When worlds collide: managing farming systems projects through conflicting worldviews

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Abstract: *Historically, the focus of rural industries and R&D projects in Australia has been on the development of technologies as technical tools. This has meant that it has been difficult to experiment with alternative methods of knowledge production. 'Innovation' in this environment has classically been viewed as 'hardware'. There is however an increasing realisation amongst some in the R&D community that the instrumental approach is having limited success with complex problems, particularly in relation to feedbase management. This challenge is only likely to get bigger with climate change and increased land competition and urbanisation. New approaches to knowledge generation are therefore being explored with the belief that this will lead to more industry change. Early work in this area included farmer first approaches. However applying such approaches to achieve large scale industry change has proven challenging given that programs of work are dominated by the instrumental paradigm. This paper will discuss how the task of integrating knowledge perspectives is heavily predicated on the resolution of 'frame conflicts'. We will explore two cases from the Australian dairy context to highlight how resolution of such conflicts is dependant upon 'frame reflection'. Frame reflection requires actors to move beyond the safe ground of existing cultural frames and engage with alternative 'views of the world' via concrete acts of 'co-design'. We suggest that the facilitation of such co-design is best managed by actors more aligned with adaptive management, which poses significant challenges to an industry dominated by a mechanistic orientation.*

Keywords*: integration, frame reflection, adaptive capacity.*

Background & Introduction

Compounding uncertainties

The Australian dairy industry finds itself, like many agricultural industries around the world, confronting a range of significant challenges. After two consecutive 'one in one hundred year droughts' and 10 years of below average rainfall, dairy farmers are now confronting the effects of what were predicted to be worst case scenarios in climate change. These extreme variations in seasonal weather patterns have highlighted the risky nature of Australian dairy businesses due to their reliance on off farm inputs such as purchased feed and irrigation water (Thorrold & Doyle, 2007). Combined with a declining terms of trade, this has seen national milk production stagnate since 2000 and dramatically decline over the last two seasons. Annual milk production for the coming season is forecast to be approximately 8.8 billion litres, down from 11.3 billion in 2001/2. This reduction in overall industry capacity poses threats around market security. Historically, industry shocks such as deregulation of the industry in 2000, have seen a reduction in total farm numbers but maintenance of the national herd and milk production. Farmers responded to such shocks via expansion, built upon an underlying confidence in the production systems they were implementing. However in the face of these recent 'climate shocks' we are seeing the opposite. Farmers are exiting the industry. Those who are staying are downsizing to reduce their exposure to risk and thus total industry output is being slashed. Typically, when this has occurred in the past, there has not been a rapid recovery (Kenny and O'Brien, 2007).

Crisis of confidence

Such compounding uncertainties have generated a 'crisis of confidence' within the industry as a whole. For the first time ever, farmers when surveyed as a part of the annual industry 'Situation and Outlook' report, cited climate change, not milk price as their greatest concern (Dairy Australia, 2007). Within the research community, a recent spate of reviews have lauded the standard of research being

undertaken but have been critical about its capacity to support the advisory sector in their efforts to deal with contemporary challenges. And the extension profession has been so focused on 'fighting fires' (drought, locusts, floods, bushfires) that there has been no scope to strategically build the industries capability to manage the next shock. We find ourselves in this context asking – what is required to build the adaptive capacity of our industry to deal with external shocks, and so become more resilient?

Building adaptive capacity

Building adaptive capacity as a response to complexity is not a new concept. As early as 1967, Brooks (cited in Schön, 1983) described how the professions (here include agricultural science) were facing an "unprecedented requirement for adaptation". This primarily because they were required to cope with two types of change simultaneously: the changing knowledge base of their profession, and, the growing expectations of the society they serve. The gap between these two changing positions is the bridging challenge confronting the professions. In a rural context this bridging has been approached through efforts to better represent the contribution that farmer knowledge can make to rural development programs like the Farmer First initiative (Chambers et al., 1993; Scoones and Thompson, 1994).

