

Making farm management research relevant to farm management practice

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Abstract

Although publicly-funded agricultural research is a well-entrenched aspect of modern agriculture, it has been recently challenged in ways that reflect broader changes in the attitudes of 20th century Western Society towards the role and conduct of scientific research. This has brought increased scrutiny to the area of agricultural research which provides scientific analyses and tools to improve farmers' planning and decision making. However, history has shown that achieving relevance in this area of research activity has been problematic for agricultural scientists, and especially for agricultural economists. This paper examines the interface between farm management practice and research about farm management practice, reflects on unsuccessful attempts to bridge the 'gap' between the two, and proposes that a paradigm shift in research, where farmers and researchers share perspectives and strive together to solve problems and discover opportunities, will be necessary to enable research to effectively intervene in farm management practice.

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Introduction

In Farm Management Research (FMR), as well as in other non-agricultural fields, accounts of how 'management science' has been and/or should be conducted to be effective in aiding practical management have generally been from the standpoint of the researcher's perception of the manager's needs or from the standpoint of a particular philosophy of inquiry. While both standpoints are legitimate and sometimes helpful, the underlying theme of this paper is that unless science-based intervention in management is seen in a broader context of societal changes in attitudes over time, there is a grave danger that research aiming to intervene in real management, no matter how well conducted, will not be relevant to real managers.

Our discussion draws on the experiences of agricultural economists in research which aimed to support farm management practice. The struggles of economists to be effective in achieving this aim provide lessons which we use to explore the differences between farmers' practice and the scientific approaches designed to aid practice, and why past attempts to bridge the gap between the two may have failed. We then discuss how more effective bridges between theoretical approaches for guiding management and the real farm management can be constructed. This paper argues that to the extent that FMR has been about helping farmers, it has been insufficiently attentive and/or responsive to what has been happening at the broader interface between applied science and practice.

Society's changing attitudes towards science-based intervention in public matters

The rise of science and technology within the progressive model of governance

Throughout much of the 20th century, scientific research was carried out under the 'progressive model' of governance, where it was taken for granted that the scientist was the neutral expert and that good factual knowledge was sufficient to resolve most public policy questions. The progressive vision was founded on a consistency among the models of positivistic empirical science, rational and comprehensive planning, and democratic government in the public interest. As described by Maxwell and Randall (1989):

The progressive movement of the turn of the century sought to introduce scientific methods and techniques into government. It reflected an age when public confidence in science and human progress was at its peak. Progressive political theories sought to define a mutual working arrangement between the sources and providers of expert knowledge and the democratic political process. Since the progressive faith in science and human progress seemed boundless, it is not surprising that the progressives were concerned to, first, expand the role of experts in government, and second, ensure that these experts functioned according to the then-prevailing notions of positivistic science. (Maxwell and Randall, 1989, p. 234).

The public confidence in science and technology flowed to the professions. In both the universities and in the professions the dominant view of professional knowledge emerged as the application of scientific theory and technique into the instrumental problems of practice (Schon, 1983). 'Rational' and standardised knowledge replaced craft and artistry in customary practice which was viewed as having no lasting place in rigorous, practical knowledge (Schon, 1983).

Farm Management Research under the 'progressive' model of governance

Farm management emerged as a field of study about a century ago. Under the progressive model, the American government set up organised programs of research and professional intervention in the management of farms in the early 20th century, and similar programs occurred later in Australia. Although the origin of an 'academic' profession of farm management can be related to the above broad social changes, it can also be related to

pressing problems of agriculture at the turn of the 20th century - land settlement and expansion of agriculture, internationalisation of grain markets, revolutionary technology, and farmers under financial stress as a result of these factors (McCown et al, in preparation).

Within the 'progressive' philosophy of governance, in time, professional analysis grounded in theory became the explicit approach of FMR as an area of professional activity. The influence combined the education of farmers and the conduct of farm management practice. A new type of farmer was being fashioned in line with the new progressive view of a management (Taylor, 1994). The view of the manager as a practitioner of an art, that utilised a unified practical rationality that cannot be reduced to explicit rules was replaced with a view of the manager as a technician "whose practice consists in applying to everyday problems the principles and methods derived from management science"- i.e. a technical/economic rationality (Schon, 1983, p. 236).

In the United States and Australia, the earliest professional efforts to aid the development of the farm as a business were initially made by agricultural scientists, and without economic theory. Their approach to improved farm economic performance was to work through farmers' actual financial accounts to identify possible efficiencies, mainly through cost savings (Norman, 2000). Dillon's (1965) history of academic effort in farm management describes this as a period characterised in part by 'the lack of any specific institutional framework for farm management research and teaching' and "in the main....the absence of any analytical principles or orientation to farm management problem solving as we now understand it" (Dillon, 1965, p.175). But he noted that "overall it certainly did not have the fault of not being addressed to real farmers' real problems" (Dillon, 1965, p.181).

In the 1920s in the USA and in the 1940s in Australia FMR moved strongly in the direction of economic analysis, the key change being the use of production economics theory to identify what an economically rational manager 'should do' to optimize profits, i.e. a theoretically normative approach (Norman, 2000; Dillon, 1965). The early FMR work which involved descriptions, explanations, and commonsense guidance of farm practices using simple accounting techniques was replaced by theory-based models intended to provide rational plans for resource allocation in the mixed enterprise farming that predominated.

