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4   **Re-figuring the problem of farmer agency in agri-food studies: A translation approach**

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12   **Abstract.** This article argues that present theoretical approaches within critical agri-food studies  
13   are inadequate for conceptualizing the role of non-humans in the shaping of farmer agency.  
14   While both political economy and actor-oriented approaches are significant in drawing attention  
15   to the broader social relations that construct and govern farmers as agents, the ordering and  
16   disordering influence of non-humans as part of these processes are neglected. Drawing upon a  
17   sociology of translation, located within actor network theory, the article explores how the  
18   ontological move to recognize non-humans as actants contributes to a re-conceptualization of  
19   farmer agency. Through the application of four “moments” within a translation approach –  
20   problematization, interestment, enrollment and mobilization – to a dairy planning workshop in  
21   Australia, it is concluded that non-humans are central in two key ways to programs governing the  
22   agency of farmers. First, they take the form of material artifacts and forms of inscription that are  
23   used by governing agencies to build durable actor networks. These inscriptions represent new  
24   ways of reflecting on farming practices and re-defining the scope for farmer action. Second, non-  
25   humans can take the form of material agents that, while crucial to the building of actor networks,  
26   are not always straightforward to enroll. The article demonstrates that problems enrolling these  
27   entities limit the efforts of governing agencies to “act at a distance” and shape farmer behavior.

29   **Key words:** Australia, Dairy farm planning, Decision-support tools, Farmer agency, Non-human  
30   agency, Translation

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## Introduction

The agency of farmers is the subject of ongoing conceptual and analytical debate in critical studies of agriculture and food. These debates are dominated by political economy and actor-oriented perspectives. Scholars drawing upon a political economy approach argue that globalization is structurally transforming the nature of on-farm production. This, it is ~~believed~~ leads to a loss of agency by small-scale commodity producers as global agribusiness conglomerates exercise increasing control over the agri-food system (Bonanno et al., 1994; Buttel et al., 1990; Le Heron, 1993; McMichael, 2000). The actor-oriented approach, developed by Long and others, draws on somewhat different theoretical traditions and conceptualizes farmers as active agents in negotiating change. From this perspective, farming is characterized by considerable diversity and heterogeneity, which shapes how farmers deal with interventions to change their practices (Long and Long, 1992; Long, 1997; Long, 2001; van der Ploeg, 1992, 1993). Each approach has been influential in moving scholarship beyond crude behaviorist and rationalist models of farmer action and in drawing attention to the broader social and cultural milieu in which farmers make their decisions. Nevertheless, for both, the role of “non-human” entities is neglected in constituting, shaping, and making possible particular arrangements of agency. As a consequence, while a range of entities arguably impacts on the capacity of farmers as agents, it is mostly “human” and “social” relations that provide the focus of scholarly attention.

The purpose of this paper is to develop a more material analysis of farmer agency, one that draws attention to the ordering and disordering effects of those non-human entities that have, up until recently, been bracketed out of agri-food studies. In order to study the centrality of non-humans within the construction of agri-food networks – which Lockie and Kitto (2000) argue should be the task of a “progressive” agri-food studies – a “translation” methodological approach, located within actor network theory, is drawn upon. Rather than seeking to overcome the distinction between macro and micro-sociological approaches, the point of using a

~~sociologyn-analyties~~ of translation is to explore the role of localized material practices in “summing up” farmers’ capacities as agents (Latour, 1999). As Latour argues, in the social domain there is no change of scale from macro to micro interactions. Both “are local effects of hooking up to circulating [material] entities” (1999: 19). This indicates the significance of these entities in framing and “holding together” interactions – even those relatively durable relationships that are often conceptualized by sociologists as “macro-structural” in nature (see Callon, 1998). Thus, while the scope of human action is variously constrained or enabled by “structures,” these are rendered knowable, practicable, and transformed into practice through specific localized material entities such as computer printouts, financial statements, market reports and other forms of inscription. Through the examination of a privately operated, yet largely state-funded, dairy planning workshop operating in the State of Victoria, Australia, the paper explores how farmers’ agency is a relational achievement that is rendered thinkable and governable in and through heterogeneous (not simply human) associations. Prior to expanding on this argument it is first necessary to provide a context for discussion by outlining how the governing of farmer agency is conceptualized by agri-food scholars and the limitations of this work.

### **Agri-food globalization theory**

Agri-food globalization theory or the “sociology of agribusiness globalization” (Buttel, 2001: 171) has had a major influence over how farmer agency is conceptualized by scholars. From this perspective, structural constraints external to on-farm production place limits on farmer action. New technologies and practices that are promoted as improving farm production must therefore be examined in light of these broader structures (see Buttel et al., 1990). Small commodity producers are generally constructed as agents who, at worst, have little choice but to conform and, at best, have the capacities to exercise a limited form of resistance against the increasing control that transnational agribusinesses are exercising over agricultural production (Bonanno et al., 1994; Buttel et al., 1990; Le Heron, 1993; Marsden et al., 1996; McMichael, 1994, 2000).