Studies of local knowledge (or indigenous knowledge) over the past two decades have been central to understanding effective intervention. Stiles (1995) has defined this work as an attempt 'to find the modes of effectively communicating the rural peoples' science to people who are trying to help them improve their lives within sustainable limits. The core challenge here is achieving a good translation of the contents of that knowledge, while at the same time ensuring the knowledge remains in the 'ownership' of the people who produce it', (ibid., p.177). We see here a complex dynamic of knowledge production and translation, interspersed with power relationships around the regulation of this process. In relation to this, of importance is understanding not only the power struggles between 'outsiders' and 'locals' but also the working of local power structures. Interestingly, the researcher who investigates these processes, along with their objectives and life-world, are an intrinsic part of such studies (ibid., p. 186). Researching the intervention process is therefore inextricably linked with the change process itself.

A number of theoretical perspectives have emerged in recent years to explain the way the learning process contributes to the development of adaptive capacity. Cerf et al. (2000) have applied a number of these theories in a variety of agricultural contexts. Some of the more important theories in relation to learning, knowledge and change in a research development setting include second order cybernetics, communities of practice and activity theory. Second order cybernetics views human knowledge of systems as something that is grasped through the use of models that are simplifications of the system to which they refer. Social systems have agency so that the observer and the observed cannot be separated. Second order cybernetics refers to the need to appreciate a double loop construction of a system (the observer) that is observing a system (observed) as part of the learning process (Heylighen & Joslyn, 2001). A second theoretical perspective has been extensively discussed by Wenger (1998) as Communities of Practice. These communities are defined by the expertise that they share and the tools they use to perform their practice. Practitioners can be core or peripheral to the community depending on their level of involvement in the community learning and adaptation. Activity theory is the third perspective we investigated because it provides a social construction of learning and action (Engstrom, 2000). Actions are goal directed activities performed by people (subjects in a community) who follow rules when using tools to attain objects (eg. computers, paper, printers) that are then transformed into outcomes (eg. manuscripts and books). While these three perspectives informed our thinking about adaptation as a learning process they did little to address the issue of colliding worldviews. We therefore turned refined our problematic to address issues of scale and knowledge integration before searching for a more appropriate theoretical perspective.

Scaling up from 'the local'

While these insights from development work provide valuable contributions to our understanding of adaptive capacity, we think a more challenging task in industrialised agricultural is to embed these perspectives on knowledge creation at a whole of industry or organisation level. Why more challenging? At a local level it is possible to have intimate and frequent contact with others who are central to the intervention. Across an industry we are more likely to encounter a greater number of different actors and professions, and each may embody a number of frames of reference (an

underlying structure of belief, perception and appreciation) that influence the way they solve problems, pursue goals or perform their practice.

New wine, old wine skins: frame reflection and the bursting open of things

"…..no one pours new wine into old wineskins. If he does, the wine will burst the skins, and both the wine and the wineskins will be ruined. No, he pours new wine into new wineskins." Mk. 2:22

The 'wineskins parable' comes hot on the heals of a challenge to the emerging 'Jesus sect' around religious observance. It therefore captures the inherent tension faced by innovation and change management workers, namely the meshing of existing and emergent ways of knowing. Like new wine, new ways of knowing require appropriate supporting structures to be nurtured, at least in an ideal world. The reality is however, that the organisational arrangements required to support new ways of knowing will never be built from scratch. We are therefore faced with the situation that, like new wine poured into old wine skins, new ways of knowing will always be 'poured' into old ways of 'doing'. The end result will inevitably be a bursting open of things as new and old collide. On a surface reading, some could see this as a bad thing. However we interpret this 'bursting open' as an inevitable result of conflicting cultural frames of reference. As such, the 'bursting open of things' can be read as evidence of 'knowledge integration' at work. The core challenge here is not to avoid the bursting open of things, or minimise its effects. Rather it is to ensure that the 'bursting open of things' is a creative process that leads to more integrated and effective ways of 'knowing and doing'.