Economics came to dominate the field of farm management research, Farm Management became accepted as a branch of applied economics (Hardaker, 1979) and workers developed a strong professional status. John Dillon was appointed in 1965 as the first Professor of Farm Management in Australia, and his department at UNE achieved academic eminence. A steady flow of theory-based analytical techniques followed, including production function estimation, programming methods, optimisation of farm input and output combinations, decision theory methods focussing on utility analysis and risky decision analysis (Malcolm, 2000), and public sector agricultural advisory units absorbed substantial numbers of economists competent in using them.

It didn't take long for some to conclude that things were not going according to expectations. The bad news was that FMR with an economic theoretical orientation had become more focussed on theoretical and methodological issues and of less and less relevance to the solution of practical farm management problems. The crisis has been comprehensively critiqued in both Australia (Malcolm, 1990) and in the USA (Johnson, 1981).

John Dillon went from proclaiming the bright future of FM (Dillon, 1965) to questioning if the economic theory could be relevant to any real world problems i.e. helping farmers to decide on a course of action (Dillon, 1979).

"...Farm Management based on production economics has lost touch or must inevitably lose touch with farmers' needs and the practicality of farming because of its emphasis on logically attractive but largely inapplicable theory" (Dillon, 1979, p.11).

While Dillon was by no means alone in his crisis of confidence in production economics, his remarks are particularly telling considering it was only a decade earlier that he was championing the techniques of production economics. Dillon (1979) clearly set out the

difficulties faced by economic researchers in representing real-world farms in theoretic models:

“There is no conceptual difficulty in formulating static production economics in terms of a utility-maximizing criterion, nor in conceptualizing its logic for non-physical processes. The difficulty lies in *application*.

First, data are not available to be able to specify the relevant production processes (both physical and non-physical) to any significantly relevant degree - particularly if we recognize the *uniqueness of individual farms*.

Second, the farm system is *dynamic*, not static, both in the broad as a purposive organization in a *changing* environment and also through the pervasive role of biological time-dependent growth processes in its technical subsystem.

Third, even if data were available to specify the required production processes adequately, the task of analysis even under perfect information would be both *too complex* and too costly for either farmers or computer-aided professionals. "Non-optimizing" mode of behavior has to be used.

Fourth, the problem of *uncertainty* has to be handled. Again this is pervasive in agriculture due to the stochastic vagaries of climate and markets especially, but also because of uncertainty about technology, policy and people. While techniques have been suggested to handle such uncertainty, their cost on a thing approaching an individual farm basis makes them impractical.

Fifth, even if all farmers faced the same production functions and the same judgements about the probabilities, they would still have *different preferences* and so need different prescriptions for utility maximisation across their *individual multiple goals*" (Dillon, 1979, p.11).

By the late 1970s FMR in Australia, as a branch of agricultural economics, had largely run its course (Malcolm, 1990). The institutional support also crumbled with the termination of the Australian Extension Service Grant scheme in the early 1970s as state departments became less able or less willing to support as strong a farm management extension focus. Increasing pressure on government budgets with the economic slowdown of the late 1970s contributed to the slow attrition of economists in agricultural departments (Kemp and Girdwood, 2002).

Tellingly, a recent review of farm management research (Kemp and Girdwood, 2002) noted "... NSW Agriculture reduced the number of extension agronomists a few years ago. This generated more concern among farmers than the loss of extension farm management economists....."(Kemp and Girdwood, 2002, p.3).

Although FMR has evolved considerably over the last 100 years, Norman (2000) concluded that didn't live up to expectations of its potential to guide farm management practice. In Australia, Malcolm (1990) similarly concluded that the emphases on production economic estimation of resource activities, on linear programming approaches, on systems simulation, utility analysis and formalised probability analysis had been of virtually no direct use so far as actual decision making on farms went.

Difficulties in other management sciences

Farm management economists were not the only professionals experiencing difficulties in being relevant to practical management. As agricultural modelling and its applications have inherited much from the field of Operations Research (McCown, 2002), it is significant that similar problems were being felt in operations research and management science, as described by Schon (1983).

“After World War II, the development of the digital computer sparked widespread interest in formal, quantitative, computerized models which seemed to offer a new technique for converting "soft" problems into "hard" ones. A new breed of technical practitioner came into being. Systems analyst, management scientists, policy analysts, began to use formal modeling techniques on problems of inventory control, business policy, information retrieval, transportation planning, urban land use, the delivery of medical care, the criminal justice system, and the control of the economy. By the late 1960s there was scarcely a described problem for which someone had not constructed a computerized model. But in recent years there has been a widening consensus, even among formal modelers, that the early hopes were greatly inflated. Formal models have been usefully employed to solve problems in such relatively undemanding areas as inventory control and logistics. They have generally failed to yield effective results in the more complex, less clearly defined problems...” (Schon, 1983, pp. 43-44).

