FARM ENTERPRISES AS SELF-ORGANIZING SYSTEMS: A NEW TRANSDISCIPLINARY FRAMEWORK FOR STUDYING FARM ENTERPRISES?[1]

Egon Noe

Danish Institute of Agricultural Sciences, Department of Agroecology

Hugo Fjelsted Alrøe

Danish Research Centre for Organic Farming

INTRODUCTION

Our research group on Farming Systems at the Danish Institute of Agricultural Sciences has been committed to on-farm research for more than 30 years, studying various aspects of farming in practice. At first our focus was more on technical and biological aspects of foddering, strategies for growing fodder beets, production of high quality silage, herd replacement strategies, etc. In the 1970s and 1980s the findings of this research were not well-received within the academic circles as its methodology was regarded as case orientated and unscientific, without the statistical evidence that generalizing projects could provide. However, our findings were in great demand by consultants and farmers because they were readily applicable in practice.

The growing attention to the sustainability and, now, multi-functionality[i] of agriculture and food production calls for a multidisciplinary research and development approach. What is needed now is to move from on-farm research to farming system research. Organic farming, nutrient balances, and nature quality are among the new topics. In the early 1990s a cybernetic model of a farming system was adopted (Figure 1) (Sørensen and Kristensen 1992) where the management system was introduced in the theoretical framework as the farm's controlling system (controlling the production system though measurement and adjustment). However the controlling system remained an unexploited black box in this model. It was still not explained how the farms were organized and why they were managed so vastly differently. The farmer was introduced as an observer of the system but not as a part of the system observed. It was realized that the hard system could not be studied independently of the soft system but this problem was still dealt with in a pragmatic way by describing the individual case as a platform for the transverse analyses and interpretations of the cases. From the early 1990s we have worked on developing a theoretical framework for transdisciplinary[ii] studies (Alrøe and Kristensen 2002) that can treat a farm as a *whole system* i.e., as an entity which includes both the social and the technical aspects of a farm and, more importantly, the connections among the social, biological, and technical elements involved.

Within the fields of Rural Sociology, Agronomy, and Economics, attempts have been made to establish a theoretical framework for observing and analysing a farm as an entity. We have in particular been engaged with three different theoretical frameworks: the farming styles approach, the Bawden approach (also known as the Hawkesbury approach), and the agroecosystem approach. While acknowledging their contributions in this paper we argue that these theories do not offer a truly transdisciplinary theoretical framework for understanding farm enterprises.

Furthermore, we will introduce a new theoretical concept, combining Actor-Network theory and Luhmann's theory of social systems, as a working ontology[iii] that understands a farm enterprise as a self-organizing system, and thereby as a system independent of an external observer, and argue how the latter can serve as a platform for transdisciplinary studies.

REVIEW OF LITERATURE

Many different attempts have been made to grasp the farm as a whole system in order to explain the dynamics of farming and development. In the following we will discuss three important and widespread approaches: 1) The 'farming styles' (FS) approach developed by van der Ploeg and his colleagues at agricultural university at Wageningen, The Netherlands; 2) The Hawkesbury approach (also known as the Bawden framework), which is a research and education methodology (paradigm) developed by Richard Bawden and his colleagues on the Faculty of Agriculture and Rural Development at the University of Western Sydney at Hawkesbury (Australia);

1 A draft version of this paper have been presented at the xvth ISA World Congress of sociology, RC40 Sociology of agriculture and food. 7 – 13th July, Brisbane, Australia

3) Conway's 'agroecosystem' approach with a theoretical heritage from cybernetics and general systems theory, with the primary focus on sustainability assessment.

