COUNTERING KNOWLEDGE MARKETS IN AGRI-SYSTEMS

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Abstract

Agriculture and rural society faces many challenges for viability, security and sustainability. Part of the challenge comes from society demanding a broader contribution from agriculture towards economic, environmental and social purposes. Emerging issues for land managers include food security, traceability and quality specifications. Accompanying these challenges has been increased privatization of agricultural knowledge service industries.

This paper uses a case study of the Australian Dairy sector to critique privatization strategies that aim to improve the management of knowledge as a whole of sector response to adaptation and change. The field research involved three phases: a literature review; an interview program with sector stakeholders; and a workshop to co-construct a national strategy for knowledge management. This dairy case contributes to a broader debate on issues of public and private knowledge resource management. These contributions are critically dependent on the structural arrangements and on the processes used to align networks of practices.

Keywords: Knowledge markets, innovation, agriculture.

Countering knowledge markets in agri-systems

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1 Introduction

1.1 Challenges to agriculture in society

Numerous commentators have observed the changing status of agriculture in western societies. Malthusian forecasts of starvation through overpopulation ensured food production from agriculture was of prime importance to nations in the nineteenth century. The world wars of the twentieth century amplified awareness among nations like the United Kingdom of their dependence for food production. Quantum leaps in food production through the green revolution of the 1960's tended to lessen concerns about food supply at a global scale. Correspondingly, concerns started to emerge about the damage that high input agriculture was having on the environment. A new agenda for agricultural research, development and extension (or adult learning) emerged with these growing concerns about the environment.

This new agenda included some long standing concerns like improving the economic viability of farm businesses under conditions of risk and uncertainty and evaluating the impact of urban expansion on regional resources (especially the loss of high fertility soils). New issues included analysing supply chains and food value chains for food security, traceability and quality specification. Food security now included attributes of responsible resource management, in addition to the conventional health and flavour attributes of food. Land managers are now farming to satisfy a mix of economic, environmental and social purposes. Farming systems have become more complex as a consequence and the use of technology in farm production needs to account for a risk society that uses more precise specifications for what constitutes value and quality in food.

Agricultural sectors have usually responded to pressures for adaptation and change through recourse to technology, in particular, the use of information and knowledge resources. This paper uses a case study of adaptation in the Australian Dairy Sector to critique privatisation strategies that aim to improve the management of knowledge as a whole of sector response to adaptation and change.

1.2 Privatization of service sector responds to challenges

With the decline of the welfare state in western democracies through the late 1970's and early 1980's we have seen a growing dependence on free market policies as a way to improve the management of the public sector. Privatisation and corporatisation of the public sector varied between countries, with New Zealand and the United Kingdom adopting some of the most extreme free market policies for health, education and agriculture (Duncan and Boland, 1992). Federal democracies like Australia varied in their responses at a state level, with some adopting comprehensive free market policies (South Australia) while others retained many elements of a public rural support system (Queensland, New South Wales and Victoria).

A Federal level study of the Australian situation therefore provides a convenient case to question some of the assumptions about resource allocation and productivity efficiencies that are expect to accrue from a free market model for sector level management of knowledge and innovation. The concept of knowledge markets will be introduced before moving to the case study.

2 Theoretical Issues

Knowledge markets treat knowledge as a commodity, a resource that can be stored, retrieved, exchanged and used as an input to an innovation process. Under this view information is a precursor to knowledge. At its simplest, patterns in the way data are arranged constitute information, and interpretation of information is knowledge. Applying this view to the situation in agriculture above assumes that the innovation challenges for service industries are no different from other sectors – they are essentially addressing a small business situation that has entrepreneurs making decisions and who at times utilise an advisory or consultancy service to complement their knowledge requirements. Knowledge has value because an exchange process is used to achieve improved productivity outputs.

The formalisation and systematization of scientific knowledge makes it particularly amenable to being treated as a commodity and therefore an object that is readily 'traded' in knowledge markets. Quality standards are imposed through peer review processes and

distribution mechanisms have been greatly enhanced in recent times through the power of the internet and electronic media. Knowledge is stratified under this regime with education providing the means to create a variety of 'haves and have nots', or those who possess greater and lesser classes of knowledge. Constructing knowledge in this way places a new emphasis on the phrase, 'a little knowledge is a dangerous thing' (Neef, 1999). Failure to possess the right type of knowledge is paramount to failing in life. Analysing market failure of a 'knowledge economy' requires an investigation of transaction costs or monopolistic inefficiencies that interfere with the efficient allocation of scarce (in this case knowledge) resources.

