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Abstract

Public good objectives have, for many years, encouraged governments to target farmers with propositions for change to their production practices. Initially these propositions were attempts to accelerate the adoption of innovations that offered enhanced productivity. They have come to include change designed to enhance environmental stewardship. Coarse or incomplete specification of the costs and benefits of practice change, and of the whole process in which its promotion is embedded, impedes meaningful analysis of likely levels of adoption. In this paper frameworks from marketing and organisational behaviour are applied to a case study to evaluate their possible usefulness to the better framing of adoption decision making.

Keywords: NRM; usage context; co-production; psychological contract; adoption interface; engagement interface; relationship.

Introduction

Research of extension and adoption related to productivity-enhancing innovations in agriculture has long struggled to find a reliable grounding for good extension practice. The difficulty is one of residual imputation: in the absence of a reliable model of the process of adoption of innovations, the impact of various ways of attempting to accelerate that process cannot be separated from the effects of partially understood determinants of the rate of adoption.

In recent years two research paths in adoption research have emerged to better frame adoption. One has adopted marketing constructs, especially 'usage context', to refine techniques that identify the contextual determinants, and level, of the 'relative advantage' of an innovation (Kaine et al. 2007). Usage context also influences the process of 'sensemaking' of innovations (Sneddon et al. 2009). From this, market segmentation can proceed and be a basis for tailored extension programs.

A second path has been what is now called 'knowledge brokering' (Bielak et al. 2007). This can also be described as overlapping with marketing in that it involves reacting strongly to the fact that it is the adopter that defines the value of an innovation. It does this, *inter alia*, by feeding salient contextual information back into the innovation development and promulgation process. Or, as marketers express it, 'finds out what they want and gives it to them'.

There is overlap between these paths, the second 'starting' the manipulation of the adoption process further back in the practice development process, at the innovation creation phase. There are also commonalities. Both assume usage context to be critically important to actual relative advantage. Too, ephemeral purchase-decision factors are ignored in the analysis of the likely total demand for specific practice innovations; as in marketing, the adoption process is seen as a promotional challenge that follows innovation design. It is design that determines adoption potential/market size.

The conflation of relative advantage and purchase-decision factors that characterises most instances of adoption research is avoided with these approaches. This is arguably essential to useful analysis of the adoption of innovations (unless they are universally appealing) because market size has to be defined prior to consideration of the dynamics of uptake (Kaine et al. 2007). Both adopt the approach used in market research.

Compared to productivity-enhancing innovations, gaining adoption in the natural resource management (NRM) domain can present a more heterogeneous challenge. When the relative advantage of an NRM innovation is significant, the NRM character of the innovation will be incidental to the process of adoption. The process will closely approximate the process of adoption of strictly productivity-enhancing innovations. The range of relative advantage across innovations, however, is wider: it extends to, and through, zero. The characteristic that distinguishes NRM practice change from productivity-enhancing adoption is the common fact that the innovation reduces productivity given most farmers' objective functions.

This is to say that, except when enhanced sustainability appeals to the personal values of a farmer, NRM outcomes typically carry some opportunity cost to productivity. Unless farmers' values can be modified, which is extremely unlikely (Hayden 1988), this is commonly assumed to imply the need for incentives, penalties or regulation to evoke practice change. This assumption may be wrong. To establish the true costs and benefits of possible innovations in farm practice it is necessary to frame the farmer's decision-making context appropriately. An approach to this, for NRM innovations, is suggested in this paper.

Framing Practice Interventions

The importance to adoption of the utilitarian advantage to a farmer of an innovation, relative to the technological status quo, is well established (Lindner 1987). It is obvious that the features of the context in which the innovation must be applied will significantly inform this advantage. Those features may exist in several categories including, but extending beyond, technical fit (Kaine et al. 2007). The fact that purchasers differ in the promptness of adoption of an innovation indicates that either perceived relative advantage (derived from usage context) is positively correlated with speed of adoption or other factors inject a lag in the behavioural response to relative advantage. Arguably, relative advantage can be assumed to be accurately perceived by decision makers. In the case of farm practice innovations this seems a reasonable assumption (Kaine et al. 2007).