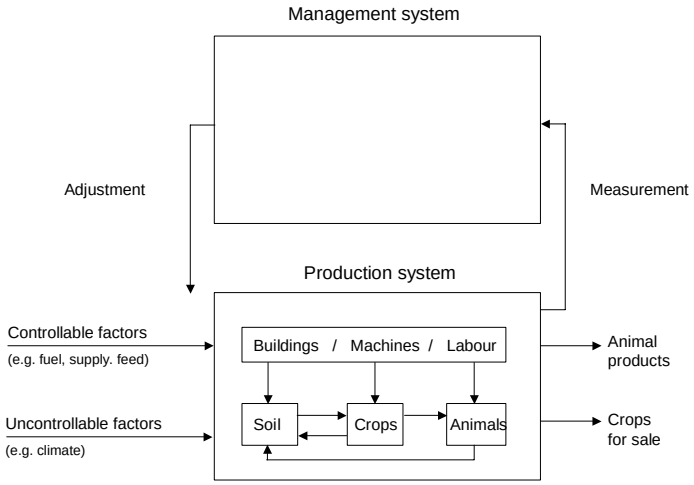

Figure 1: Sørensen and Kristensen's (1992) model of a livestock farm as a cybernetic system

The farming styles (FS) approach

The point of departure of the farming styles theory is to grasp the heterogeneity among farmers. Van der Ploeg defines a farm as:

> "…a social (and therefore goal-orientated) co-ordination of the whole range of tasks, which together constitute the totality of the farm labour process, and that such social co-ordination implies the ongoing observation, interpretation, and evaluation of similar and different forms of social co-ordination (i.e. one's own and the farming practice of others)…." (Ploeg 1994:17).

In this view a farm is understood as a system of activities or practice, linked to the goals of the actor(s) involved.

The individual practice of a farm is developed within the framework of local social constructed farming styles, which Ploeg defines as follows:

> "Farming styles refer to a cultural repertoire, a composite of normative and strategic ideas about how farming should be done. A style involves a specific way of organizing the farm enterprise: farmer practice and development are shaped by cultural repertoire, which in turn are tested, affirmed and, if necessary, adjusted through practice. Therefore, a style of farming is a concrete form of praxis, a particular unity of thinking and doing, of theory and practice." (Ploeg 1993:241).

In 1995 Ploeg adds to this definition of a farming style:

"In general terms, a style of farming can be defined as a particular unity and coherence of the following elements:

1. A set of strategic notions, values, and insights shared by a particular group of farmers concerning the way farming ought to be organized;
2. a specific structuring of the practice of farming that corresponds to the strategic notion or "cultural repertoire" used by these farmers;
3. a specific set of interlinkages between the farm enterprise on one hand and the surrounding markets, marked agencies, government policy, and technological development on the other. These interrelations are structured in such a way that the specific farming practice can be reproduced over time."

At first glance the definition of a farm as a social co-ordination of tasks seems to be a useful way of approaching the farm as a whole as well as understanding some of the differences in dynamics and processes between farms. Values and insight play a central role in the understanding of the goal orientation of the farm,

and Ploeg (1990) uses the notion of calculus to explain how the goals and values are translated into the strategy of a farm.

> "The way particular goals are translated into practice is investigated in this study in terms of patterns of farming logic, as a calculus, which defines how work must be done in practice for all relevant tasks and under all conditions." (Ploeg 1990:31).

Both the concepts of values and logic/calculus are useful for understanding the self-organisation of a farm-enterprise. However, when it comes to the development of the theoretical framework of FS, these concepts turn into a structural theory. The calculus or logic does not belong to the individual farm, but to the styles of farming and thereby to the social structures. And how the farm differentiates from the styles of farming is not clear.

> "A calculus or farming logic is here conceived of as the practical discourse that farmers follow in the organization of the labour." (Ploeg 1990:31).

Paradoxically, in his efforts to explain the agency of individual farms Ploeg ends up with a structural theory where the individual farm can only be understood through its membership connection with a certain cultural repertoire. Furthermore, the degree to which these cultural repertoires--in terms of discrete styles of farming--are real entities or just heuristic parables has been strongly questioned (Vanclay, Mesiti and Howden 1998).