But has sufficient consideration been given to this thing called knowledge? Has the market model provided an adequate representation of knowledge by treating it as a commodity? Epistemologists have grappled with issues of knowledge over millennia to accumulate a 'store of information'. Two things can be taken from this project on knowledge. For individuals to appropriate this store as knowledge they must in some way process and interpret an organised set of symbols (information) to construct their knowledge of the topic. Second, ways of processing are a type of know-how in themselves, and fundamental to any acquisition of knowledge. Individuals vary in their capacity to process information, but the systematisation provided by the scientific method has enhanced the capacities of societies to rapidly relearn the know-how of previous generations.

Some authors are concerned that societies are failing to store a particular type of knowledge which is becoming increasingly valued by societies – tacit knowledge, or the knowledge of the practitioner (Schon, 1983). Within any profession like agronomy or engineering the practitioners will vary according to the extent to which they possess and use rules to select information from their stores of experience. They combine these selections with other choices made about what to observe and what to ignore under different professional conditions to formulate strategies for taking different courses of action. Often the possibilities for action burgeon as experience and observations expands, so competent practitioners possess advanced faculties for making selections about 'what really counts'. Practitioners have an acute sense of their competence relative to their peers – experts are frequently successful in ways that defy communication to novices in the same profession. This innate ability is a type of know-how, though it is difficult to trade

as a competence (Schon, 1987). Failure to represent tactic knowledge and competence as a commodity in a knowledge economy risks a diminution of value relative to more systematised information resources. Perhaps not surprisingly consultants have been well aware of this distinction between scientific information (that is reasonably accessible) and tactic knowledge that is reasonably scarce (and therefore valuable) and embodied in the individual. There is a risk of underestimating tacit knowledge as a resource for innovation in a sector because of this lack of visibility relative to scientific knowledge when markets treat knowledge as a commodity.

Advocates of knowledge markets also make assumptions about how innovation operates at the sector level. In a knowledge market an innovation is something that is new, and as an object it usually possesses features that are an improvement over its predecessors (Engel and Salomon, 1997). Technological innovations are a product of investment in research and development teams and facilities. Private sector investment in the development of innovations accelerates when (intellectual) property rights can be exerted over an innovation process or product as this affords more security over the protection of returns from the investment (Hodkinson, 1987). Free market policies to privatise public sector research, development and extension therefore place more value on those innovations that can attract a market value than those that have difficulty being represented in market values (such as some innovations related to environmental or social outcomes). Furthermore, innovations as part of a privatised policy are best handled as transactions operating at the level of individual businesses. Yet investment decisions relating to innovation are made at a collective level when many small businesses use a similar production process like dairy farming and the level of investment is beyond any one individual.

The impact of privatizing knowledge on innovation within the agri-environmental sector has been highlighted by many authors as a major issue facing agricultural prosperity globally (Roling, 2002). Arguments against increasing privatization suggest negative impacts such as reduced innovation, increased risks through exclusion (actors excluded from relevant knowledge) and/or substitution (issues and/or methods focus on well-resourced clients) and possibly high transaction costs (‘bureaucratization’). Many challenge the idea that the capacity to innovate towards sustainable agriculture can be optimally maintained through a knowledge market.

3 Methods and Procedures

3.1 Australian dairy industry as a collective response to innovation

The Australian dairy sector is a significant contributor to the GDP with an annual farm gate value of approximately AUD$3.7 billion (ADC, 2002:3). The system for milk production from most farms uses improved pastures with supplementary feeding from cereal grain or other supplements. The sector is a cost-effective producer of high quality milk, with Australian dairy farmers constantly increasing on-farm productivity through improved pasture, feed and herd management techniques (ADC, 2002). Productivity, measured as litres of milk produced per grazed hectare, has increased by 31% from 1991 – 1998 (Riley, 1999).

Australian dairy farming systems are in a continual process of intensification. Australian farms have generally become larger and more efficient in response to competitive pressures. The figures below highlight how these changes have occurred. Farm numbers have rationalised from 22000 in 1980 to just over 11000 currently (ADC, 2002:5). The average herd size increased from 80 cows, to an estimated 215 over the same period (ADC, 2002:5), and there are many farms with herds greater than 250 cows. Milk production has steadily increased, with an average annual yield per cow increase from 2850 litres to 4760 litres over the last two decades (ADC, 2002:6).