In both business marketing and adoption research, contemporary approaches contemplate the usage contexts in which the value of innovations will be judged by purchasers. This is difficult to do validly unless potential purchasers are engaged with directly. Without such engagement there is a risk that the technical characteristics of possible innovations will dominate the attribution of value by researchers or marketing firms. This risk arises because purchaser-specific usage context factors are often heterogeneous across a market and, especially, because technical characteristics are usually at the core of organisational specialisation: valuable innovations are created by the application of specialised skills rather than specialisation in meeting farmers' needs, a notion without specific disciplinary/knowledge content. There is always the risk that the technical feasibility or virtuosity of an innovation will be inappropriately equated to usefulness by its creating organisation. (Television screens in refrigerator doors may be an instance.)

Publicly-funded practice interventions in agriculture occur, arguably, for a single reason which can take a variety of manifestations. That reason can be defined as being to enhance the societal productivity of farming: to overcome market failure. This used to collapse to enhancing productive efficiency on-farm but now, in Australia, extends as well to satisfying government NRM objectives. The source(s) of market failure, among information inadequacies and attenuated property rights, have been argued to imply the need for different kinds of intervention (Mullen et al. 2000). The research reported here appears to complicate this issue further.

Attempts to enhance productive efficiency are pursued to offset perceived market failures both in new practice development and rate of adoption, serving static and dynamic efficiency respectively. The strategy is to accelerate both, compared to the expected rates without government intervention, by offering increased resource productivity. Interventions to promote NRM outcomes differ fundamentally: the purpose is to alter the perceived rationality ('the culture' or 'policy constraints') of current resource use when its functionality in output production processes has not changed. If resource productivity is simultaneously increased, the challenge implied is reduced but only partially.

Co-production

Productive efficiency gains and NRM outcomes are achieved to the extent that farmers adopt. That is, from the perspective of the protagonists of change, farmers are the lowest-level (meaning final) participants in the production systems that create and apply innovations to enhance achievement of these objectives. Farmers are never continuing, paid employees within these systems, they are 'co-producers': they are directly involved in the making of the

desired outcomes of protagonists by their adoption of innovations designed to modify their production processes¹.

Inevitably, therefore, there exists an interface between farmers and the systems that generate innovations and seek their adoption. The 'quality' of this 'adoption interface' is indicated by the speed of adoption by those farmers who will ever adopt. The adoption interface is composed of farmers and extension staff. The quality of the interface is determined by the adequacy and appropriateness to the decision-making criteria of farmers of the information that extension staff provide.

The central role of usage context in determining the relative advantage offered a farmer by an innovation causes co-production to have another facet: farmers are the most reliable source of advice about their usage context and the costs and benefits of possible innovations. Co-production can usefully include input of that information to innovation design, including extension design. When this occurs, the domain can be called an 'engagement interface'. The role and importance of the engagement interface is derived from the importance to the optimisation of relative advantage of farmer involvement in the design process.

The 'interface' terms we are introducing here are generic to co-production situations. Their specific characteristics will differ across focal products. They apply beyond the public good origins of the notion of co-production (Ostrom 1996). They apply, we submit, to any situation where 'production' and 'consumption' denote non-subsistence processes. There is, here, the prospect of information being both acquired and distributed to enhance efficiency: what Phillips (1968) referred to as the essence of the 'concept of marketing'.

As well as 'co-production', a parallel term used in marketing is 'co-creation' (Payne et al. 2008). It refers to the extent to which consumers participate in the production of the final commodity they consume and for which a purchased output is an input. (This is a theoretical construct reminiscent of Muth's (1966) 'household production function'.²) This term applies to private goods. In fact, because final consumption normally involves, at the least, the use of one's senses, and intermediate consumption the exercise of human effort, it applies to all private goods (apart from those few where consumption is administered while the consumer is unconscious).

With respect to private or public goods, co-production or co-creation, the engagement interface is that between potential consumer and producer and the adoption interface is that between seller and potential buyer. Sellers and buyers may be agents for producers and consumers, respectively.