Cultural frames in the Australian dairy industry

We observe two 'cultural frames' operating in the Australian dairy industry, and these tend to collide over issues of strategic significance to the future of the industry. 'Frame 1' assumes that industry benefit will primarily flow from technological progress and that this progress is unleashed through a culture of managerialism. We see this as a mechanistic worldview that talks in terms of key performance indicators, outcomes and the optimal allocation of resources to achieve predetermined goals. Such a view is well aligned with the operations research approach to industry planning. Ackoff (cited in Schön, 1983), a founding father of operations research has drawn a distinction between the practice of operations research and the problem context to which it applies itself and concluded; 'the future of operations research is past' (ibid, p. 16). The disconnect between the analytic techniques of operations research and the synthetic skills required to build new futures amid messy, complex uncertain futures has resulted in the emergence of an alternative worldview. This alternative view, 'frame 2', sees benefits to industry flowing primarily from human capacity. This frame appreciates the world as Ackoff describes it, a world where optimisation routines are not enough to cope with the unpredictable nature of a complex operating environment. It is a world of process that emphasises the journey rather than the destination – a world of adaptation because nothing is certain.

The mechanistic managerial worldview is the dominant culture in the Australian dairy industry. This dominance imparts privileges to those who follow this way of operating. Privilege has significant consequences on the flow of resources and on the expectations of projects to push beyond technology development alone to deliver outcomes for shareholders (i.e. farmers). This is how demands are made of agricultural science professionals, and the way in which success is interpreted. Yet within these ranks of professionals there is increasing unease that the mechanistic view is inadequate for today's problems. We are seeing a collision of cultures as the adaptive management challenge is being addressed. Schön (1987) describes this collision as follows;

"When representatives of different professions take conflicting views of the same situation … they are unlikely to resolve their dispute by reference to facts or judgements of the relative effectiveness of actions. With their different ways of framing the situation, they tend to pay attention to different sets of facts, see 'the same facts' in different ways, and make judgements of effectiveness based on different kinds of criteria. If they wish, nevertheless, to come to agreement, they must try to discover what models and appreciative systems lead each of them to focus preferentially on one set of facts or criteria, make their tacit cognitive strategies explicit to themselves, and find out how each one understands the other's framing of the situation. Their ability to come to substantive agreement will depend on their capacity for frame reflection.' (ibid., p.218).[emphasis added]"

Working at 'knowledge integration'

In an environment of 'cultural dominance', where the epistemological foundations of the dominant culture stand in stark contrast to that of the emergent culture (yet whose patronage is required by the emergent culture to 'do its job') it is easy to see how 'integrating knowledge perspectives' is a challenging task. However it is in this environment several programs of work in the Australian dairy industry have attempted to tackle this task. In the next section we will describe an example of this and go on to analyse its relative success in enabling 'frame reflection'.

Integrating knowledge perspectives – a practical example

The FutureDairy project was meant to be about the science; a conventional technical research project exploring new technologies to enhance productivity. Early scoping work in 2003 had been done with farmers and researchers to identify technologies with potential to achieve 'quantum leaps' in productivity. Some of these ideas, such as Automatic Milking Systems (AMS) and high yielding crop rotations, were selected for further research and development. From here, the project leader (a technical scientist) stepped into the role of developing the FutureDairy project and in 2004, together with the newly appointed technical research leader developed the initial proposal.

The project leader did however question the capacity of a project consisting of just technical research to address the farming system issues associated with the development and implementation of new technology. He sought out leaders of the Innovation and Change management research group in order to explore the challenges he expected in the project:

"…. he was [asking us] as people researching extension processes and change - what we saw as the issues he would be facing in that project…" Project social research leader

Issues identified included the location of the research, given the large industry segments present in other states and the labour issues associated with 'scaling up' the proposed technologies to the commercial level. It was also highlighted that developing new technologies depended upon developing appropriate perspectives on knowledge systems:

"… you can't grapple with the question of path to market for technologies as a one way street… you're immediately into the territory of a 'knowledge systems' problem, because you're talking about a two way conversation that has to be mutually respectful of the knowledge types… [and you are] recasting technology now as something that's emergent and adaptive in a system sense….." Project social research leader

It was from this interaction and many like it, that the project evolved into a self described 'farming systems project'. No longer was the project limited to the research station. It was now attempting to grapple with the wider knowledge system through the involvement of commercial farmers, regional advisors and a range of researchers in a multidisciplinary enquiry (Figure 1). Key to this evolution was the addition in 2005 of; partner farms as a means of co-developing technology in real time; an extension researcher/development leader whose task it was to manage the relationship between the research team and the commercial farmers, and; social researchers, whose task it was to record and analyse the new relationships over time.