Schon's (1983) assessment of the problems not unlike Dillon's assessment of FMR:

“In spite of the increasingly powerful status of management science and technique, managers have remained persistently aware of important areas of practice which fall outside the bounds of technical rationality. This awareness has taken 2 forms.

Managers have become increasingly sensitive to the phenomena of uncertainty, change and uniqueness.

[In the] day to day routine of management practice, managers have remained aware of a ordinary dimension of ordinary professional work, crucially important to effective performance, that cannot be reduced to technique. Indeed, they are sometimes aware that even management technique rests on a foundation of non-rational, intuitive artistry” (Schon, 1983, p.239).

He describes the reaction of operations researchers to this realisation:

“Formal modelers have responded to this unpleasant discovery in several different ways. Some have continued to ply their trade in the less demanding areas of the field. Some have abandoned their original training in order to address themselves to real-world problems. Others have decided to treat formal models as "probes" or "metaphors" useful only as sources of new perspectives on complex situations. But for the most part, the use of formal models as proceeded as though it had a life of its own. Driven by the evolving questions of theory and technique, formal modeling has become increasingly diverted from the real-world problems of practice, and practitioners who choose to remain on the high ground have continued to use formal models for complex problems, quite oblivious to the troubles incurred whenever a serious attempt is made to implement them” (Schon, 1983, p.43-44).

Russell Ackoff, co-author of the first textbook on Operations Research, shocked the profession in the 1970s by arguing that “The future of operations research is past” (Ackoff 1979). The failure of the highly structured and quantitative problem solving methods of Operation Research was that “managers do not solve problems, they manage messes” (Ackoff, 1979, p.100).

The loss of confidence in science and the professions

The problems that had become evident in FMR and Operations Research were taking place against a setting where public confidence science and technology, and in the associated professions, had begun to wane in the second half of the 20th century.

There has been a general loss of faith in attainability and desirability of the ideals of the progressive vision. Randall and Maxwell (1989) noted the “pedestal upon which the progressives had placed science” had been lowered given the increasingly tentative nature of scientific inquiry – that is, interdisciplinary conflict reflected in competing paradigms and interest groups, recognition that knowledgeable people within a discipline could reasonably disagree on scientific questions, that science could not provide unambiguous answers, and that the planning process can never be entirely rational and comprehensive. As a result, the 'progressive model' gave way to the rise of pluralism.

Positivism, once the dominant philosophy of science, attracted 'devastating' criticism. For example, Blaikie (1993) reports that the positivist view of science was accused of replacing the world of social reality with a "fictional non-existing world constructed by the scientific observer" (Blaikie, 1993, p.102). As alternative philosophical positions emerged, the professions were increasingly viewed as vehicles for social control, elite instruments of the establishment, with their technical expertise an instrument to control the have-nots in society (Schon, 1983). For many, society had changed from being receptive to information and expert advice to sceptical and distrusting. The tables had turned with objective knowledge falling out of favour, making way rebirth of interest in the nature and importance of subjective reality and appreciation of skilful human performance (Schon, 1983).

In a pluralistic society the opinions of laypersons do carry weight, and communities will take action to achieve goals, rather than passively wait for elected politicians and governments to get it right (Randall and Maxwell, 1989). The growing dissatisfaction among various communities with having important decisions being made for them by 'experts' has resulted in the 'demystification' of the professions (Schon, 1983), sprouting a new breed of community members equipping to take over the territories of the professional experts. Likewise, the adequacy of the familiar knowledge-producing institutions such as universities and government research organisations has been called into question (Gibbons et al, 1994).

Re-orientations in farm management research over the 20th century

Changes in the conduct of agricultural research as reflecting society's changing view of scientific intervention were first evident in less developed countries (LDCs). This occurred at a time when perceptions were growing that 'station based' research was not as relevant to local situations as was needed to ensure the generation and uptake of improved practices amongst small-scale farmers in LDCs. Like some of their counterparts in the USA and Australia, economists working in this context struggled to adequately deal with the problems of small-scale farming using their theoretic models imported from their FMR backgrounds (Norman, 2000; Dillon et al, 1978). The 'gap' between theory and practice in LDCs was more exaggerated than in countries such as Australia and the US.

This stimulated substantial changes in agricultural research, based on the recognition of the farm as a purposeful social system, reflecting Dillon's (1979) call for a re-orientation of FMR. Trials moved to small-holder farmers' fields and the importance of farmer participation in guiding research was recognised (Norman, 2000). This became known as farming systems research (FSR) and became institutionalised in the international agricultural research centres in the 1970s and 1980s. FSR evolved and began to distinguish itself from FMR in several ways, including a return to some of the characteristics of FMR before the 'take over' by theoretical economics. For example, economists in LDCs were turning to less theoretical approaches and budgeting was recognised as the stand out approach. Social scientists later joined FSR teams, and developments such as Farmer First, emphasised farmers' involvement in defining the problem as well as the importance of the social context, using methods such as rapid rural appraisal and participatory rural appraisal. Farmer first for example incorporated systems thinking, constructivist philosophy, and the reality of multiple perspectives. The feminist critique of science had also questioned the assumptions guiding RDE, noting the *situatedness* of knowledge in people's lives (Woods et al, 1997). A number of 'brands' of systems research approaches in agriculture now exist. What they have in common is a movement away from a view that science can research the management of agricultural systems without real participation of systems managers (Carberry, 2001).