Such an approach is powerful in drawing attention to the macro-level actors and structures that constrain the capacities of small farmers to act. However, as Higgins (2004) argues, there is a tendency within this perspective to focus almost exclusively on key actors seen to be driving change – specifically, transnational capital and global governance agencies (see also Busch and Juska, 1997). While the identification of these actors is important in terms of explaining the

constraints on farmers' capacities to act, there is little consideration of the material complexities that shape the actual practice of rule (Higgins, 2004). This means that non-human entities are attributed a role in the shaping of farmers as agents, but only in-so-far as they accord with the broader logic of global capitalist expansion. As a consequence, an ontological distinction is constructed between "social" and "natural" in which the latter is de-politicized and seen to be driven by the former (see Goodman, 1999)

Arce and Marsden (1993) attempt to problematize the influence of global processes on farmer agency and, in so doing, emphasize the heterogeneous relationships through which farmer agency is constructed. They argue that greater scrutiny is needed of how "actors shape, and are shaped by, institutions, different styles of farming, and different ways of consuming" (p. 297). For these authors, more attention needs to be paid to specific spheres of food production and consumption, and their inter-relationships, in order to understand how commodities are constructed "through actors' social practices, everyday experiences and actions" (p. 308). While the work of Arce and Marsden gives greater analytical focus to the heterogeneity of relationships and practices that shape farmers' capacities as agents, there is little engagement with the role of non-human entities in this process. As Lockie and Kitto argue, while Arce and Marsden borrow the terminology of actor network theory, they "avoid the ontological shift that is intrinsic to ANT" in terms of "the influence of non-human actants on food networks" (2000: 9). Thus, agency remains conceptualized in terms of purely human relations. This is the case also for an actor-oriented approach.

### **The actor-oriented approach**

There exist a broad range of actor-oriented perspectives. This paper focuses on the paradigm developed since the 1970s by Long and others that views farmer agency as constructed through social relations. Such an approach seeks to move beyond the behaviorist and frequently individualistic assumptions that characterize many brands of actor-oriented research. According to Long:

Social actors are not simply seen as disembodied social categories (based on class or some other classificatory criteria) or passive recipients of intervention, but active participants who process information and strategize in their dealings with various local actors as well as with outside institutions and personnel (1992: 21).

Such an approach represents a counterpoint to structuralist modes of analysis that conceptualize farmer agency as an outcome of external forces and actors. Central to the actor-oriented perspective is the concept of knowledge “interfaces.” It is sensitive to how, in interactions between farmers and other actors, different versions of “reality” are played out and to the forms of knowledge that come to be constructed as truthful. As Arce and Long note:

Studies of interface encounters aim to bring out the types of discontinuities that exist and the dynamic and emergent character of the struggles and interactions that take place, showing how actors’ goals, perceptions, values, interests, and relationships are reinforced or reshaped by this process (1992: 214).

In the context of this paper, the concept of knowledge interfaces represents a conceptually coherent starting point for exploring the constitution and transformation of farmer agency in the process of intervention. Nevertheless, while an exploration of knowledge interfaces has the capacity to shed light on the diversity, complexity, and contingency of farming practices, this perspective has been criticized by some for failing to relate these particularities to broader structural changes (e.g., Buttel, 1996). In turn, scholars drawing upon an actor-oriented approach have argued that the concept of “structure,” as referring to a set of external, uniform, and disembodied forces that drives agricultural practice, needs to be reconstituted. Thus structures are:

...an extremely fluid set of emergent properties, which, on the one hand, results from the interlocking and/or distantiation of various actors’ projects, while on the other, it functions as an important point of reference for the further elaboration, negotiation, and confrontation of actors’ projects (Long and van der Ploeg, 1994: 81).

This understanding of structure, drawn from the work of Giddens, as a resource that can be drawn upon as well as a consequence (either intended or unintended) of action suggests that it is only in the interplay of different actors’ projects that structures are rendered knowable and have an influence.

However, while valuable in emphasizing the local diversity and contingency that constitute agricultural interventions, an actor-oriented perspective remains unclear as to **how** emergent structural arrangements enable the projects of some actors to achieve durability over others. In

other words, it may well be vital “for social actors to win the struggles that take place over the attribution of specific social meanings to particular events, actions, and ideas” (Long and van der Ploeg, 1994: 67), but how they do this is the key question. This is where an analysis that takes more explicit account of the constitutive role of non-human actants provides a potentially valuable contribution. An actor-oriented approach places power relations at the center of its analysis without giving sufficient attention to the non-humans that enable the constitution and ordering of these relations (see Law, 1999). While it is true that “things” as well as people are attributed significance in actor-oriented accounts (see for example Long, 1992; Long, 1997), these are conceptualized generally as entities through which different “social” meanings can be negotiated. Thus, as Goodman argues, “there is no place for agricultural nature nor other non-human actors in this (re)negotiation” (1999: 24). In effect, this neglects how these entities are actants that contribute to the ordering and disordering of farmers’ capacities. The paper argues that a “sociology of translation” enables non-humans to be attributed a more central analytical status in studies of farmer agency.

A sociology of translation, developed originally by French sociologists Callon and Latour (e.g., Callon, 1986; Latour, 1986, 1987), is by no means new to an actor-oriented approach ~~(CITATIONS NEEDED)~~. In fact, the term is used explicitly to refer to the social composition and transformation of farmer agency at knowledge interfaces (Long, 1992; Long, 1997; Verschoor, 1997). The problem with the use of translation in works such as these is that it is framed purely in terms of “the social.”<sup>i</sup> In other words, the focus is on human actors in the construction of knowledge rather than the range of heterogeneous “actants” that are enrolled in network-building projects and the forms of ordering that this makes possible (Callon and Law, 1995; Goodman, 1999; Law, 1992; Michael, 2000). The purpose of this paper is to show how a translation approach can be applied to take explicit account of the hybridity that characterizes the construction and shaping of farmer agency.