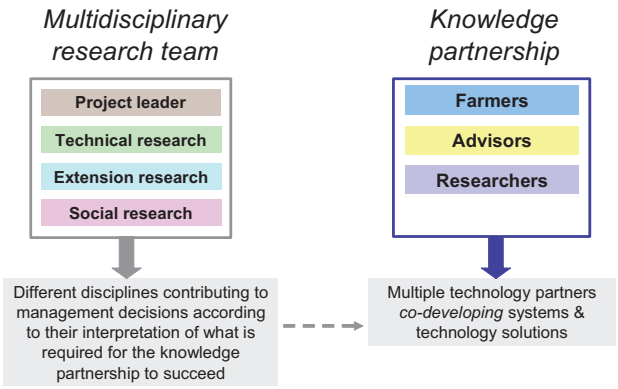

Figure 1. Multidisciplinarity in FutureDairy

The first 18 months of activity within the project resulted in much being learnt about the knowledge partnerships as a means of generating new knowledge (Nettle & Kenny, 2006; Kenny and Nettle, 2006; Kenny and Kabore, 2006). However in late 2006, the limitations of the approach to effectively integrate knowledge perspectives started to become apparent. The technology focus of the partnership was becoming constraining. The question of what kind of guidelines for management would emerge through the research started to surface. This related to what it meant for the farmers to get it 'right' with regards to applying new technology on their farm. When local adaptation occurred, this was variably interpreted as either an excellent learning on the innovation process or a failure to 'do things right'. Along with this, the associated knowledge system issues identified early by the social research leader, were not engaged with at all. Of primary importance and concern to many in the project steering and management group was how results of the research work would be 'extended' to advisors and 'adopted' by farmers. Issues around the task of regional adaptation were only tackled in a bio-physical sense with the human aspects of adaptation abstracted out and seen simply as not doing things properly. Fundamentally, all of this was an expression of 'frame conflicts'.

In response to these challenges, a shift in focus was proposed in late 2006. It was driven by the extension development leader and involved moving from developing generic management guidelines for a specific technology (as prescribed by the project), to establishing processes that would enable the adaptation of technologies to local conditions (physical and social):

"…there's a kind of undertone to what I'm pushing which is moving it from a very technologically driven project to something that's actually still built around the same questions, but almost like a 'hub for innovation'. So it's addressing the questions whether it's technical solutions, social ones, capacity building, etc…" Extension development leader

This shift manifested itself as an 'integration process'. This consisted of a series of activities that aimed to; a) identify the technical and social limitations to effectively adapting new technologies to the local context (where partner farms were located), and b) enact strategies to address these gaps. The key means of doing this was via 'integrating' the various sources of knowledge which had been accumulated over time. As it was initially conceived, the project researchers, advisors and farmers would go through a process of 'dumping' what they had learnt, reflecting on the adequacy of this knowledge and describing what was required to either fill identified gaps or embed what had been grasped.

The outcome of this 'process' has been mixed. At the farm level there has been a shift in focus amongst the local partner farm support group from one centered purely on technology development:

"*We want to know if we can grow 40 t DM/ha. We want to have enough information to be able to theoretically compare the inputs and outputs of the CFR with alternative intensive systems*."

to one which is grappling with the knowledge system implications of the new technology:

"*We need to thoroughly explore issues of 'risk' before jumping in to alternative forages. We need to understand why you grow what you grow. We need to work this through together, in the field*."