Another critique of the FS-theoretical framework, relevant in this context, is that FS misses the co-production between nature and culture (Goodman 1999:24) –i.e., how the natural and biological processes are interwoven with, and are mutually influencing, the social and technical processes of farming. Furthermore, the co-evolution with the surrounding world is very poorly understood in the FS-framework. The surrounding world is characterized as 'room to manoeuvre', but how this space is influenced by farmers' strategies and relations is poorly understood. To conclude, although the FS-approach offers a comprehensive theoretical framework of the social construction of farming, and some interesting conceptual tools for studying heterogeneity among farmers (Ploeg 1994), it still remains incomplete as a theoretical framework for understanding the organization and dynamics of a farm in its biological, economic, technical, and social context.

The Bawden framework

Bawden and Wilson took a leading role in their advocacy of Peter Checkland's SSM approach (Wilson and Morren 1990). Checkland (1981) distinguishes between 'hard systems' that are predictable, and 'soft systems' that are unpredictable from the vantage point of an outside observer. Soft systems are internally capable of reflecting, learning and choosing. They are not, therefore, determined by natural laws. Checkland further distinguishes between human activity systems (such as railways and companies) and social systems (social groups that are characterized by particular sets of human activities). As a theory of management Checkland's focus is on the human activity systems.

As a framework for multidisciplinary studies, the Bawden framework builds on Checkland's system typology and includes four levels of research: reductionist science (basic science), reductionist technology (applied science), hard system science, and soft system science (see e.g. Bawden 1991). From our point of view, the theoretical platform for the systems/research levels remains pragmatic and the connection between the four levels of research (and how the biological and technical processes of a farm influence the social processes and vice versa) remains unclear. We argue that more theoretical efforts are needed to connect the different levels/modes of reduction (Alrøe and Kristensen 2002).

At the soft system level the Bawden framework operates with the notion of a farm as a system entity and refers to Maturana and Varela's theory of autopoiesis[iv] and theories of self-organization (Sriskandarajah, Bawden and Packham 1989). This leads to a conceptual understanding of a farm as 'an organism' of human activities (figure 2).

In our view this model has two problems. The first problem is that it views a human activity system as a closed system, visualised by enclosing lines drawn around the farm, open only for input and output. The conceptual model of the farm becomes a physically and structurally closed system with only internal relations or activities. The assumption of a farm being physically closed is add odds with the reality of today's agriculture, where each farm is inextricably involved in numerous relationships as a consequence of specialisation, technologisation, and globalisation (Benvenuti 1975), and where the activities that contribute to the physical

production and reproduction of the farm belong not solely to the farming system, but to numerous other actors and systems.