## Translation

In order to appreciate the applicability of a translation approach to the construction of farmer agency, it is first necessary to outline how the body of work within which this analytical approach is located (i.e., actor-network theory) conceptualizes “agency.” Unlike modernist perspectives that emphasize the significance of a rational knowing subject, actor-network theory treats agents as “an effect of a **network of heterogeneous materials**” (Law, 1992: 381;

emphasis in the original). As such, humans do not possess agency (or power) – such capacities are a consequence of enlisting heterogeneous materials (“human” and “non-human”) and, if the relations between these materials hold, generate patterned effects or durable actor-networks. Action, therefore, is strategic – in terms of certain groups seeking to achieve particular sets of goals – but the ability of that action to achieve the desired effects is possible only by “an intense activity of enrolling, convincing, and enlisting” a range of people and things (Latour, 1986: 273). Such alliances are crucial in transforming and translating a diverse range of interests into a “black box” so that an object of controversy is no longer subject to contestation and dispute. This is not to suggest, however, that there is a single, all-powerful actor orchestrating the construction of actor-networks or that all actors are equally powerful. In a translation analysis there is a methodological imperative to “follow the actors” and the forms of action and agency that such network-building renders possible (Callon, 1986; Latour, 1987).

Two key features of agency follow from this point. First, actor-network theory does not simply focus on humans in the constitution of society. Rather, it argues that non-humans can be agents as well. It, therefore, is more accurate to use the term “actants” rather than actors since the latter implies only human agency. In making the ontological move to reconceptualize agency, proponents of this approach draw upon a modified structuralist epistemology that examines the social world as outcomes of relations. Structuralist thought focuses primarily on linguistic relations. However, actor-network scholars take this one stage further applying a “semiotics of materiality” in which the relationality of entities is applied “ruthlessly to all materials – and not simply those that are linguistic” (Law, 1999: 4). From this perspective, agency is a property (Callon and Law, 1995) that emerges through arrangements of relations (not simply “social” relations). Second, agency is performative in that it is constituted in and by these relations. The durability of agentic capacities is an achievement highly contingent on how material relations hold together. In other words, for Verschoor, “action is rather a composition of relations between associated entities” (1997: 261). This means, as Law notes, that “everything is uncertain and reversible, at least in principle” (1999: 4).

Translation may be considered an analytically coherent methodology for studying how particular arrangements of farmer agency emerge and are held together sufficiently long to achieve effects (see Higgins and Kitto, 2004). In particular, a translation approach enables an exploration of the relationship between broader projects or rationalities of rule, as manifested in specific programs, and their negotiation into social practices. The main features of a sociology of translation will be discussed only briefly since its relevance to agri-food issues is outlined in

depth elsewhere (Clark and Murdoch, 1997; Donaldson et al., 2002; Higgins and Kitto, 2004; Lockie and Kitto, 2000).

Callon (1986) delineates four moments in the translation process. “Problematization” is a moment in the translation process where an actor or group of actors define an issue as problematic and attempt to become an “obligatory passage point” that others must pass through to meet their own interests as well as the interests of the network builder. Another moment is “interessement,” whereby technical devices are deployed in order to impose roles and identities upon other actors previously defined during the problematization phase. These devices appear in the form of intermediaries that are, “anything passing between actors which defines the relationship between them” such as “computer software, disciplined human bodies, technical artifacts, instruments, contracts, and money” (Callon, 1991: 134–135). In effect they define and distribute identities and roles to humans **and** non-humans. The success of these two moments of translation leads to “enrollment,” which involves the stabilization of the network of alliances. Finally, “mobilization” occurs when the newly created network is mobilized and the “solution” (which may be embedded within an object or technical device (i.e., computer software programs) proposed is provisionally accepted by a larger group of actors until further translations occur. However, this is not to suggest that order and stability are inevitable outcomes of translation. Law argues that rather than social order, “there are endless attempts at ordering” (1994: 101). This means that translation and, as the paper argues below, the attribution of agency are a precarious and heterogeneous process. Prior to the application of a translation approach to the case study of a dairy planning program, it is necessary to provide some background of the broader political and policy milieu in which this program is located.

### **Background: Governing the Australian dairy industry**

Dairying in Australia is, overwhelmingly, an export-driven industry. Since domestic consumption of dairy products grows only slowly, the development of the industry is, both in recent times and in the future, dependent on the supply of low-cost products such as milk powder, cheese, and butter to the expanding Asian market (ABARE, 2003). In fact, Australia now exports over half of its total dairy production, making it the third largest exporter of dairy products behind New Zealand and the European Union. Declining terms of trade, along with the



increasingly export-oriented nature of the industry, has meant an ongoing need for improvements in productivity and efficiency by producers.

Up until early 2000, farm-gate milk prices were regulated at the Australian State level “with different subsidies paid according to the end use of the milk” (Cocklin and Dibden 2002: 31). This meant that milk prices remained relatively stable. However, this regulatory system was subjected to increasing levels of scrutiny since the late-1990s. The Federal government, along with many farmers’ organizations, argued that continued regulation was contrary to the National Competition Policy,<sup>ii</sup> and that it weakened Australia’s bargaining position for trade liberalization in World Trade Organization negotiations (Cocklin and Dibden, 2002). Such arguments in favor of dairy reform<sup>iii</sup> led to farm-gate milk prices being deregulated completely in July 2000.