Woods et al (1997) have reported that, on a global basis, agricultural research has continued to move from the provision of technological components for production and resource management towards more participatory processes, noting "the RDE revolution is about the importance of choice, and that and is as much about responsibility and accountability within a wider community as effectiveness and efficiency in production and marketing" (p.470).

Contemporary farm management in Australia

Farm management in a participative and pluralistic society

Most farm businesses in Australia continue to be owned and operated by farm families (Kingwell, 2002) and in many respects, many of the fundamental problems of farming in Australia have not changed much since the first professional farm management researchers took an interest in farm management practice. Jack Makeham's 1968 assessment of the major challenges to the farm manager is still highly relevant today, that is - (a) how to incorporate new technology profitably into an existing business organization; (b) how to be sufficiently flexible, mentally and financially, to adjust resource management to meet both changed economic circumstances and widely varying climatic conditions (Makeham and Malcolm, 1993).

However, recent reviews (Mullen, 2002; Ronan, 2002; Kingwell, 2002; Macleod, 2002) have highlighted the added complexity of the external environment which farm managers must face. These challenges relate to markets and trade arrangements, new technology and information sources, environmental degradation, public interest in the ethical values of modern science and farm technology, declining terms of trade, growth of non-productivity 'amenity' values for which markets do not exist or are in their infancy, distance and remoteness, and demands of consumers and society. Of the items sitting on the current farm management agenda, the need to implement sustainable resource management rates highly. Landscape and ecosystems degradation comprises a range of problems such as soil health, water quality and quantity, salinity, erosion, acid soils, biodiversity loss. While many farmers would like to have more sustainable farming systems, the reality is that applied knowledge and technical solutions do not always exist (Kemp and Girdwood, 2002; Pannell, 2001).

Farmers, like other members of the community, want increasing participation in controlling their own research agenda, and various proactive farmer groups are now successfully securing funding and organising their own research (Carberry, 2001; Marsh and Pannell, 2000). It has been suggested that the transfer of the research mandate to clients – farmers and agribusiness – is evidence of an irrelevancy of our traditional research methodologies and institutions (Carberry, 2001). The broader community, both indirectly and directly affected by natural resource degradation problems, is also represented by a number of organisations which are also actively funding their own research and seeking access to the processes through which public issues in natural resource management are negotiated. Even public opinion has come to carry a good deal of weight, even if there has been a divergence between the viewpoints of public and expert opinion. A recent example concerns the public interest in "droughtproofing" Australia, despite low enthusiasm for the concept from leading scientists. Kemp and Girdwood (2002) highlighted that the concepts involved in constructing and managing systems sustainability will become increasingly important given the contemporary political discourse about the degradation of landscapes in a pluralistic society where there are conflicting political, social, economic issues concerning primary production.

Perspectives on contemporary farm management research

The re-orientations in agricultural R&D that have their been guided by society's changing view of science have been described by Woods et al (1997) as the 'quiet revolution' because they have been better developed in concept rather than practice in Australia. That said, in recent years, there has been widespread interest and establishment of 'systems' research approaches across Australia as step towards ensuring relevance of research to farm management practice. This is evident, for example, through GRDC's establishment of Farming Systems Research projects and sponsorship of a major symposium on FSR in 2000¹. It has been noted that FSR in Australia has been characterised by little uniformity in approach (Petheram and Clark, 1998) or common understanding of the concepts. This diversity may represent a search for appropriate models of FSR for Australia, but overall,

¹ GRDC Day: "Doing Farming Systems Research", 10th Australian Agronomy Conference, 28 January-1 February, 2001, Hobart.

Australian-style FSR has been only vaguely defined and there appears to be little reference to international literature involved in the spectrum of new FSR programs and projects (Petheram and Clark, 1998).

While agricultural economists were leading the charge on the FSR front in the early 1980s in LDCs, FSR was largely ignored by researchers in places like Australia (McCown, 2001a). This was despite salient contributions of Australians, including Dillon, to early FSR development internationally. Although the ideas of FSR eventually diffused into Australian agricultural research in various ways, agricultural economists have not been prominent in Australian style FSR, which has had a highly technical, 'hard' focus. McCown et al. (1998) distinguished between 'farming systems research' and 'systems research about farming.' The 'hard' mode of the latter utilizes modelling of biological and/or economic aspects of farming. Although there is a small group of agricultural economists involved in farming systems research projects in Australia, in the main, scientists have worked with farmers without a social scientist involved (Brennan and McCown, 2000; Kemp and Girdwood, 2002). Malcolm's (2000) poetic perspective on this suggests that the challenge for economists of re-inventing Australian FMR in systems approaches was too difficult and that other opportunities lay elsewhere:

“.. farming systems approaches would have to prevail. It would be difficult, and progress would be slow..... most academic workers in farm management economics had decided that this was a rough shed and it was a fine day for travelling” (p.13).