Engagement interfaces span all research conducted to identify consumer preferences relevant to new product design and promotion. This spans the panoply of interactions from one-on-one interviews to crowdsourcing (see, e.g., <http://www.edelmanberland.com/industry-trends/crowdsourcing-as-research/>) and web-based surveys. As with adoption interfaces, a

¹ Co-production has been defined as '... the process through which inputs used to provide a good or service are contributed by individuals who are not "in" the same organisation' (Ostrom, 1996, p. 1073).

² A new paradigm has emerged in marketing theory over the last decade which, likewise, echoes Muth's insights. It is 'service-dominant logic' which proposes, inter alia, that service is the core of exchange, the consumer invariably co-creates value and value is always determined by the 'beneficiary' (Vargo and Lusch 2008). This S-D logic was first published in 2004 (Vargo and Lusch 2004a, 2004b) but the central concepts first appeared in Epworth (2002).

variety of product- and customer-related factors can condition the suitability of different approaches to engaging with potential customers. In the public good context, such as NRM, the engagement interface is where relevant co-producer perceptions and preferences, and government agency agendas, are considered with a purpose of optimising the impact of NRM initiatives. Regional and scale issues are salient in ways that they usually are not for private good engagement interfaces.

Adoption interfaces span all that marketers include in 'promotion': advertising, personal selling, publicity and all other communication (called 'sales promotion' - leaflets, promotional price discounts, in-store displays, etc.) (McColl Kennedy and Kiel 2000). The appropriate emphasis placed on the components of these various ways of presenting information varies with products (good of service content), customer types (organisational or consumer), product novelty and all other factors that condition the best way to communicate salient information to induce adoption.

Exchanges

The interfaces we have identified above imply that there are, potentially, a number of different exchanges surrounding a transfer of novel producer output to its consumer. At most, they will include information exchanged over the engagement interface (or 'market research'), information exchanged over the adoption interface (or 'promotion') and the exchange at which the 'product' (be it good, service, practice or action) is the focus. A given customer may not be involved in engagement, as it is typically voluntary, nor adoption if the product is regarded as attracting 'low involvement' (Kaine et al. 2007). The latter is unlikely; slight amounts of promotion are more commonly consumed than none when a novel product is adopted. In the case of farmers adopting modifications to production systems, where choice errors are subsequently revealed repeatedly, it is most unlikely that the adoption interface will not be operant prior to adoption; the innovations tend to be 'highly involving' (Kaine et al. 2007).

The efficiency of the conception, design, production and adoption of a new product depends on all of these exchanges. Optimising them requires an understanding of the operant needs and preferences of customers, or farmers in this context, at each interface. The first question to be resolved is how interfaces for a given class of product should be framed.

We have already observed that NRM programs typically impose a cost on the adopter, if not in absolute terms, certainly relative to innovation not attended by NRM outcome-seeking features. Framing the adoption interface as a domain where the customer should perceive the objective as the optimisation of the value to them of innovations, while valid for private goods and voluntary exchange, is not valid for NRM innovations. There is some element of public good involved and an aura of possible government regulation (forced exchange) as an option, should adoption be judged inadequate.

Another characteristic of exchanges related to NRM and farmers is the fact that this is an organisational buying context involving modifications to repeated production processes. This implies that farmer decision making will be extensive because the decision is highly involving due to the magnitude of the perceived risks of error (Kaine et al. 2007). Search effort can be expected to be substantial and (one-to-one) personal selling very appropriate compared to more arm's length means of information provision.

Still another characteristic of these exchanges is that they are single: specific transactions are rarely repeated with a farmer. This has implications for best ways to manage the adoption interface, most notably that, in marketing terms, the relationship between the 'seller' and adopter is the focus of the adoption interface, rather than individual transactions.

(Relationship marketing builds on agency theory and transaction cost analysis; see McColl-Kennedy and Kiel (2000), pp. 682ff.)

This marketing analog of exchange at the adoption interface provides some insights but is challenged in some ways by the public-good, potential-forced-exchange elements of the interface for NRM. We explore this further below.

The exchange occurring at the engagement interface for NRM products is very different. There is no product being exchanged. The co-production is focused upwards. Marketing analogs are inappropriate. More appropriate are management models of exchange relationships. The most general of these is the 'psychological contract'. A question is whether this is also more appropriate for the NRM adoption interface.