The improvements in productivity have been achieved through a reliance on new innovations like improved genetic merit of the national herd, more efficient water and pasture management and advances in milk harvesting. A mix of public and private sector organisations have been active in supporting farmers in their efforts to management of their resources. Farmers collectively invest in their own innovation (matched by Government funds) through a national development corporation (Dairy Australia). The research, development and extension agenda has become more complex for this organisation and others like state departments of primary industries. Public perceptions of agriculture typically relate issues of water and land management to the food systems and the environmental imperatives they value as a society. Dairy production systems are becoming more accountable to public and consumer scrutiny. Individual farm businesses

are accommodating these demands through compliance with quality assurance schemes and by adapting their production systems to reach a mix of environmental and economic targets. These efforts have increased the complexity and stress on farmers, at a time when business performance has been low due to drought and removal of price support schemes. The sector has also responded at a collective level using a combination of structural and strategic moves to construct an effective whole of industry response to these challenges. The following section will briefly outline the structural and strategic features of this response to highlight knowledge management issues that have arisen through these changes.

3.2 Structural changes

The Australian dairy sector aims to grow its capacity to be internationally competitive, innovative and sustainable. Part of the collective response to this intent has been structural, through the formation of a new dairy sector organisation, Dairy Australia[1] following the deregulation of the national dairy product market. Another has been strategic, through the recognised need for sector research, development, extension and marketing that contributes to sector performance in a way that identifies and acts on contributing factors to productivity performance. Challenges to achieving the sectors growth expectations include a less than desired productivity performance (currently 1.6% growth in productivity); a loss of extension capacity with privatisation policies; and the growing complexity of farming systems within communities. Taken together these challenges provide an excellent case for examining issues of knowledge management at a sector level. The case of the Australian dairy sector embodies a number of more general issues that relate to aspects of knowledge market management, the nature of knowledge in interactions across disciplines (dairy production, dairy science, dairy marketing, agri-business) and across communities of practice (farming, research, advisory practices). However introducing new structures at a federal level only provides a partial solution. Processes are also required to implement change including the way sector purpose and direction is negotiated, how power relations are handled, and how information flows are managed – these are considered as strategic responses.

[1] Dairy Australia is a new organisation formed on July 1 2003 responsible for industry strategy and performance in relation to manufacturing, production and services (Research, development and extension (adult learning)) in the dairy sector. It formed from the merger of the Australian Dairy Corporation (marketing) and the Dairy Research and Development Corporation (farm and manufacturing). Dairy Australia invests in research and development on behalf of the dairy industry through farmer levies and matching Federal (Australian) government funds.

3.3 Strategic Activities

Two whole of sector reviews were commissioned between 2000 and 2002 to determine the criteria and strategic directions for investing in the future of the dairy sector (CIE Review, 2001; ADIC Review, 2002). Both reviews used the principle of market failure to identify where the sector should direct its investment in research, development and extension. The role of extension was problematic to these reviews so an additional study was commissioned to scope the views of key stakeholders and organisations in an attempt to develop a strategy for extension and knowledge management. Criteria for engaging the stakeholders and developing a sector strategy were developed by a small working group. These criteria included: participation, inclusiveness, pro-active leadership, empathetic and appreciative engagement with stakeholders, co-operative approaches, the review process must be robust and well targeted using an outcomes focus.

4 Results

4.1 Managing knowledge markets, multi-disciplinary innovation and communities of practice

A desktop study and a series of semi-structured interviews with key informants from public and private sector organizations were used to determine the issues and opportunities for improving the management of knowledge in the dairy sector. The findings and contributions from this work to the development of the strategy will now be discussed.

4.2 Desktop Results

A literature review was commissioned by Dairy Australia to examine international developments in knowledge management and determine how support services were provided to sectors as they adapt and change (Nettle, 2003). The literature covered developments in adult learning, technology management, collective action, aspects of productivity in farming systems, international perspectives on agricultural knowledge management and the influence of public and private-good agendas. The main implications for the Australian dairy sector were gleaned from analysis of the issues, contexts and findings from the literature. The future characteristics or attributes of a knowledge management system for the Australian dairy sector were generated for industry discussion.

The review found that knowledge managers will in future need to develop social and organisational capabilities - not just technical. These capabilities will be vital to support dairy businesses through the changing community and environmental expectations outlined above. This highlighted a need for increasing capacity in the sector. Current knowledge management activities lack a supply chain focus and need to do more to service a range of abilities across the industry.