No movements towards systems research approaches appear to have filled the void left by the departure of FMR from universities and departments. In universities farm management teaching has been re-orientated towards 'agribusiness' (Godden, 2001; Charry and Parton, 2002) and applied science frameworks (Charry and Parton, 2002). A recent workshop on farm management² revealed some pessimism on the outlook for farm management, viewed in the more contemporary context of a broad, multi-disciplinary field of authoritative knowledge and professional activity. Charry and Parton (2002) suggested that there has been a depletion of Farm Management research opportunities. Kemp and Girdwood (2002) have suggested that “few fresh ideas are being identified with and claimed to be within the field of farm management; the advances are being claimed elsewhere” (p.4) and that “farm management as a component of agricultural economics does not appear to have made many advances in recent years in exciting great interest in students or in research” (p.5).

However, such comments indicate that 'farm management research' might currently be as ambiguous as 'farming systems research.' From its origins, FMR was about management of the farm as a business. Later the methods of FMR shifted from book keeping to analysis to microeconomics. Two decades after economists abandoned the FMR field, most of those who have succeeded them in research on the management of farms choose not to describe themselves as working in the field of 'farm management'.

“Much agricultural R&D aims to improve the sustainability of farms, but rarely is this described or claimed as farm management research” (Kemp and Girdwood, 2002, p.5).

A new, as yet, ill-formed, identity is evolving related to the primary emphasis of this new generation of work – ecological sustainability of profitable farming practice.

At the same time the primary activities of Australian agricultural economists often do not have as their primary aim the generation of knowledge to guide farm management. Instead, farm-level modelling is conducted to evaluate prospective land uses, technologies and policies in relation to the impact of these on farm viability, off-site costs and net benefits to society in order to influence management indirectly by contributing to policy debate, development, evaluation and communication, and to guide efficient use of research resources in farm management problems. Where such research is intended to guide farm management practice, an extension officer may provide the interface.

² Farm Management Workshop, The University of Sydney, December 5-6, 2002, Orange.

Farm management research and practice – tensions at the interface

The transforming effects of a century and a half of agricultural research leading to design of revolutionary material technologies tend to mask the relatively disappointing outcomes in another area of agricultural research - the provision of scientific analyses and tools that improves farmers' planning and decision making (McCown, 2001a). For over 30 years computerised models of farm economies or production systems have claimed the ability to identify superior alternatives for management action. Despite the huge improvements that have been made to the competency of models and the increasing computer ownership among farmers, model based interventions in farm management have failed to generate or sustain interest (McCown, 2001b) and attempts to make these models more user-friendly by packaging them as DSS has failed to have a substantial impact. While not expected to be a great consolation to economists, a sizeable number of agricultural scientists and engineers have now experienced the disappointment experienced earlier by farm management economists.

Contemporary research and intervention concerning triple bottom line farm management, presents economists with the frustrating paradox of economics being marginalised from activity which is inescapably economic. After all, with its theoretically-normative approaches to guide planning in the presence of resource scarcity, and given the inherent importance of good economic performance on farms, it would seem obvious that any research concerning superior farm management practice must include economics. Furthermore, the addition of environmental concerns to the FM agenda should present an opportunity for economics to assist with challenges relating to economic-environmental tradeoffs.

A clear disparity between scientific research that identifies what a farmer should do as best practice and what a farmer actually does has persisted (McCown, 2001b). The failure of attempts to intervene in farming practice using those theoretical principles is problematic because there is an expectation that research should contribute to improved planning and decision making by farmers, given that farming appears to be more complicated and intractable than ever before. Mullen (2002) notes that the role of Australian public research institutions in the design of material technologies to improve efficiency in farming practice will decline, and indicates that there has been a marked shift in publicly funded research resources towards "management- or knowledge- based disembodied technologies" on the grounds that this research is viewed as being in the public interest to deliver environmental outcomes that have consequences for the rest of the community. Rural research and development corporations are also making such investments (Mullen, 2002).

Reflections on past disappointments and implications for farm management research

In this section we look closely at the nature of farm management practice, and at an internal distinction highlighted by Dillon (1979). In lamenting the degree of recourse to esoteric philosophical explanations of failures of FMR, he points out that

“... the discussion seems to have been conducted without drawing adequate distinction between farm management (i.e., the farmer's activity) and Farm Management (i.e., the professional activity)” (Dillon, 1979, p.12).

We are concerned with the nature of this gap between farmers' practice and the scientific approaches designed to aid practice, why past attempts to bridge the gap may have failed and how more effective bridges between science theory for guiding management and the real-life practice of farm management can be constructed.

Real farming vs the scientific approach to farming

Farm management from the farmer's viewpoint – the 'inside' view - is *situated*. It is *social* and it is *local*. By social we mean practice is *subjectively purposeful* and it is 'choreographed' by the community of practice (McCown 2001a). The much used aphorism of a colleague of ours that 'on a given farm, that farmer is the world's expert' captures an important aspect of '*local*'.

Much of the practical knowledge of a good farmer comes from experience in his/her life-world that revolves largely around actions and consequences. This accumulation of expertise means that even though farms and farming environments are so complex that they make holistic scientific models infeasible, the complexity is not necessarily a problem for the experienced farmer on that farm.