Psychological Contract

The notion of the 'psychological contract' is applied most often in situations of continuous, paid employment relationships. The model can be generalised to any employment context, such as co-production. In fact, arguably it can be applied to any exchange relationship (eg., Lusch and Brown 1996).

The core of the notion (Rousseau 1990) is that an employment relationship is most comprehensively mapped by examining the degree of mutuality of relevant perceptions of obligations of both parties; specifically, whatever the express, formal dimensions of the relationship, what does each party consider to be reasonable expectations of themselves and the other party and what concordance is there of these expectations?

Relevant obligations can be classified into two categories: 'transactional' and 'relational'. Transactional obligations relate to the work contract: what is the employee being paid to do for what rewards? They relate to monetisable exchanges over a brief period. Relational expectations relate to career development, help with personal problems and job security, from the employer (or their agent), and commitment to the organisation by the employee. Relational obligations are of a more continuous, longer-term nature. Both classes of obligation exist in a normal paid employment situation. These classes are not necessarily mutually exclusive: specific aspects of employer:employee relationships may lodge in both categories (Coyle-Shapiro and Kessler 2000).

Perceived inconsistencies between employer and employee expectations of either class of obligation lead to a breach of the perceived contract and to dissatisfaction in the perceiver. This, in turn, reduces organisation performance (Coyle-Shapiro and Kessler 2000).

A defining characteristic of psychological contracts relating to co-production is that the absence of salary or wages removes any continuous transactional obligations: there is unlikely to be a bedrock to the relationship on which an 'employer', a practice change proponent, can rely. For both the adoption and engagement interfaces, psychological contracts can be composed continuously only of relational obligations. Logically, this is true of all public good, volunteer situations. This contrasts sharply with normal employment relationships where strong mutual relational obligations are often valuable but not essential.

The consequences of this are profound. One is that, since NRM outcomes do not eventuate without farmer co-production, the less explicit, more subtle element of the psychological contract has to be optimised for lack of a transactional obligation backstop to farmer commitment to NRM outcomes. This is reinforced by the fact that NRM dimensions of practice change tend to have negative impacts on productivity: the transaction is characterised by opportunity costs to the farmer.

A second is that, since relational obligations relate to the longer term of interactions, optimising relational obligations with farmers will likely require a longer-term perspective by change agents. Focusing on practice change initiatives one-by-one will not be appropriate: exchanges/transactions must be understood to occur in the context of a longer-term relationship. This relationship is the focus of the psychological contract and determines the impact of serial, distinct change initiatives.

In economic terms, farmer and change agent utility are maximised over serial transactions. This is a strategic matter in that utility is derived variously for both parties from each individual transaction *and from the contribution of each transaction to the maintenance of the relationship*; maximising utility in each transaction would be suboptimal. More colloquially, the reliance on relational obligations means that there will be 'give and take' across transactions; this is what a concern for the welfare of the farmer by the change agent, and a commitment by the farmer to the change agent's aspirations, imply for behaviour.

A series of questions are provoked by this reasoning. What are the specific items that matter in the relevant psychological contracts? Does breach of expectations lead to relationship failure and damage to NRM outcomes? What are the relevant psychological contracts; which change agents are involved? How do productivity-enhancing practice changes and NRM practice changes interrelate? How do adoption interfaces and engagement interfaces interrelate?

Case Study

In the context of dynamism in the structures and funding within various NRM-seeking organisations, we undertook an exploratory case study for the Victorian Departments of Sustainability and Environment (DSE) and Primary Industries (DPI) and the Goulburn Broken Catchment Management Authority (GBCMA). The purpose was to refine our understanding of efficient ways to structure relations with farmers for the purpose of maximising achievement of NRM outcomes.

Following the above reasoning the focus was on confirming the validity of that reasoning and identifying the dimensions of psychological contracts, the consequences of breach and the implications of our findings for the design of the interfaces between organisations and between organisations and farmers. The focal program for the study was the Sustainable Irrigation Program in the Northern Region of Victoria.