International experiences point to the perils of a total reliance on the private sector for provision of knowledge services. Some knowledge systems were moving toward an emphasis on learning and decision making rather than an acceptance of expert solutions. What was behind these shifts? Performance gaps were occurring with regard to advisory development (advice was not relevant to current issues) and environmental performance impacts were not being addressed to the satisfaction of the public (limited innovation and change in privatised systems).

The desktop study concluded nine criteria needed to be met by any strategy to successfully manage knowledge in the Australian dairy sector:

i. In projects using multi-disciplinary teams (social, economic, technical) there is a need to include farmers, researchers and extension expertise. These teams need to focus on food systems and eco-agri farm business management - not just better farming.

ii. Expertise in extension must build credibility, be equipped with technical support and provide career structures for practitioners. The extension practitioner needs to attain an equivalent status to researchers. Effective research and extension linkages must address industry relevant needs.

iii. Activities must be driven by industry and environmental outcomes.

iv. Negative consequences arising from privatizing knowledge resources need to be monitored and managed to minimise effects at the sector level.

v. The capacity for research and extension must expand.

vi. Change is a focus for providers as well as farmers.

vii. Research and development is required on extension in its own right.

viii. The knowledge system must perform to measured effectiveness standards.

ix. Private and public knowledge resources need to be integrated for effective capacity building across the sector.

The suggested characteristics of a system to manage knowledge in the dairy sector included: a focus on client needs; support provided to enhance learning and change processes; improved links between communities of practice, in particular between adult learning and research work; more emphasis on the professional development of knowledge managers; and, research was required in adult learning and knowledge management itself.

4.3 Results from interviews

A series of interviews were commissioned by Dairy Australia to ascertain the needs and preferences of sector groups in relation to future knowledge management issues (Drinan, 2003). Semi-structured interviews were conducted with 35 key industry stakeholders to gather their views about current issues and the framework needed to support the sector over the next 5-10 years.

Interviews were held face to face or by phone with key informant individuals and sometimes with small groups. Respondents included state and national level farmer organisations (n=7); State Departments of Agriculture (n=7); regional development programs (n=9); private consultants (n=3); agribusiness (n=4); research investors (n=2) and research providers (n=3).

The interviews were conducted around two themes:

i. What are the issues which should be considered if extension is to be better placed to support dairy farmers over the next 5-10 years?

ii. What are the main challenges that dairy farmers are likely to face over the next 5-10 years?

These themes usually led to conversations about matters such as:

- Strengths and weaknesses in current extension arrangements.
- The identity of the extension agents/providers in the future.
- Training, refreshing and upgrading of extension agents.
- The relationship between research and extension.
- The future roles of different extension agencies, and their interrelationships.
- Who should pay?

Interview results were analysed thematically and 20 “propositions” were developed as a way of conveying findings to an industry forum of the research, investor and service provider organisations who had participated in the interviews. Members of the forum used results from both the desktop study and the interviews to build scenarios for managing knowledge in the industry. A strategy emerged for the industry as each scenario was evaluated by the forum members using the investment criteria that were identified from the literature review.

4.4 Strategy for managing market failure in sector knowledge resources

Three critical capacities for the dairy sector were identified through the process outlined above.

i. Knowledge management research capacity

   This research capacity needs to focus on priorities of assisting the research and extension relationship and perform with a focus on industry outcomes (such as contributing measurable improvements in the way R&D services the sector). Support needs to be directed towards the development of specialist extension professionals (see below) as part of a general effort to build extension capacity & conduct research to support extension.

ii. Knowledge manager and mediator specialists for the sector

   This capacity focuses on the improvement of dairy farm system performance. Specialists would mediate between a national extension research team and

regional extension teams by offering planning and program development support. This tier of extension would provide a career pathway to retain exceptional professionals within public sector activities.

iii. A training and education capacity (technical, social)

This capacity focuses on the development of individuals and teams who work as service providers to farm businesses and agribusiness.

Structurally such an approach would require the formation of new specialist roles that would need to have an influence over a vast geographic area (dairy farm businesses are located from 15^{o}S to 43^{o}S latitude; and from 115^{o} to 153^{o} longitude). This influence needs to be multi-functional including:

- Linking production, profitability and environmental imperatives (eg water and natural resource management and biodiversity).
- Understanding the adaptation of new technologies and the associated learning challenges
- Enhancing the performance of dairy businesses in an overall supply chain of food systems
- Contribute to the development of knowledge management methods and evaluation.