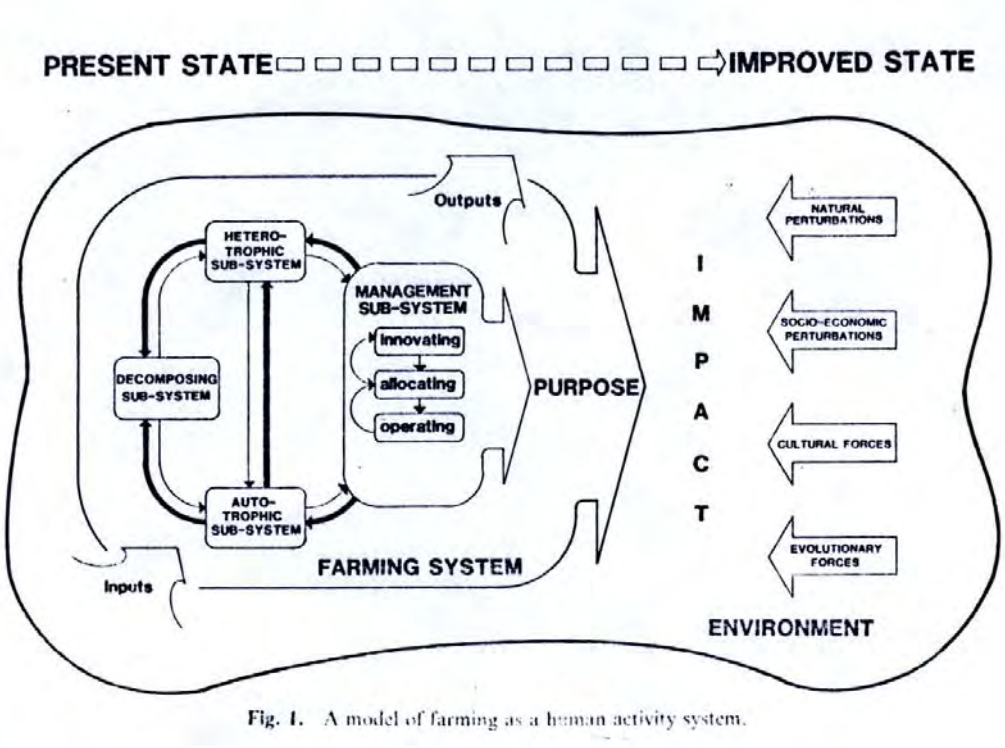

Fig. 1. A model of farming as a human activity system.

Figure 2: A model of farming as a human activity system (Source: Sriskandarajah et al. 1989)

The second problem is that the concept of autopoiesis combined with the concept of soft systems as human activity systems lead the Bawden framework to view the farming system as a mental construction in the mind of the farmer, which it designates as the farmer's worldview[v]. And since, in line with Maturana and Varela, the idea of approaching social systems as autopoietic systems is strongly rejected (see e.g. Mingers 1995), the very idea of learning comes to be restricted to the mind of the individual farmer.

The Bawden framework is caught in the opposite position of the farming styles approach. They see a farming system as a mental construction in the mind of the farmer whereas the farming styles approach sees the farm as a social construction. Thus the Bawden framework ends up with a radical constructivist position, and takes a pragmatic view on systems theory as only an epistemological question (Bawden 2002). To conclude, the Hawkesbury model holds a very clear focus on the individual farm as an entity, but fails to include the social and technical environment of the farm.

The agroecosystems approach

Conway defines farm enterprises as agroecosystems and he thus focuses on the connection between the biological and the social-technical dimension of the farm.

> "It is this new complex agro-socio-economic-ecological system, bounded in several dimensions, that I call an agroecosystem." (Conway 1987:96).

The heart of Conway's agroecosystems' approach is to build a multidisciplinary framework for studying, and for facilitating a sustainable development of, primary small farm holders in the developing countries (Conway and McCraken 1990). Conway's platform for multidisciplinary studies build on general systems theory and sees an 'agroecosystem' as a hierarchy of systems, where each level is to be studied in its own right and in relation to the other levels above and below.

Although Conway sees the agroecosystem as a hierarchy of systems, he tries to provide a unitary view of this system via the metaphor of a living organism:

> "However, agroecosystem like individual organism are clearly cybernetic. They, too, have recognisable goals and strategies to attain them. I suggest that the primary goal of an agroecosystem is increased social values" (Conway 1991:6).

Conway is here trapped in the same situation as Sørensen and Kristensen (1992) with the management system and the managed system as two separate systems that, as different levels of the hierarchy, should be studied separately (figure 3). From our point of view the farmer is not just an observer of the system, but a part of the system, and the cropping system or the herd system cannot be fully studied and understood without taking into account the values and the logics that the processes are organised around, as it is nicely demonstrated by the farming styles studies (see e.g. the monograph on farming styles ed. by Ploeg and Long (1994)).