Since deregulation of the industry, there has been pressure on farmers to adopt improved planning techniques as a means to enhance their productivity in a highly competitive export-driven environment. Deregulation highlighted for many in the industry the fact that dairy farming was a business requiring sound planning techniques in order to respond to commercial pressures (Cocklin and Dibden, 2002). While numerous farm management courses existed prior to this shift, deregulation undoubtedly placed additional scrutiny on farmers’ managerial practices and, particularly, their capacity to adjust not simply to a longer-term, cost-price squeeze, but now to fluctuating farm-gate milk prices. Training in farm management and planning represented one crucial means for farmers to respond actively to the negative impacts of deregulation.

Training in dairy farm planning and management has occupied a prominent place on the agenda of state departments of agriculture for a number of years. Prior to deregulation a developing emphasis in dairy programs on activities seeking to build human resources rather than “top-down” technology transfer was evident. In part, this reflects changing views about the government’s role in the economy and, particularly, a desire for reduction in government spending (Marsh and Pannell, 2000: 606). However, there is also a broader philosophical shift evident in agricultural extension towards initiatives that seek to “facilitate” change through education and training activities (e.g., Röling, 1988). It is in this broader political and policy context that the analysis of the following dairy program needs to be located.

### **Case study: Performing agency in the Australian dairy industry**

This section of the paper outlines a case study of the governing of farmer agency, drawing explicitly upon a translation approach. The constitutive role of non-human actants in the

“performing” of farmer agency is examined in terms of farmers devising a production plan in a participatory workshop environment and in attempts to apply this plan outside the context of the workshop. The two-day workshop has attracted over 650 farmers from Victoria, New South Wales, and South Australia since commencing in 2001. Each workshop has been attended by approximately 10–15 dairy management teams. At each workshop, a team of 2–3 trainers – themselves dairy consultants – assist farmers in setting up a workable profit plan. It is important to note that the program is not, in fact, state-run. It is privately operated, but between 50 to 75% of the cost of attendance is subsidized by FarmBis, a major Federally-funded national program for encouraging improved on-farm business management practices. Therefore, the program is consistent with broader Federal government objectives of improving farm productivity and efficiency in such a way that farmers rely less on government support and acquire the longer-term capacities to manage their enterprise in a “self-reliant” manner (Higgins, 2002).

In line with an exploratory translation methodology, qualitative methods of data collection were chosen for the research – specifically, in-depth interviews and observation. Two rounds of semi-structured in-depth interviews were conducted with farm management teams that had attended dairy planning workshops in the central and eastern Gippsland region of Victoria, Australia. In total, ten management teams agreed to be interviewed – consisting of a total of 14 participants (9 males, 5 females). The operations of these management teams varied considerably ranging from 190 to 500 cow herds and farm sizes of between 75 and 150 hectares devoted to dairying. The researcher also attended two dairy planning workshops in order to observe, learn the content and structure of the course, and talk informally with participating farmers. A research log was kept of the observations and supplements the interview accounts given by farmers.

#### *Problematization: The dairy planning workshop*

~~In 2001 [The interests of the trainers are focused on introducing the trainers, with the assistance of a computer programmer, completed the first prototype of a dairy decision-support system (DPS). Their main objective was to interest the dairy industry in the technology to the dairy industry that they, with the ongoing assistance of a computer technician, have developed, and which they believe represents a and provide a reliable means by which farmers, many of whom were struggling financially, -could] improve their profitability in a competitive, and recently deregulated, environment. -AWKWARD; PLEASE REWRITE MORE SIMPLY] -Such an objective interest is inseparable from the trainers desire to “sell” (in both financial and knowledge terms) a product to the dairy industry – primarily dairy consultants and farmers. In order to~~

ensure that farmers and other actors in the industry ~~sawee~~ the benefits of the system, the trainers created a two day workshop through which farmers would be introduced to and would learn to use the DPS. The workshop format performs a dual role. It ensures that the cost of participation for farmers is subsidized by the Federal government, thereby increasing the attractiveness of farmer involvement. At the same time, it provides a platform for farmers to learn to “drive” the DPS.

The workshop aims to provide farmers with the capabilities to set up an annual dairy profit plan. Its core objective is for farmers to “test their options and rapidly set up a comprehensive annual dairy profit plan that they have confidence in” (Course Training Notes). This indicates three key assumptions: (1) a profit plan is central to running a dairy business; (2) however, many dairy farmers either do not have a profit plan or, if they do, it is ad hoc and not of much use for dairy planning; and (3) to survive in the present deregulated environment, farmers need assistance in developing a profit plan. The workshop represents an “obligatory passage point” (Callon, 1986) for addressing the problems of farming practice and for ensuring that farmers, through ~~the usinge~~ the software, have the capacities to improve their profit margins in the long term. While the workshop might seem a highly localized means of governing the practices of farmers, the manner in which it problematizes existing managerial capacities renders it part of a broader attempt to govern farmers’ conduct in an advanced liberal way. In other words, the rationality of the workshop and the software that is used to achieve the workshops’ objectives are consistent with other farm-based initiatives in Australia promoting agricultural productivism, farmer self-reliance, and the claimed “need” for more ~~entrepreneurialfficient~~ business practices (Gray and Lawrence, 2001; Higgins, 2002).