A purposive sample of 18 farmers and 12 former or current agency staff was interviewed by Keeble and Wright, using semi-structured interviewing techniques, during 2012.

The detailed report of the study (Keeble et al. 2012) is available at

[http://www.gbcma.vic.gov.au/downloads/community_advisory_committees/keeble et al 2012 sip case study \(2\).pdf](http://www.gbcma.vic.gov.au/downloads/community_advisory_committees/keeble_et_al_2012_sip_case_study_(2).pdf) or at

<http://tinyurl.com/8u4rdsn>

The main findings and their implications are presented here. We draw heavily on the above report in doing so; it is the source for much of what follows.

The theoretical analysis led to five propositions that we sought to confirm or reject:

1. Dependency: Agencies depend on farmers to achieve their objectives.
2. Interface focus: The relationship between agencies and farmers is fundamental to achieving co-production.
3. Centrality of relational expectations: Farmers' relational expectations are critical.
4. Salient farmer preferences: Farmer preferences inform expectations.

5. Interface Design: The design of interfaces influences farmer motivation to co-produce.

Each of these propositions was confirmed. The implications of the analysis using the psychological contract and co-production constructs were clearly endorsed. The major findings were as follows.

Agencies rely on farmers for knowledge, action and advocacy: 'Knowledge is needed from farmers to lend interventions local appeal, relevance and appropriateness to maximise both the potential achievement of desired NRM results and the real achievement through adoption. Action is the adoption of interventions. Advocacy is either offering legitimacy to interventions by supporting them or providing recommendation of interventions to other farmers.

'Knowledge and advocacy is acquired at the engagement interface. This is composed of the forums where agency staff and farmers consider actual and possible interventions; most prominently, committees.

'Action is the result of interaction at the adoption interface; most often one-on-one interactions between agency staff and farmers.

'Advocacy also occurs away from the interfaces but depends on farmer satisfaction with the outcomes of interactions at them. Advocacy can thus be by farmer representatives on committees or individual farmers to individual peers' (Keeble et al. 2012, p. 7).

Effective co-production we found to be heavily reliant on the satisfaction of farmer expectations by salient components of interactions at the engagement and adoption interfaces. The key expectations were relational, not transactional, and both farmers and agency personnel understood this clearly.

'As would be expected, farmers' salient preferences determine the relational expectations that they bring to the interfaces and the factors they experience that breach them, corroding the psychological contract and, therefore, the potential for effective operation of the interfaces.

'We found the *motivation factors* that attracted a farmer to the adoption interface were *interest* in the issue, when a *threat or opportunity* was perceived or they required *access* to opportunities. The most common reason farmers were attracted to the engagement interface was to have *influence* over an issue or pending change. Typically, the issue was perceived as a threat, opportunity or was simply an issue of interest. For others there was a sense of *altruism* - they wanted to give back. *Our findings identify specific relational expectations, their motives and factors that have caused them not to be met.*' (Keeble et al. 2012, p. 8).

Relational expectations at the engagement interface

At the engagement interface farmers sought access and influence, various interpersonal features (related to managing relationships) and agency staff professionalism and expertise. Most commonly breached were expectations of influence. Breaches have led to withdrawal from committees and negative advocacy related to committee outcomes. The latter can be to peers, media or politicians. Perceptions of mock authority, and of committees being politicised, attracted firm disinterest in continuing participation by farmers.

An implication of this is that, as in any organisational setting where relational expectations are important to performance, decentralised authority is a major determinant of 'employee' satisfaction and commitment. This creates tension where the principal agencies involved are in the public sector, with its inevitable emphasis on accountability to government.

Relational expectations at the adoption interface

At the adoption interface farmers sought, as before, interpersonal factors (trustworthiness, familiarity with farm, attentiveness and ability to interpret the implications of a program for this farm), professionalism and expertise, together with respect. Respect expectations were breached when agency staff lacked empathy, lectured rather than listened or arrived unpunctually or without adequate preparation. Breaches disrupted communication effectiveness and diminished farmer preparedness to consider proposals lacking apparent value.

