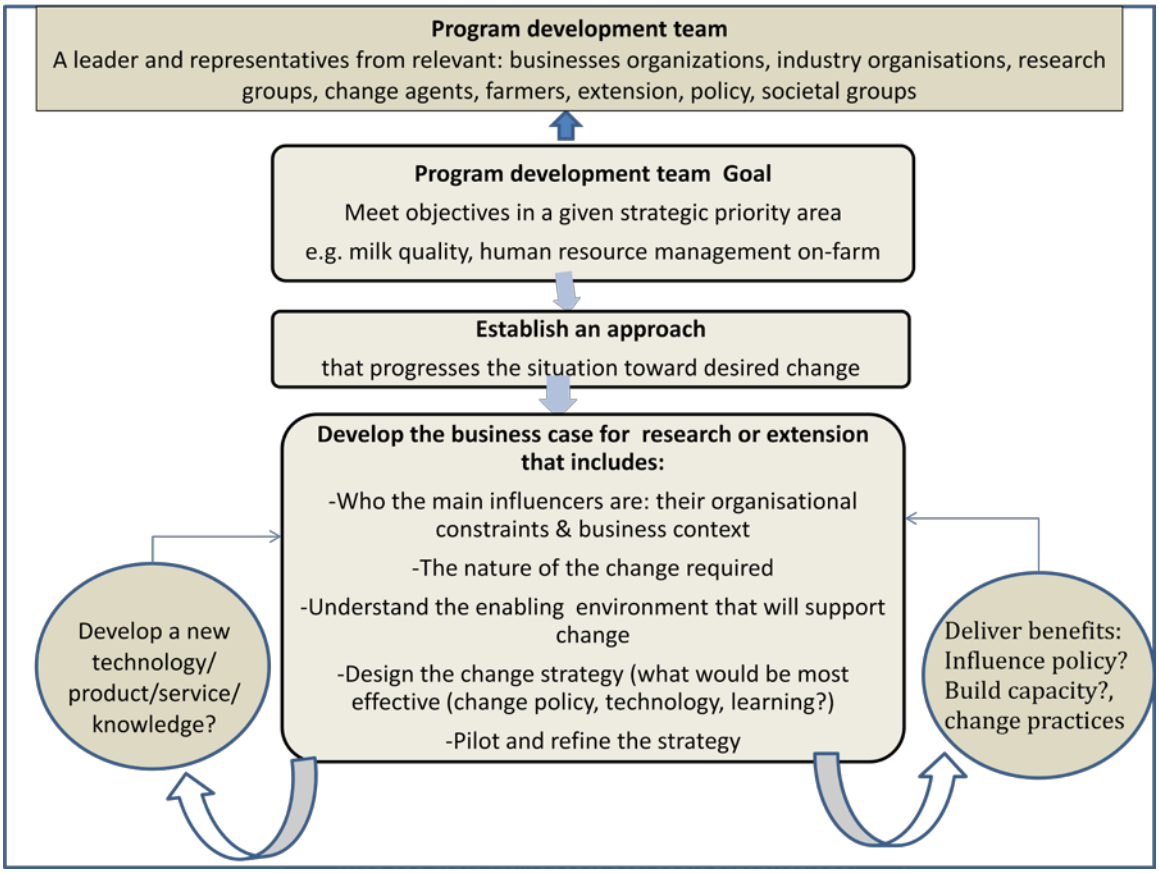

Figure 2: The elements of the program team model as innovation capability in a research-centric innovation system

5. Conclusion

The program-team model for rural innovation provides legitimacy to the activities of people that were previously ‘muddling through’ (Weick, 2002). The model provides direction to those that

know something is necessary for innovation but are unsure what needs to be done, and also provides a more visible or transparent basis for investment in these activities.

Although much of the program team model may be defined by innovation systems researchers as a standard model of innovation brokerage or open innovation (Chesbrough, 2003) it is argued that the program-team model more specifically defines the tasks and activities that operationalize an innovation capacity at a sector-scale rather than general references to innovation functions (Hekkert, et al., 2006) or innovation intermediary roles (Geels, 2004; Klerkx et al., 2009a, d). Further, building innovation capability does need to give more emphasis to the form of innovation system people are currently in than propose general capacity building efforts (Hall, 2006). It appears that program-teams operate in what Klerkx, et al., (2010) label effective reformism because in their activity, the team reflects adaptive innovation management.

Whilst this study primarily concerned the definition of innovation capability within a research-centric innovation system, the program team model has some application in systems innovation settings. Current issues in systems innovation include identifying and mobilising the right networks of actors together and making co-production in networks for farming systems work (Hubert, 2006). The program team model addresses these two issues by identifying criteria for the operation of a network of actors (a program-team) and placing a governance system around its operation, whilst providing the freedom to 'operate adaptively'. An emerging issue concerns how to avoid normative assumptions about what constitutes program team activity.

The Australian dairy sector is beginning to institutionalise 'program-teams' in some areas with the establishment of program champions and multi-disciplinary communities of interest, in which priority activities are being decided. For instance, in the dairy industry "people" domain, different community groups, health agencies, industry groups, training providers and farmer representative organizations are engaged in defining the changes and research needed in improving farmer health and well-being.

Challenges remain however in that there is still little direct investment in this capacity with much of the work being combined with people's current roles. This flags an important question for future research: What is the sustainability of innovation capability within a research-centric innovation system?

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