Partner farmer & support group comments – from meeting minutes

The subsequent action plan for the next 2 years is centred on a range of activities which aim to build the capability of local farmers and advisors to strategically design new forage systems which better manage the risks associated with an increasingly variable climate.

However at the project level, despite a high level of support for the concept , there has been little evidence of 'integration at work'. The technical researchers barely engaged in the process. This was mostly due to the tyranny of distance (the research farm being a 3 hour drive and a 2 hr flight from the commercial farm), but also a reluctance to having their knowledge questioned. For example, one partner farmer worked closely with the extension development leader and his local agronomist to develop a forage plan which met his needs for scale in the coming season. This plan balanced decreasing labour and land availability, increasing milk and fodder price and the needs of the farmer to take stock of where his operation was at. The implications were that the projects technical package which was being trialled on the farm (an intensive forage rotation) was adapted to fit the particular context. This was seen by the extension leader as an excellent example of adaptation. However the researchers response when confronted with this adaptation was to suggest that the farmer was wrong to move from the original technical concept and that he should try harder in the coming season to get it 'right' so we would 'know' what was really possible.

As such, even though there was a shift in cultural frames at the grass roots level, this didn't translate into 'frame reflection' amongst the projects technical researchers. Given that these researchers represented the dominant culture within the project the integration effort was limited in its success. There was no 'bursting open' as desired and therefore no progression along the path toward an integrated knowledge perspective at an industry level.

The missing links

The task of integrating knowledge perspectives is aligned with Schön and Rein's (1994) notion of design. Here the designer is engaged in problem solving, moving from abstracted environments to the 'real world, from formulations of solutions to identification of new problems and thus from an initial position on defining values, criteria and constraints to an evolving one. This process of seeing – moving – seeing is fundamentally one of adaptation. It is therefore aligned well with the task of integration and 'frame 2' as described above. Schön and Rein (1994) identify 3 levels of complexity within their model of design rationality:

1. *Individual design*: This is the fundamental unit of seeing – moving – seeing. It involves the individual, a situation and their materials. Means and intentions are somewhat emergent as the designer is in ongoing conversation with the situation. Such design is thus an ongoing process of problem setting and solving.
2. *Political drama*: This sees the design conversation move toward a social process "in which first layer processes are distributed among multiple actors (ibid., 167)." As with the first level, reflection is central to success. However reflection now has to expand to include the communication amongst actors. This testing of messages sent and received is critical to interpreting the 'back talk' which comes about through the design process. This act of 'double designing' is highly political, as one does not want to compromise the designing coalition by their next design move.
3. *Engaging around cultural frames*: This sees the actors starting to deal with the consequences of their communication. Frame conflict inevitably arises as actors, effectively autonomous and driven by frame dependent interests, appeal to different sets of facts to achieve their 'ends'. There are four main ways of dealing with such conflict: continuation or escalation; a marketing strategy; negotiation, or; co-design. It is the last of these, co-design, that is dependent upon frame reflection for its success.

If we examine the above cases for their capacity to realise knowledge integration through 'frame reflection' two critical observations can be made. Firstly, it is clear that since early 2000, RD&E professionals have been engaged primarily in a 'political drama'. At no stage is there evidence of a concerted effort at frame reflection and thus no evidence for the emergence of an integrated perspective. There have however been several instances of frame conflict. In FutureDairy, they were observed through the questioning of what it means for the farmer to get it 'right', and challenging perceptions around notions of extension and adoption of the technologies under analysis. These conflicts were primarily dealt with via escalation of the argument or a marketing strategy to make activities unaligned with the prevailing cultural frame appear palatable. Crawford et al. (2003) reported frame conflicts in a parallel program of work that was trying to link farming systems projects at a national level. One of the most difficult challenges was to achieve adequate representation of the disciplines essential for an integrated approach.

'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.' (ibid., p. 423).