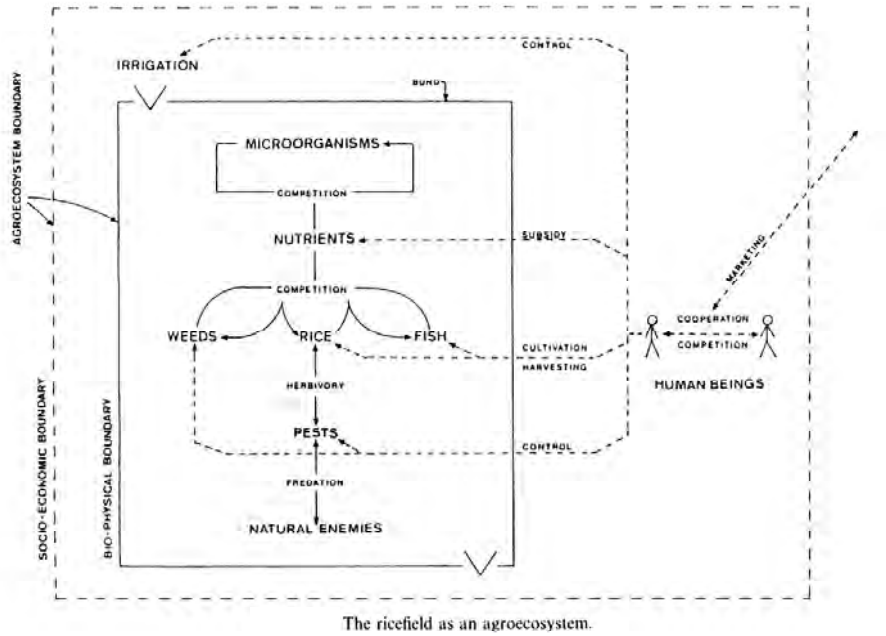

Figure 3: The rice field as an agroecosystem (Source: Conway 1987)

The hierarchic systems theory also has problems with boundaries, illustrated in figure 3. In our opinion these physical boundaries will always be contingent, depending on the choices of the observer. As an example to illustrate this problem the tractor applied within the fieldwork will either belong to the system or to the systems environment depending on whether the tractor belongs to the farmers or to machine pool. In physical terms it seems much more fruitful to apply a network metaphor for understanding physical *interactions* of the farm as interactions do not have clear-cut boundaries in time and space (Murdoch 1998).

As an applied systems framework, the agroecosystems' approach does not overcome the problems that multidisciplinary studies have with communication between disciplines. It just adds together different perspectives, epistemologies and ontologies, which belong to the disciplines that are used at each hierarchical level of observation. Conway's suggestion to overcome these problems is a common approach for analysis:

> "Each level in the agroecosystems hierarchy has to be analysed and developed both in its own right and in relation to the other levels above and below. To achieve this, with rigor and speed, is a difficult task but is greatly helped by a common approach to analysis and, in particular, a set of well defined common properties for each level in the hierarchy that can be related to each other, within and between levels (Conway and McCraken 1990:222)"

The set of common properties is the four properties of productivity, stability, sustainability and equitability (Conway 1987). Conway's approach is widely applied and valued. An explanation why it works out well in practice could be that the researchers are forced to communicate with each other about their observations, as a result of the RRA-methodology (Conway 1991). But this cannot really be translated into a broader context of agricultural research.

Despite his efforts, Conway's theoretical framework does not offer a consistent theoretical concept of an agroecosystem. The definition and determination of the system remains a pragmatic decision of the observer and not an ontological attribute of the system. In Conway's methodology the system is not evaluated with respect to its own goals but with respect to the external goals that are derived from discourses of sustainability. Hence Conway's framework cannot help us with conceiving and observing the self-organizing character of a

farm. The 'organism' stays an observer's metaphor and it is up to the observer to draw the system's borders to define the entity.

TOWARDS A THEORETICAL FRAMEWORK OF A FARM AS A SELF-ORGANIZING SYSTEM

The three theoretical frameworks contribute to the studying of various aspects of farming and sustainability. The farming styles approach helps us understand farming as a matter of social interaction. The Bawden framework contributes a clear understanding of a farm as a soft system and of farming development as a matter of learning rather than of linear calculation. Conway shows the need for a multidisciplinary approach to research and development of sustainable agriculture.