Given the trainers’ limited resources they are unable to promote the workshop as an obligatory passage point in “effective” profit planning without enlisting other entities. Typically these include glossy flyers distributed to all farmers prior to a workshop being run in a given region. However, in the context of the interviews, the local bank manager was the most significant actant involved in promoting the workshop to farmers. While no formal commercial relationship existed between the trainers and the bank manager, informal endorsement by the bank was clearly a major factor in encouraging farmer attendance. The local bank manager found out about the workshop through clients who had attended previously. After attending workshops himself, he now promotes the workshop to all his dairy farming clients. For almost all the participants interviewed, ~~it~~ was the bank manager who introduced them to the workshop and encouraged them to attend. In fact, without the endorsement of the local bank manager, most farmers stated that they would not have known about or have been interested in attending the

workshop. This indicates that bank managers represent a crucial “intermediary” (Callon, 1991) between trainers and farmers and define the relationship between them.

However, the fact that the bank manager became an “intermediary” does not mean that he had no personal or institutional interest in recommending farmer attendance at the workshops, or that there was no pressure applied in encouraging farmer attendance. In fact, he had a great deal to gain in terms of greater assurance that bank loans would be re-paid. The point is that as part of their network-building efforts, the trainers were able to enroll a relatively stable (or “punctualized” [see Callon, 1991]) actor-network (the bank) as an ally in strengthening their problematization of dairy farming and thereby giving it local legitimacy and authority. As one farmer noted:

...it’s not very often that a bank manager actually takes the time to say, you know, ‘you guys will get something out of this.’ He’d heard that people who had done the course in other areas, how well accepted it was. And you know, like any bank manager, you need them as much as they need you! If you want to grow your business and they’re saying ‘this is of value,’ and...[the bank manager]...did the course, he was there. And he can also see, you know, if we put a proposal to him now he can see where we are trying to head.

Even though farmers were not forced to attend the workshop, their participation ensured a “good” relationship with the bank and the best chances for gaining approval for future loans. From the bank’s perspective, attendance at the workshop encouraged prudent financial practices on the part of farmers since it promoted the preparation of detailed production plans and budget data – important evidence in gaining bank approval for loans.

#### *Interessment: Configuring farmers as “active” agents*

The moment of interessment is concerned with how the deployment of the DPS as a “technical” device distributes identities and binds the interests of trainers with farmers. It is here that the constitutive role of “non-human” entities assumes significance in the construction of farmer agency. The software is not simply a mediator of different social meanings but renders visible certain paths of action while discouraging others. In this sense, the software might be seen, following Akrich, as a type of technological “script” that defines “a framework of action together with the actors and the space in which they are supposed to act” (1992: 208). It is important to note that technological scripts do not determine action, but represent an attempt by designers to

inscribe their “vision of...the world in the technical content of the new object” (Akrich, 1992: 208). If users do not follow the actions anticipated by the designer, the applicability and entire “function” of the object can be called into question. The DPS as a type of script is examined below in terms of the (re)presentations of farm planning that the software makes possible.

In close consultation with a computer programmer, the workshop trainers have created a software package (the DPS) that is claimed to be user-friendly to farmers and to build on key aspects of their existing calculative capacities. Even though farmers may have had limited exposure to computers before attending the workshop, the trainers have assumed that this does not represent a problem since the software is a logical extension of what farmers already do when making decisions. In other words, according to the chief trainer, “I guess all we’ve done with the decision support platform...is mimic a dairy farmers’ brain.” This quote indicates that in creating the computer package the trainers made particular assumptions or predictions about ~~a~~ farmer’s existing decision-making practices.

Central to the successful operation of the software is the input of data collected from participating farmer enterprises. Farmers are expected to complete an electronic questionnaire a number of days prior to the workshop requiring them to enter data on such details as farm finances, milk production, calving patterns, physical characteristics of the farm and resource and input quantities. These figures are entered on the questionnaire under particular categories and form the basis of subsequent farm planning during the workshop. Once at the workshop farmers are able to manipulate the inputted figures to test whether a given production strategy is likely to be profitable. Of itself, the collation, categorization, and manipulation of farm data might be seen as a relatively mundane exercise. However, statistics play a constitutive part in constructing a center of calculation through the establishment of what Callon (1986) calls “equivalences.” In effect, the standardized categories of farming practice make it possible for various dimensions of the farm enterprise to be drawn together and transported “inside” the software, and for this to become representative of “the farm.” Standardization of farm data through the use of specific categories is a crucial part of representing a domain as a problem site and rendering it amenable to intervention (see Murdoch and Ward, 1997). In other words, the “farm enterprise” is reduced to a standardized set of figures that can be used as the basis of diagnosing problems and devising solutions. Thus, what constitutes the “external” world of farming practice and the “internal” world of the software are blurred into a single electronic representation. As Berg (1997) notes, there is an equivalence of tool and practice.

The visualization of farming practices through the software provides a seemingly accurate and indisputable representation of the farm’s financial position and enables alternative production

scenarios to be devised based on what the statistics for the previous year “show.” These scenarios are built through the “Profit Calculator” function which allows farmers to use the previous year’s profit results to calculate, compare, and test the feasibility of alternative future production plans. From the perspective of the programmer~~who designed the software~~, this is what makes the program empowering for farmers: “We want to give them the power today to make the decisions today. And that’s what the tool’s all about.” As three farmers note, the software does indeed enhance their capacities to accurately plan:

You know these things, and you know, I guess you know why, but you can’t see the figures. And ah, so when you see the figures you just think, ‘oh no! I knew that but I should have been doing it!’