However, this complexity, viewed from the 'outside', that is, the *objective* viewpoint of the economist, tends to lead these observers to think that their role was to somehow help farmers in dealing with the complexity of the farm and its management, when, in fact, complexity has often not impaired farmers perceptions and actions, at least not for long (Pannell et al, 2000).

As Dillon pointed out (quote above) farm management economists under-appreciated the distinction between the natures of the 'inside' (farmer) and 'outside' (economist) views of management reality. There was a tendency to view the objective outside view as superior and that it was only a matter of time before good farmers replaced naïve, intuitive, 'inside' views with the scientific view, if the professionals did their jobs well. Of course in a way this is correct. Farmers have learned much from science regarding the nature of the world in which they farm and trade, and sometimes better factual knowledge ("knowing that..." of Ryle (1949)) has big payoffs. But the type of knowledge that is more important in farm management is what Ryle (1949) termed 'knowing how.' This dichotomy of knowledge is central to the crucial distinction made by Longworth and Metz (1980) between the concern of agricultural economics with management *outcomes* as opposed to management *process*. The focus of economic theory on resource allocation *outcomes* and the logic of its optimisation by-passes management *process*. This means that the timing of actions, important local aspects of the situation, and the manager's knowledge and expertise in executing allocation is ignored.

Agricultural economist and Nobel Prize winner, Theodore Schultz suggested that farm management, as a branch of economics, struggled in guiding farmer decision making because the theoretical apparatus of economics was problematic.

"It is through price and technical expectations, that changes in taste, techniques, and resources are transmitted to the firm. These expectations, accordingly, act as a barometer of all the economic changes which impinge upon the actions of the firm from without. The farmer as entrepreneur must do two things. He must formulate the price and technical rates that he expects. He must then develop a production plan based on his expectations which will give him optimum use of his resources. Expectations cover the first and the plan covers the second.

The more difficult and also the more important of these two categories of decisions, both to farmers and to other entrepreneurs, is the formulation of expectations. ...there is in reality a considerable element of risk and uncertainty in whatever expectations are formulated..." (Schultz, 1939, p. 577).

Schulz (1939) acknowledged that although the process of planning is very important, farmers do not rely strongly on resultant plans, even though this is the area where Farm Management economists had stepped in to assist. Schulz (1939) suggested that it was futile for economists to "provide rules which make more effective the essentially trial and error procedure by which farmers try to maximise profits over some time plan" because it is impossible to get the input-output technical co-efficients that reliably represent the real-life transformations that take place on a particular farm. Rather, he suggested that what is important on the physical side of farming is not what input-output rates are possible in practice but what the farmer expects, as it is the latter that enters into his plans. Therefore, what farmers need to resolve from a practical point of view is closing the gap between expectations and realisations. Schulz (1939) questions whether FM researchers should be redirecting their energy to the

formulation of expectations but questioned whether economic theory was going to offer much help:

“We know that the prices and outputs which farmers expect are at best probable, very often nothing more than guesses, and sometimes even only hunches. Economic theory, however, is not able to give us much help (Shultz, 1939, p.585).

“ [A farmer's] most costly mistakes can usually be traced back to faulty expectations. It is in the imperfections of expectations that we come into contact with the more important real production problems and also the more difficult analytical problems of economics” (Shultz, 1939, p.586).

Day (1971) similarly recognises that a critical aspect for understanding economic behaviour is that plans are based on information that is not the ‘true state’ (i.e. what is actually going to happen), but rather what the decision maker *expects*, without knowing the final outcome. As expectations don't equal the true state, he highlights the limitations this imposes on economic analysis:

“In the absence of perfect knowledge, optimality must be relative and an essentially speculative (ex ante) prospect” (Day, 1971, p.236).

“Man is placed in the absurd position of having to optimise without knowing if his behaviour is optimal” (Day, 1971, p.249).

Day's claim that “one's concept of the feasible depends on experience” (Day, 1971, p.240) is central to his call for a theoretical shift away from normative ‘rational’ economics with its *outcome* orientation to a behavioural economics approach which retains a concern for outcome but which recognises that the subjective processes of decision making are integral to meaningful management activity.

But elevation of subjective experience to an integral aspect of economic theory of the behavioural sort doesn't mean that its inadequacies for important farm planning and decision making are not significant. In the dryland farming systems in which we work, inadequacies of subjective knowledge are especially stark in dealing with three issues. First, almost every management activity is contingent on the rainfall, and the rainfall climate is so unstable that it is doubtful if previous experience is of much value in management of this risk. This problem of extreme variability seems to qualify as an ‘outcome irrelevant learning structure’ (OILS) of Einhorn (1982) in which outcome feedback does not significantly influence subsequent action. Second, farmers that are succeeding financially are continually either considering, or implementing, change. This means that new uncertainties are being created, since all it takes to make an experienced expert into a novice is a radical change in technology or strategy (McCown, 2001a). Third, the problem of long-term ecosystem degradation presents another type of OILS problem due to degree that the feedback cycle exceeds the decision-making cycle. This is nicely captured by the somewhat sexist Arab proverb “Experience is the comb that life gives to a bald man,” which, in view of the general state of Middle Eastern agricultural landscapes, may well have had its origins in this farm management issue.