Major salient implications

A purpose of the case study was to identify valid objectives for agencies to work towards when designing interfaces with farmers. Considerable detail was provided about this (Keeble et al. 2012). The findings were subject to two main caveats: the main focus was irrigated farming, and not dryland; and the study is exploratory, yielding compelling insights into appropriate models of interaction of a qualitative, but not quantitative, nature - the relative importance of factors could only be glimpsed, sometimes, in responses in ordinal terms and never in cardinal terms. Further work is planned to validate and quantify the model.

The power of the study, as is common among exploratory studies, is its contribution to the specification of valid models of interaction between NRM agencies and farmers. What is found not to matter is as important as the converse.

Beyond NRM, the results may be generalisable to all public good co-production contexts, including those commonly, if naively and inadequately, addressed using marketing models under the rubric 'social marketing'. These include public health campaigns, workplace safety campaigns and waste recycling campaigns. There would seem to be some capacity to apply our results to private good marketing, as well, in circumstances where high customer engagement in new product design is efficient. An example may be training program design for an organisation or professional body.

Arguably, business marketing specialises in the adoption interface for private goods in the absence of forced exchange in pursuit of maximisation of long-run Return on Assets Employed, subject to government regulation. Co-production, or co-creation, commonly exist in such contexts but are made tractable to optimisation because mutually beneficial trade lies at the base of the exchanges involved.

The entry of public goods into this situation troubles that tractability with the shift in the transactions that we have explained. Interestingly, this includes farm extension activity (definitionally at the adoption interface) for productivity-enhancing innovations where the public good element is accelerated adoption (yielding socially-valued dynamic efficiency) and, perhaps, somewhat greater total adoption.

One particular result in the case study relates to this analysis: all farmer respondents attributed lower 'motive' credibility, lower trust, to private sector representatives than to agency staff. A few were confident that they could 'see through the salesperson's spin'; most simply judged there to be so serious a breach of relational obligations that interactions over innovations with private sector staff were treated as unreliable and tangential to decision making.

Implications

Two models tumble together in this research. One is that from marketing which distinguishes situations where single transactions are the focus of exchange (e.g. buying an ice cream) from those where single transactions are but events occurring within a continuing relationship (e.g. buying a professional consultation from one's routine provider).

The other is the model arising from the application of the notion of the psychological contract to quasi employment situations, called co-production, involving public goods. Here, the same terms are used with similar meaning: transactional obligations are perceived, intrinsically short-term contractual obligations; relational obligations are perceived, longer-term obligations embodying obligations extending across serial transactions (employment effort).

As in marketing, if relational elements don't matter, they should not be considered by those seeking to optimise exchanges. If they do matter, they join individual transactions/tasks performed as the focus of management attention.

Public goods involving co-production unavoidably cause relational obligations to matter *exclusively* in psychological contracts. The erratic role of transactional obligations causes relational obligations to dominate design decisions intended to optimise psychological contracts at the interfaces. The relational obligations expected and delivered at these interfaces will condition the prospects for any proposed practice change. The importance of relational obligations implies the need for continuity at both interfaces.

The continuity in relationships formed at these interfaces adds a source of costs and benefits for farmers and agencies: the costs arise from meeting obligations, and benefits from having expectations met, within the relationship. Evaluating the costs and benefits of individual proposals without including those from this source is invalid; they are inseparable. Farmers, notably, will evaluate them in the context of the ongoing relationship they have, or don't, with agency staff at the adoption interface.

For the central question, how to encourage the adoption by farmers of costs or opportunity costs to enhance NRM, the strategy implied can be described clearly: it is necessary for these costs to be perceived by farmers as relational obligations at the adoption interface. That is, supporting the NRM wishes of agency staff at the interface is among the obligations the farmer perceives are due to the agency representative given the obligations that those staff are meeting. The latter are, in general terms, the provision of salient, valid advice for a given farmer on a given farm.

Exploring the implications

Since NRM goes to the culture of resource use, it seems apparent that the most efficient way to maximise the quality of relationships between farmers and agency staff at the adoption interface would be to have that interface relate to practice change related to production (resource use) as well as NRM. That is, the more the benefits associated with productivity enhancement can be associated with the relationship wherein the agency staff member seeks NRM costs to be borne, the higher would be the prospect of moving NRM costs into the set of farmer obligations.