The natural checks and balances in the program, you know the ‘can this happen in the real world?’ checks and balances in the program, and I mean that definitely is one of the real strengths of that program. {You know as soon as you’re...~~-[wanting to do something that is not profitable]...getting into the rounds of this is not really possible~~ it [the software] tells you so.~~UNCLEAR; PLEASE FIX~~ So you’ve got to change the way you’re trying to do things.

It does, it certainly challenged you.... I think it definitely, on your feeding strategy of grain and your production curve, whether you would or wouldn’t feed 300 kilos of grain or 1.5 tons of grain to a cow. It allows you to work out where you’d go if you did feed 1.5 tons per cow – ‘yes I can make a profit out of it, and I can clearly see that I can.’ Whereas beforehand you were sort of ‘oh, shit, I dunno, ton of grain’s a lot of grain, that’s gonna cost me this much, can I get that much out of the cow. Oh, I dunno, maybe I’ll go half way and I’ll feed it 500 kilos.’

The software, therefore, makes it possible to represent less tangible aspects of farm planning in a seemingly “accurate” and materially intelligible way. From the farmers’ perspective, accuracy, calculability, and predictability are, in fact, its most valued features. In constituting different scenarios for improving the accuracy of farm planning and indicating areas that require attention, the software also seems to place farmers firmly in control of their enterprise showing them that they have the capabilities to improve profit regardless of changes in the milk price. Thus, the inscriptions made possible by the software represent farmers as “active” agents who, far from having little control over external forces such as changes in the milk price, are able to

manage their resources in new ways so that they have the capacity to be profitable regardless of such fluctuations. The following two sections of the paper examine whether farmers are able to translate these representations of active agency beyond the context of the workshop.

#### *Enrolment: The impact of the production plans on farming practices*

In general terms it can be argued that the farmers interviewed were enrolled into the network being built by the workshop trainers. Observations at workshops and interviews with farmers suggest that most were able to develop a production plan that they believed would be workable and would contribute to an improved profit outcome once they returned to their farms. However, it is insufficient to leave the analysis here. What is of greatest significance is how farmers apply what they learned in the workshop on their farms.

On completing the workshop, participating farmers are permitted to print out the production plan and forward budget they devised using the software. These plans devised in the “virtual” world are taken away to be applied in the “real” world. In rendering mobile the calculations done by farmers using the software, the printouts enable what Latour (1987) describes as “action at a distance.” In other words, the calculative techniques inscribed in the software are deployed to shape the decision-making capacities of farmers beyond the context of the workshop. They not only represent the “solution” to the problems proposed as part of the workshop, but they are also an “immutable mobile.” The latter provides a means of translation between the workshop as a center of calculative governing, and the day-to-day practices of participating farmers.

At face value, the production plans had the impact desired by the trainers on farmers’ planning practices. The greatest changes to farmers’ existing practices were in the areas of feeding/grazing strategy. Throughout the workshop the key message given by trainers and inscribed in the operation of the software functions *iswas* that it is more financially prudent to increase milk yield by feeding a higher quantity feed to fewer cows rather than by buying more cows. On this basis, farmers are encouraged to (a) increase their grain inputs or try a different mix of grain, (b) increase the use of fertilizer to improve pasture quality, and (c) grow fodder crops with higher levels of metabolizable energy (ME). These practices had been pursued actively by most of the farmers interviewed. While some farmers “decreased the herd size,” most either increased their “input of concentrates and fertilizer” or changed “the magnitude of grain feeding.” In the case of fertilizer use, one farmer commented that he was applying it “a lot more frequently than previously. We were sort of two maybe three applications a year, where now we’re doing it every two months.” Another stated that the workshop had prompted him to



increase “fertilizer by 25%, so I’ve got a dollar budget for that now...~~from the~~ ~~\_\_\_\_\_~~ [WORD MISSING], even last year I spent \$31,000 on fertilizer – that will go to \$40,000 this year.” One farmer who applied the mix of fertilizer he had worked out using the software was impressed by the immediacy of results: “Ah, fertilizers I implemented before I finished the...course, I’d already ordered and paid and had spread some of [the] mix, and it was a great success. Everybody thought it was raining on my farm and nowhere else!”

Use of the software had also changed the way in which farmers fed their cows. As one farmer noted,

grain feeding is up just a little bit...and that’s, that’s increased again um, with confirmation from the course. Last year the general input was that it was too expensive to put in, um but then at the end of the season when you look at the cows, it wasn’t too expensive to put in.

While changes may not have been radical, they were, according to one farmer, a matter of “not necessarily feeding more we’re just feeding wiser now. And it has taught us different practices to enable that to happen, I suppose. Being a bit wiser on the different types of feed that we can use.”

The above quotes indicate that through printouts of production plans the trainers were able to enroll farmers and mobilize computer-generated representations of farming practices, or at least aspects of them, beyond the context of the workshop. ~~In effect, the construction of farmers within the workshop as active agents through the workshop, as a center of calculative governing, was mobilized “at a distance” t-through the printouts, —thus strengthening the network being constructed by the trainers, and altering how farmers understood their capacities as agents. UNCLEAR; PLEASE REWRITE~~ However, while many farmers clearly experienced immediate benefits, in terms of both production outcomes and changed practices, from applying aspects of their plan, most did not consider the longer-term ecological or social impacts of a high input system of production. Only two farmers expressed concern over the model of production being promoted through the workshop and software. ~~O~~ne farmer noted:

I think that the high input system that the DPS software allows you ~~to~~~~TO~~ test works fine when you’ve got good milk prices, cheap feed costs, and the balance between supplements and milk prices works okay. Um, I think the message [...] can be quite misleading and dangerous in farms that are lower stocked, have a lower stocking rate, when maybe feed costs are expensive and the milk prices are low as we have at the moment.