It is informative to examine these sources of conflict as they are key to understanding the requirements of effective co-design. Primarily each of these frame conflicts arose around questions of effectiveness – what does it mean to do 'systems' research? what does it mean to develop guidelines

for management? What does it mean for the farmer to get it right? The question of what does it mean 'to be effective' cuts to the heart of what it means 'to know', and it is here that the flames of conflict are fanned. Seen as a conflict alone, asking these questions will be destructive. Seen as a shared position (ie: we all desire to be effective in addressing this problem) the question of effectiveness is an opportunity. Required therefore, are appropriate activities that provide the space to explore this question of effectiveness. Schön and Rein (1994) talk of the situated resolution of policy controversies. Conflicts, when situated in the mess of practice, are more likely to be resolved given practitioners working on something together tend to have an overriding desire to get the job done. In contrast, when a conflict is not situated and actors are not engaged in co-design:

"…they are under no compulsion to converge on agreed upon action, and they lack the aids to communicating that co-design provides." (ibid, 178)

The failure to attain the integration ideal in both cases was in part due to the inadequacy, or lack of, the co-design task. In the former, there was no mandate to actually engage in co-design as there was no mutually shared problem area. In the later, the problem area was shared, but the dominant culture interpreted all activities through a technology development lens. As such, the space created was only entered into under these terms.

Secondly, if we take the idea of 'design' as being akin to the task of integrating knowledge perspectives, then a key flaw to date has been the control exerted by the dominant culture. Frame 1, being pre-disposed to a mechanistic worldview, is focused on optimisation and getting things 'right'. Is it any wonder that in an environment that must be characterised by the principles of design (see – move – see) there is a lack of success when frame 1 'calls the shots'? For frame 1, the functional unit of innovation is a product, whilst for frame 2 it is a functional system (Schön, 1973). As such, frame 2 is more focused on adaptation and the role of the human in this. Frame 2 is therefore more amenable to change and would seem to be in the best position to oversee the task of integrating knowledge perspectives. The key challenge is therefore to achieve this in an environment of cultural dominance.

Towards integrated knowledge perspectives

We can imagine two scenarios that play out the integration process drawing on the three design levels of Schön and Rein (1994). The first is when programs operate at the level of the political drama for too long. Using an Australian context this would involve continuing technology dominated research agenda with extension relegated to the role of developing adoption pathways and social research performing an independent evaluation role. Technology outcomes will be primarily determined by the agricultural sciences. Under this scenario the power is concentrated with the technical sciences as they are the primary authors of innovation, the other disciplines (including farming) are playing a passive role. There is no 'bursting', no emergent methodology and therefore no serious progress on critical issues like climate change. Conflict between disciplines is characterised as a defensive stance for the profession, common escalation in arguments ground in frame conflicts, and little or no frame reflection.

A second scenario is to move to level three where the professions engage around cultural frames through 'co-design', reflecting on their worldviews and those of others as they grapple with contemporary complex issues. Here the program is focused on the knowledge system in the broadest sense. Equivalent status is given to farming knowledge and methodologies are developed to formalise this in way that others can better access and utilise it. Extension and social research are key players in the design of adaptive management strategies because the process of change is the primary focus. Outcomes of higher adaptive capacity and more resilience are emergent and continuously appraised as part of the process – there is no final destination. Conceptual debate is a frequent occurrence between the professions because frame reflection has become the norm. Adaptation is a changing continuity in the practices of farming, researching and extension.

Conclusion

From the discussions around integrating knowledge perspectives and the examination of contemporary examples from Australia, we draw some key conclusions:

- Working toward an integrated knowledge perspective requires a big enough problem area, and therefore vision, to sustain the emergence of a 'new order' of things beyond frame conflicts. The current crop of complex challenges meet this criteria.
- Working toward an integrated knowledge perspective requires a fracturing and 'bursting open' of current ways of knowing.
- Ensuring that this process is creative, not destructive is key. Frame reflection, situated in practice, is the key to resolving frame conflicts creatively.
- The time frames for integrating perspectives are long and there exists 'evolutionary stages' when moving toward an integrated perspective. The current journey in Australia has been over 7 years and there is much work left to do.
- Actors more oriented to an 'adaptive management' frame of reference are best positioned to oversee the task of situated frame reflection given they are more amendable to change.

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