The case study region has a number of adoption interface models operating. One is DPI extension staff presenting both productivity-enhancing and NRM practice change. Another is GBCMA staff principally focusing on NRM but, in an outstandingly successful tactic, linking NRM innovations to long-term physical farm development plans. Both of these examples are consistent with the rationale, above, of drawing all farm production practice change costs and benefits into the one relationship. The question arises, naturally, whether further merging of these relationships, to one, would enhance the outcome of application of the rationale. In our report (Keeble et al. 2012) we suggest consideration of the creation of a dedicated entity to provide adoption interface services. This could enable enhanced satisfaction for both farmers and agencies as well as moderate the impacts of endemic budgetary and structural changes in client agencies (such as DPI, DSE and CMAs).

Were this approach to be adopted, the already considerable degree of integration among agencies creating and promulgating practice change initiatives would need to increase. The 'blizzard' of initiatives, as was perceived by both agency and farmer respondents, could then be better integrated and sequenced. This would enhance farmer perceptions of respect and professionalism coming from agencies and enable a more reliable mapping of practice changes onto farms through time by agencies better understanding the complete portfolio of initiatives being developed.

Although engagement interfaces derive their importance from their impact on the appropriateness and appeal of proposed practice changes at the adoption interface, there seem to be no benefits, but likely costs, to merging engagement interfaces across different types of practice change or different agencies. The relational obligations arise from different motives to those at the adoption interface, and knowledge and advocacy depend on the degree of focus in the representation of farmers. The history of change in the structure of engagement interfaces put in place by agencies is consistent with the nonexistence of a structural ideal; decentralisation of authority, adequacy of representation (numerically and by focus) and avoidance of 'professional committee volunteers' interact to make an ideal structure elusive and dynamic.

Little of what we found in the case study would surprise current extension staff. They are at the adoption interface, whatever its quality. Many we surveyed were concerned that breaches of the psychological contract, in our terms, are being triggered by policy changes within agencies that limit the management of relationships with farmers in the study region.

The same can be said of agency staff at engagement interfaces. They have worked with good and less good models and seen the impact of poor psychological contracts on effective engagement, even simple participation, and the negative flow-on effects on program design, then adoption.

Discussion

There is merit in separating the relative advantage and the factors determining the rate of adoption of an innovation, as current approaches to adoption research do. Relative advantage determines adoption potential. Given an innovation, the rate of adoption will depend on factors that determine awareness and urgency.

However, these distinct constructs may not be veridical: farmers may be optimising much messier decision problems than these constructs imply. The true, objective relative advantage of an innovation for their usage context may diverge radically from that determined by an agency, and farmers' subjective relative advantage still further. Relevant uncertainty can play a prominent role in these exercises in cognitive algebra.

For most of the farmer respondents in our case study, a clear expectation that they had of agency staff at the adoption interface was that they could competently interpret the value of an innovation to a specific farm and farmer. This implies that farmers are not confident in their own (initial) judgements. Although this is related to the degree of novelty of an innovation, the process of tracing out the various implications and risks of adoption can be difficult with respect to any innovation. Also, a consequence of a farmer's initial assessment of innovation value is that it conditions the allocation of managerial attention to decision making about it (Kaine et al. 2007).

The scarcity of managerial attention, the information demands associated with evaluating innovations, the damage of bad choices and the dynamism of relevant technological and policy environments all favour the creation of continuing relationships between agency staff

and farmers. The efficiency of these depends on the mutuality of perceived obligations under their psychological contracts.

When NRM outcomes are added to the mix of practice change objectives, with the increased fragility of the psychological contract that the absence of stable transactional obligations implies, the need for firm, continuous relationships increases. Pertinent relational obligations and the associated access to willing co-production are unlikely to exist in the absence of this type of adoption interface.

Beyond this, the knowledge and advocacy provided at engagement interfaces to intervention design processes likewise relies on relational obligations. The efficiency of these impacts directly on the relative advantage, and opportunity costs, achieved for targeted usage contexts. In turn, this bounds adoption.