The environmental and social consequences of high input farming are well documented in the literature in terms of placing farmers on a “treadmill” of increasingly intensive production practices and, thereby, contributing to greater environmental degradation (Buttel, et al., 1990; Gray and Lawrence, 2001; Marsden, 2003). Thus, while seen from the trainers’ perspective as “empowering” for farmers and contributing to improved sustainability, the production plans, if applied by workshop participants over the long-term, could well contribute to non-sustainability. This is an issue beyond the empirical scope of this paper. Nevertheless, some insights into the actual effects of the workshop (and software) on both farm sustainability and farmer agency can be ascertained by examining the contingencies of enrolling “non-human” actants in order to render farmer production plans durable in practice.

#### *Mobilization of the network? Negotiating the printouts into practice*

As various scholars have pointed out, the extension of standardized “scientific” products into local contexts is a precarious process (as applied to agriculture see Wynne, 1992; Clark and Murdoch, 1997). Even though actors –such as farmers – may change aspects of their practices, the successful mobilization of the network is by no means guaranteed. Within the agricultural context, Clark and Murdoch argue that this is largely due to the fact “that the growth (or contraction) of a scientific network is dependent not just on the actors who build it but also on both those (social and natural) entities who are enrolled into it and on the terms of their enrollment” (1997: 55). ~~Within the present case study of the dairy planning workshop, the extension of “non-human” entities had a significant influence on the capacity of farmers to apply their production plans in practice. plan into farmers’ existing practices represented problems from the outset since, as the paper examines below, it involved the enrolment of other entities that the farmers had calculated for these entities in the course of devising their plans, however they but were unable to be enrolled in the desired manner outside the context of the workshop.~~UNCLEAR; PLEASE REWRITE}

The main problem reported by farmers in making their plans workable ~~was~~ is the inherent variability of farming. In both regions where interviews with farmers were conducted there had been below average rainfall for some time and this had created difficulties in obtaining the feed required to produce the outcomes indicated in their production plans. For instance, farmers explained:

We did start with the idea of running 220 cows on the farm, and the idea of maintaining as high a number as is reasonable, is because our idea... because there's no way that we could make that 220 this year, particularly this year with the feed we've had, like no hay, no silage.

We used the feed available that we had at home and hopefully get an earlier break than what we did, which we haven't. So we've really only stopped feeding maize silage now which, as the course told us is very high in NDF [Neutral Detergent Fibre]. So they can't physically eat enough to produce as much as they should be able to.

A further and closely related key consideration in the transformation of the printouts into practice is the agency of the cows themselves in terms of the feed they prefer in producing higher quantities of milk. Cows are central to the operation of a dairy enterprise and, as such, have a clearly defined role in producing the quantity and quality of milk required to earn the management team a satisfactory income. For farmers' plans to work in practice, cows and their digestive systems must be enrolled successfully. Increases in the quantity and mix of grain fed to the cows, it is assumed, will result in the requisite gains in energy, milk production and thus profit that the software indicates is achievable. However, interviews with farmers indicated that many herds did not respond in the desired way to changes in feed practices.

But when I put into the [...] program that I was going to feed 500 kilo cows 2.3 tons of grain and a ton of hay, and it says they should do 9,000 liters and when we did that at the research farm they only did 7,000 liters, I'm afraid the credibility of the software is questionable.

Yeah, well with what we planned to do [...] and how it's panned out is different. You know it's worked out differently because the season just came in that much tougher than we were expecting, and we tried to up the grain and probably got a little bit of acidosis in the grain, in the cows and that knocked them back and then, and so, it's just sort of compounding itself the whole time. As we try and fix one problem we've created another!

Yeah. I mean they're getting more grain but they're still not producing anything more than last year. But [an agricultural consultant] reckons that they're just putting feed back on their back at the moment.

609 From the point of view of the workshop trainers, the failure to produce outcomes that the  
610 software indicated was achievable may simply be blamed on the managerial capacities of  
611 individual farmers. The trainers acknowledge that profitable outcomes are contingent on a range  
612 of other factors **within** the control of farmers. Nevertheless, the above quotes emphasize that the  
613 farmers' capacity to act was limited by problems in enrolling cows' digestive systems, an entity  
614 that was assumed to be a relatively unproblematic "production factor" within their production  
615 plan.

616 The capacity of farmers to render their plan workable in practice was also contingent on a  
617 range of other variables being successfully enrolled including weather, sufficient water and  
618 pasture.

619  
620 ...the biggest thing with the [DPS] stuff is that it relies on everything just running smoothly,  
621 it doesn't allow for not being able to get water, it doesn't allow for a week of shitty weather,  
622 and you knock the top off the peak of your cows, and stuff like that.

623  
624 ...it would be much easier if you did have irrigation to do that course. Especially if you were  
625 an irrigation farmer ... where you've got center pivot and you could really take on those  
626 principles with unlimited water, and you really should be doing what they are doing. But it is  
627 hard when it is dry land like this, and we do have to rely on rain, our pasture quality backs off  
628 there's not a thing we can do about it.