At the time of writing the strategy is partially implemented using a combination of four sub-programs and three themes. The sub-programs draw on some of the capacities and structures that were operating in the sector prior to the review. For example, a national network of regional development programs has been operating for a decade but they are now aligning their regional activities with national priorities through the use of strategic themes. Similarly, national learning packages have been operating for five years and now represent a comprehensive and expanding extension resource that is being integrated with complementary programs (like the National Dairy Farming Systems program). A third sub-program is currently linking several extension projects together under a common focus on improving skills in farm business management. The final sub-program is a new development area that will create a ‘virtual campus’ networking eight specialist extension

professionals across the country using electronic and project management activities. This sub-program is at a concept stage and is referred to as the Centre for Change Management. It will have a core research and development team that will support the specialists by investigating issues that intractably interfere with the achievement of the social, economic and environmental outcomes desired by the sector and society.

These sub-programs work across three key theme areas focused on improving sector performance. The first theme seeks improvements in the management of complex farming systems. This complexity is not viewed as a negative, rather the demands for improved environmental and social outcomes from our farming systems are viewed as a healthy but challenging demand arising both within and from outside the sector. The second theme is to continuously improve the business management capacity of producers to manage complexity. The third theme focuses on capacity building among the service providers who support the management of change across the sector. These themes provide an agenda framework for each sub-program which may contribute to one or more thematic outcomes.

5 Conclusions

In conclusion, this paper with a comment on the conceptual framework used in the development of the strategy. Our purpose in raising this issue at the conclusion is to suggest some challenges to researchers who are working on models for sector level innovation and change.

A general model explaining the relationship between science and technology was developed by Gremmen (1993). This was later adapted by Paine (1997) to critique sector level innovation. The Interplay Model informs the design and tactics used by individuals and organisations with an interest in improving the networking of discipline based research and extension teams (Paine, 1999). These tactics include growing the capacity of knowledge brokers like extension workers, particularly when they are active in spanning boundaries between research teams and farm producers. Interplays are the types of exchanges that are made between knowledge workers like researchers and professional practitioners. The model is not explicitly concerned with identifying the determinants of

market failure nor does it seek to arrive at a definitive position to prescribe appropriate levels of sector investment in research, development and extension. A central concern of the model is to address the question that was first raised by Star and Griesemer (1989): '*how do different practices, with different methodological and substantive concerns succeed in co-operating?*' Practices are therefore the primary unit of analysis when working on cooperative strategies for sector level knowledge management.

Practice is defined as a meaningful pattern of activities that other practitioners recognise, judge and position with respect to their own practice. Links between practices are made using experience rules that emerge through trial and error from day to day activities. To perform collective activities these rules tend to be shared across practices and may become sufficiently formalised to define key elements of competent performance (ie. defining rules). Different practices interplay at an interface which could be a conference, a project or workplace. The interface provides opportunity for different practices to mutually share different aspects of competent performance. A continuum of interplays can be performed at an interface ranging from periodic but discrete exchanges through to a sustained sharing of competent performance to ultimately fully embodying the defining and experience rules to create an emergent practice (eg. ecological economics from ecology and economics). External stimuli like public expectations or Government regulations can prompt the formation of these new practices, as can internal discontent with frequent errors in performance.

Extension can be analysed as a practice in relation to sector level knowledge management. It has a unique role as a mediating practice. As such its competent performance is based on a capacity to share in a number of competent performances with a range of other practices like farming, researching and policy making. In so doing extension requires its own body of theory and methodological resources to continuously improve its practice and that of other practices in which it shares a competent performance. This represents a challenge for researchers concerned with organisational knowledge and learning. What theoretical and methodological resources are required to improve the performance of mediating practices that broker knowledge resources at a sector level? How do sectors monitor and evaluate practices that mediate knowledge resources? Should mediating practices have a role in determining desirable sector outcomes? These questions could form the basis of a research and development agenda

that could span a number of industries and sectors to derive general principles for improving investment in knowledge and innovation and for guiding more effective change management by the practices operating in the sectors.

We conclude that knowledge management in the Australian Dairy Sector is integrally related to the performance of its extension practice. Current extension practice needs to embark on a course of continuous improvement. The destination for this course is emergent but involves a capacity to mediate across practices while concurrently expounding its own agenda for developing its capacity as a practice.

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