This work indicates a need to be alive to the temporal and serial contexts of the adoption of innovations by farmers. Also implied is the possible inappropriateness of (implicitly) assuming that all salient costs and benefits associated with a given innovation are specific to it. A focus on individual transactions in a domain that is pervaded by a continuing relationship within which these are understood to occur is a mis-framing. It is not appropriate for marriages, continuous employment, or co-production. Its implications for managing NRM innovations warrant some thought.

References

- Bielak, A., Campbell, A., Pope, S., Schaefer, K. and Shaxson, L. 2008, 'From science communication to knowledge brokering: the shift from "science push" to "policy pull"' in Cheng, D., Claessens, M., Gascoigne, T. Metcalfe, J., Schiele, B. and Shi, S. (eds), *Communicating Science in Social Contexts: New Models, New Practices*, Springer Verlag, New York, pp. 201-226.
- Coyle-Shapiro, J. and Kessler, I. 2000, 'Consequences of the psychological contract for the employment relationship: a large scale study', *The Journal of Management Studies* 37(7), 904-930.
- Epworth, R. 2002, *The Nature of Products, Goods and Services*, PhD thesis, University of New England.
- Hayden, F.G. 1988, 'Values, beliefs and attitudes in a sociotechnical setting', *Journal of Economic Issues* 22(2), 415-426.
- Kaine, G., Lees, J and Wright, V 2007, 'An approach to predicting demand for an agricultural innovation', *Australasian Agribusiness Journal* 15 (Paper 7).
- Keeble, B., Wright, V. and Kaine, G. 2012, *A Case Study of Co-production to Support Sustainable Irrigation Objectives in Victoria*, Goulburn Broken Catchment Management Authority and Victorian Department of Sustainability and Environment, Victoria.
- Lindner R. 1987, 'Adoption and diffusion of technology: an overview', in Champ B, Highly E. and Remenyi, J. (eds), *Technological Change in Postharvest Handling and Transportation of Grains in the Humid Tropics*, Australian Centre for International Agricultural Research, No 19, pp. 141-151.
- Lusch, R.F. and Brown, J.R. 1996, 'Interdependency, contracting, and relational behavior in marketing channels', *Journal of Marketing* 60(4), 19-38.
- McColl-Kennedy, J.R. and Kiel, G.C. 2000, *Marketing: A Strategic Approach*, Nelson Thomson Learning, South Melbourne.
- Mullen, J.D., Vernon, D and Fishpool, K.I. 2000, 'Agricultural extension policy in Australia: public funding and market failure', *Australian Journal of Agricultural and Resource Economics* 44(4), 629-645.
- Muth, R.F. 1966, 'Household production and consumer demand functions', *Econometrica* 34(3), 699-708.
- Ostrom, E., 1996, 'Crossing the Great Divide; Co-production, Synergy, and Development', *World Development* 24(6), 1073-88.
- Payne, A.F., Storbacka, K. and Frow, P. 2008, 'Managing the co-creation of value', *Journal of the Academy of Marketing Science* 36(1), 83-96.
- Phillips, J. 1968, 'A revised approach to marketing', *Review of Marketing and Agricultural Economics* 36(1), 28-36.
- Rousseau, D. M. 1990, 'New hire perceptions of their own and their employer's obligations: a study of psychological contracts', *Journal of Organizational Behavior* 11(5), 389-400.

- Sneddon, J.N., Soutar, G.N. and Mazzarol, T. 2009, 'On-farm innovation in the Australian wool industry: a sensemaking perspective', *Experimental Agriculture* 45(3), 295-312.
- Vargo, S.L. and Lusch, R.F. 2004a, 'Evolving to a new dominant logic for marketing', *Journal of Marketing* 68(1), 1-17.
- Vargo, S.L. and Lusch, R.F. 2004b, 'The four service marketing myths: remnants of a goods-based manufacturing model', *Journal of Service Research* 6(4), 324-335.
- Vargo, S.L. and Lusch, R.F. 2008, 'Service-dominant logic: continuing the evolution', *Journal of the Academy of Marketing Science* 36 (1), 1-10.