629  
630 In translating production plans into practice, the capacity of farmers to act as agents was  
631 contingent on the cooperation of entities not usually considered to have agency in the modernist  
632 sense. As the perspectives from farmers suggest, the cooperation of these "others" (e.g., the  
633 weather, water, and cows' digestive systems) was crucial for maintaining the farmer agency  
634 constituted through the DPS. This is an example of what Pickering (1995) calls "material  
635 agency," the situation in which seemingly "natural" forces act upon the actions of humans in  
636 unpredictable ways. For Pickering (1995), non-human and human agency differ in that only the  
637 latter has an intentional structure. However, human action is also intertwined with, and re-  
638 configured by material agency. As a consequence, Pickering argues that the contours of human  
639 and material agency:

640  
641 emerge in the temporality of practice and are definitional of and sustain one another. Existing  
642 culture constitutes the surface of emergence for the intentional structure of scientific practice,

and such practice consists in the reciprocal tuning of human and material agency, tuning that can itself reconfigure human relations (1995: 21).

Thus, while non-human entities may have constrained the capacity of farmers to apply their plan in practice and, thus, weakened the durability of the network being built by the workshop trainers, these same non-human entities also held the key to farmers mobilizing their plan and translating on-farm the representations of “active” agency constructed in the workshop. In this sense, these forms of material agency also shape farmers’ practices in ways that may contribute to a re-thinking of the high input strategy promoted in their production plans.

## Conclusion

This paper has argued for greater analytical attention in agri-food studies to the centrality of non-human entities in the constitution and governing of farmer agency. While valuable in exploring the social relations through which farmers acquire particular capacities as agents, political economy and actor-oriented perspectives do not go far enough in examining farmer agency as a relational effect of human and non-human relations. As a consequence, the effects of these entities on the performance of farmer agency have generally been overlooked in agri-food research. A translation methodology was drawn upon in this paper to explore the role of non-human entities as part of broader interventions for changing farmer practices. Through the application of this methodological approach the paper makes an ontological shift from the political economy and actor-oriented perspectives to demonstrate the significance of non-humans in the success, or lack of success, of programs governing the performance of farmer agency.

Non-humans need to be considered in the form of material artefacts and inscriptions that represent farming practices in new ways and open up pathways of action and forms of agency that may not have previously been thinkable or practicable. For instance, the functions of the DPS software package were crucial to attempts by the trainers of the dairy planning workshop to bind their problematizations of dairy farm management with the interests of farmers and, thus, promote a high input/high output model of production consistent with broader, neo-liberal, Australian government objectives. In effect, the representations of farming practice calculated through the software were used by the trainers as a key ally in convincing farmers that their interests would best be served by subscribing to the trainers’ problematization of farm planning – and, thereby, using the production plans devised in the workshops to inform future practices.

Equally important, as the paper demonstrates, non-humans also have a part to play in how farmers are enrolled into networks being built by governing agencies – in this case, the trainers’ network. The production plans that farmers produced as a result of attending workshops might be seen as an immutable mobile through which the representations produced via the software acted on farming practices at a distance. Interviews with farmers, show that the production plans, or aspects of them, shaped not only how many farmers reflected on their practices, but also actual production outcomes. However, even though the production plans represented farmers as “active” agents who could make a profit regardless of milk price, this was not necessarily the case in practice. Not only did the plans that farmers devised encourage a high input and unsustainable, long-term system of production, but they also tended to oversimplify the capacities of other entities that farmers needed to enroll in order to implement their plan successfully.

The successful mobilization of the network built by the trainers was contingent on attempts to enroll non-humans outside the context of the workshop. When farmers applied their plan, or aspects of it, in practice, they had to enroll other entities crucial for making the plan work. The failure of these entities to co-operate in the desired way shaped how farmers reflected on their own capacities as agents. In other words, these entities represented a form of material agency in the sense that their actions impacted directly on farmers being able to achieve results predicted in the production plan. From this perspective, arrangements of farmer agency are a relational achievement contingent on other (non-human) entities playing their defined role. The fact that these entities refused the roles set for them meant that: (1) the production plan and, thus, the network being built by the trainers, lost its strength to act at a distance as a decision-support tool; and (2) farmers’ agentic capacities – constructed through the workshop and software as having control over farm profit regardless of external drivers (such as milk price) – were re-problematized.

What implications do the above arguments have for future studies of farmer agency? First, further scrutiny is needed into the assemblages of material techniques – or technologies – that are being used increasingly to govern farming practices in particular ways and into the programs of action to which they give rise. There have been some efforts to examine statistics (Murdoch and Ward, 1997), standards (Bain et al., 2005; Busch and Bain, 2004; Deaton et al., 2005; Le Heron, 2003), and computer software packages (Higgins and Kitto, 2004) as techniques for governing the conduct of farmers, but this is an area that deserves far more attention in agri-food studies. Second, greater attention needs to be paid to the relations (not just human) that constitute and maintain~~perform~~ arrangements of farmer agency. While rural scholars are beginning to

acknowledge the role of non-human agency in the constitution of social relations, more empirical work would undoubtedly assist in showing how they contribute to and place limits on the building of actor-networks.

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## Notes

<sup>i1</sup>. For a notable exception see Verschoor (1997).

<sup>ii2</sup>. All states signed on to the National Competition Policy by the late-1990s.

<sup>iii3</sup>. Reform arguments are discussed in more detail by Cocklin and Dibden (2002).

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