Our research on supporting farmers' subjective management practice - a work in progress

The discussion above points to an opportunity for a new type of participative farm management intervention that is in keeping with Dillon's search for approaches that are more ‘human’. Over the past several years we have been part of a team conducting an ‘experiment’ in using scientific models to aid discussions about farm management with farmers and their advisers. In our attempts to understand the apparent success of this approach, we have been encouraged by the evidence that Dillon (1979), Shultz (1939) and Day (1971) were moving toward ideas that accommodated the reality and inevitability of farmers' subjective processes for dealing with uncertainties in farm management decision-making. As in Farm Management interventions in the past, considerations are largely about the planning of future

actions. But central to this approach is recognition of the importance of farmers' *own* planning, as articulated in Russell Ackoff's *participative principle* in the same year as Dillon's critique.

"Most planners and consumers of plans believe that the principal benefit of planning comes from the consumption of the plans it produces. The interactive paradigm is based on a contrary belief: that the principal benefit of planning comes from engaging in it. In planning, *process* is the most important product. []... no one can plan effectively for someone else;...*it is better to plan for oneself, no matter how badly, than to be planned for or by others, no matter how well*" (Ackoff, 1979, p.189, emphasis added).

As mentioned above, planning by dryland farmers' is made especially difficult by uncertainty of weather, any significant adaptive changes in practice, and the mismatch between feedback cycle and the decision cycle regarding matters of ecological sustainability. In addition, the last two are exacerbated by interactions with the first. The approach has been to use a comprehensive cropping systems simulator (McCown, et al 1996; Keating, et al 2002) to 'do' virtual whole paddock experiments in response to farmers' 'what if?' questions and to examine and discuss outcomes together. To enhance relevance, a great deal of investment has gone into acquiring specific paddock weather data. After ten years of intensive interactions with hundreds of farmers in four states, there is a demand for this service that is now beginning to be met by the specially trained consultants. Research is continuing on a mode of interaction which features researchers in Queensland holding virtual meetings with farmer groups in NSW, Victoria, and WA using computer application sharing coupled with video conferencing on the Internet and spurred by the enthusiasm of involved farmers and advisers.

We authors of this present paper are especially interested in understanding this participative experience and interpreting it in the light of the history of intervention in farm management and of the reforms that have taken place in other domains of management science. One of the exciting realisations concerns the notion of 'virtual experience'. We find that once farmers and advisers are satisfied that the simulator 'tells the truth' (mainly and close enough) the way in which the simulation benefits participants is by providing learning through a form of experience. The fact that it is virtual rather than authentic has been shown by others in other situations to be outweighed by the relative advantages in time and costs, including social ones (Bakken et al 1994; Senge 1990). A secondary, but significant, benefit comes as new insights to system function. More detailed reports of progress can be found in Hochman et al (2000) and Carberry et al (2002).

The appointment of the first author to APSRU in 1999 introduced a disciplinary economics capability to the research team, and an early challenge was to explore if the inclusion of an economist could enhance the value of discussions with farmers on complex-issues relating to natural resource degradation. While this is very much a work in progress an early learning has been that simple budgeting tools teamed with the simulation models and used in direct interactions with farmers have been consistent with and supportive of farmers' own planning processes.

This is consistent with other assessments that the only clear success story from the Farm Management era was the use of farm management budgets (Malcolm, 2000). Pannell et al (2000), after acknowledging the failure of 'elaborate decision analytical methods,' see the 'straight-forward farm management budgets' of the process orientation as 'extremely useful.'

"Use of sensitivity analysis to examine discrete key scenarios and identified break-even circumstances are simple but viable methods of *incorporating risk in this decision process*, both from the point of view of risk aversion and tactical adjustments. The techniques are unsophisticated and old, yet they provide the farmer with an opportunity to discern the nature and potential impact of uncertainties in a way that *promotes sensible management of risk*. They can capture sufficient detail, *sometimes implicitly*, so that the value of the information generated for the farmer is higher than could be generated by a less timely, more partial and more obscure sophisticated risk model" (Pannell et al.2000, p76. Emphasis added.)

We take particular note that the Farm Management practitioner singled out as particularly successful by Dillon (1979) and Malcolm (1990) described his primary role as serving as a 'professional goal adjuster' (Makeham 1965). We think this aligns nicely with Schultz's

admonition for farm management research to shift its focus from normative planning to aiding farmers in formulating expectations.

“A role of professional farm management advisers is as ‘professional goal adjusters’. Farmers might state definite objectives but might not see that their physical and managerial resources do not match their wishes. It is essential to find out if the product markets and the resources...and skills are compatible with these goals..... Given this, however, the adviser cannot know more than the farmers do about what is ‘good’ for them.” (Makeham and Malcolm, 1993, p.17).

Makeham and Malcolm (1993) said that the budget enabled incorporation of the “management-human element through the spreadsheet model being specific and unique to each situation, incorporating intimate knowledge of possibilities and constraints, and decision makers’ preferences and beliefs, in the activities analysed and the numbers put in the budgets”(p.368).

This significance in enabling meaningful, committed interactions with farmers is central to way forward for economists if they aim to use their models to assist farmers with the challenging problems of resource degradation. An important learning for us from our use of simulation models in discussion with farmers (Hochman et al, 2000; McCown et al, 1998) is that they are not expecting or looking for comprehensiveness in treatment of their farm. More than anyone, they know that is not possible. Instead they are looking for evidence that the interaction might help them make sense of some aspect of the environment or of an action that is difficult for them because of uncertainties which makes decision or action problematic.

If instead of an overly simplistic representation of the ‘management system’ that is not meaningful to the farmer, economists work with a process of dialogue and interaction with farmers, the ‘management system’ is already represented by the participation of the farmer in discussion with the researcher. This ‘action’ approach (Oquist, 1978; Giddens, 1979) is significant departure from economists’ earlier attempts to use simulation models to design farm management practice (Doyle, 1990; Malcolm, 1990).

A change in the way a model is used such that researchers move from designing action based on an ‘outsider’ objective knowledge of the management system to working with a process of dialogue and interaction with farmers to support management practice by influencing ‘insider’ experience, sensemaking, and judgement, represents a paradigm shift in research. Research in this mode supports farmers’ own subjective processes for dealing with uncertainties in specific situations, which is integral to ‘soft’ systems thinking and practice (Checkland, 1980; Flood and Jackson, 1991).

Using Oquist’s (1978) typology of research described in McCown (2001), this represents a shift from normative ‘Policy Research’ to ‘Action Research’. But an important characteristic of Oquist’s typology is that Action Research presumes and builds on Policy Research. The output of policy research is knowledge to guide best practice, based on theoretical possibilities and limitations. This corresponds to much of the economics work done in FMR. Action research is also concerned with the production of knowledge that guides best practice but instead of guidance being based solely on reference to theory, it takes the latter as a reference point, along with the experience of the farmers, and searches for a farmer-judged ‘best practice’ in the practical situation. In action research, modifications in farm practice occur *as part of* the research process, rather than *subsequent* to the research as is the case for policy research.

Dillon (1979), Shultz (1939) and Day (1971) recognise the various challenges that the use of “logically attractive but largely inapplicable theory” (Dillon, 1979) poses to the practising farm management economist. Speaking from our experiences, and drawing from discussions with other Australian economists working in similar contexts, choosing to conduct one’s research in the situations of practice tends to pull one into environments described by Schon (1983) – i.e. of uniqueness, uncertainty and instability, which do not lend themselves to the application of theories and techniques derived from economics. Schon (1983) offers a perspective on this confronting realisation:

“In the varied topography of professional practice, there is a high, hard ground where practitioners can make effective use of research-based theory and technique, and there is a swampy lowland and where situations are confusing "messes" incapable of technical solution. The difficulty is that the problems of the high ground, however great their technical interest, are often relatively unimportant to clients or to the larger society, while in the swamp are the problems of greatest human concern. Shall the practitioners stay on the high, hard ground where he can practice rigorously, has he understands rigor, but where he is constrained to deal with problems of relatively little social importance? Or shall he descend to the swamp where he can engage the most important and challenging problems if he is willing to forsake technical rigor?” (Schon, 1983, p.42).

With this challenge acknowledged, we suggest that with the lessons from history to support us, research that supports situated practice is a logical direction for farm management research and that the action approach to systems research is essential to achieve the relevance that has been so conspicuously absent in the past. And as management scientist, Peter Keen (1991), succinctly put it, “unless relevance is established, rigor is irrelevant.” Whereas theory abstracts away the ‘human’ processes of farm management, the action approach augments and supports it. However, we are not saying that rigour must be forsaken to achieve relevance. Participatory action research can deliver new science knowledge and provide the opportunity to continually improve our research process (Carberry, 2001), thus providing opportunities for researchers to meet their own research aspirations.

History indicates that for most farm management economists, even the modest step to recognise the logic of re-orientation Farm Management to behavioural economics for (e.g. Day, 1971; Longworth and Metz, 1980) has proved too much. But the realities of research conducted in the practice situation to support subjective farm management processes radically stretches the boundaries of disciplinary training. It has required us to step out of traditional disciplinary areas of work and undertaking of activities that might not appear to be ‘agricultural economics’. Maybe a more appropriate professional identity that might be recognised in this new way of working should focus on the distinction between an ‘economist’ and a ‘systems researcher in economic systems’.

Conclusions

A paradigm shift in research from normative design of best practice to action research supporting situated practice is consistent with the changing organisation of science which is occurring with the transfer of the research mandate to the clients of research. This paradigm shift supports farmers’ subjective decision making processes, which include gaining experiences, interpreting them and forming expectations as a precursor to planning. Although this represents a departure from familiar ways of working, particularly for economists, this approach provides significant opportunities for a revitalisation of farm management in a new context of heightened interest in natural resource sustainability. Maxwell and Randall (1989, p.247) warn that “a discipline that focuses solely on its immediate value ...will rapidly exhaust its capital (stock of knowledge and methods) and hence its capacity for evolution. The vitality of any discipline is measured by shifts in its scientific frontier that are the result of frustrating task.”

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