But from our point of view, they all fail to establish a comprehensive model of farm enterprises as self-organizing social-technical-biological-economic systems. What all the frameworks have in common is activities as the key element of the system. They conceive the system as processes of activities and use the living organism as a metaphor of the entity for the system. But unlike living organisms which have skin as a physical border to the environment controlling the physical processes underneath the skin, a farming system has no such physical boundaries. A farm is interwoven in linkages with sundry actors and agencies. Hence, if we want to pursue the idea of a farm as a self-organizing system we need a framework capable of explaining the organizational closure of a farm and the relational openness of the farming processes. Our suggestion is to combine Luhmann's theory of social systems, which is almost unknown within the discourses of rural sociology, and the Actor-Network theory of Latour, Callon, and Law, which has become more widespread within rural sociology, mostly within the studies of food networks and organic farming (Goodman 1999; Assouline and Just 2000). Neither of these theories has yet been applied in the understanding of farm enterprises.[vi]

The Actor-Network Theory (ANT)

A farm enterprise is characterised by a heterogeneous mixture of biological processes, technical operations, geological features and processes, climate, food chains/market, financial market, knowledge, social processes, culture, labour, etc.

If we approach a farm as an actor-network there are many elements that are translated and enrolled[vii] into the objective of farming. There are the animals, various kinds of machines and technology, the fields, sunshine, rain, computers, various kinds of plants, labour, family labour, experience, skills and knowledge, values, goals, etc. depending on the heterogeneous strategy of the enterprise.

The situation is even more complex, because the heterogeneous network of enrolled entities is not limited to the physical site of the farm. Much of what we would normally call external entities are enrolled as and mobilised as actors into the farming processes: seeds, semen, advisors, capital, magazines, weather forecasts, fodder, food chains, colleagues, scientific knowledge, labour, subsidies, etc. The kind of entities and actors that are enrolled (or not enrolled) into the network and how they are enrolled are characteristics of the enterprise, e.g. whether the commercial consultants or the consultants of the farmers' unions are enrolled and to what kind of performances they are enrolled.

One may easily realize how important it is for the results of the farming processes that all these interactions in the actor-network are balanced in accordance with the strategy of the network.

The perspective we get from understanding farm enterprises from an ANT approach and the ensuing relationality of entities is that the enrolled entities get their forms and performances through the relations in which they are located (Law 1999:4). To illustrate this, a particular cow may on one farm be fed grass from the field and on another farm may be kept in the stable fed feed concentrate. Hypothetically, the same cow may produce 12,000 kg milk in one system and 7,000 kg milk in the other. The same kind of difference can be explored for other enrolled entities such as wheat varieties, computers, consultants, etc.

The notion of contingency is central to the ANT (Biejker and Law 1992). The fact that the realization of a certain actor-network is only one among (infinitely) many possible ones means that actor-networks are initiated on choices that are not open for rational decisions. The network, however, is not necessarily conscious of this matter of contingency. Only through a reflexive process can the state of choice become visible. Therefore, it is often not acknowledged by the actor-network itself that there has ever been any choice - as Mol puts it: "So they displace the decisive moment to places where, seen from here, it seems not a decision, but a fact" (Mol 1999:80).

The notion of contingency opens for exploring the heterogeneity of farming strategies among different farm enterprises. If we give up the idea of optimal solutions, the different strategies among the farm enterprises, which are reported in numerous empirical studies (e.g. Ploeg 1994; Whatmore 1994), can be seen as contingency, as actualisation of possibilities. This changes the understanding of the structural surroundings from being prescriptive of the individual farmer to being opportunities for action. This means that the higher the complexity of the surrounding world, the more possibility of heterogeneity in farming strategies.

Entities enrolled in the network of the farm can be actor-networks themselves, e.g. in the case of consultants offices, dairy companies, wholesalers, etc., which organize their own heterogeneous complexity. And each of these is striving to translate the farm enterprises into their own network strategy by selling their products, etc.

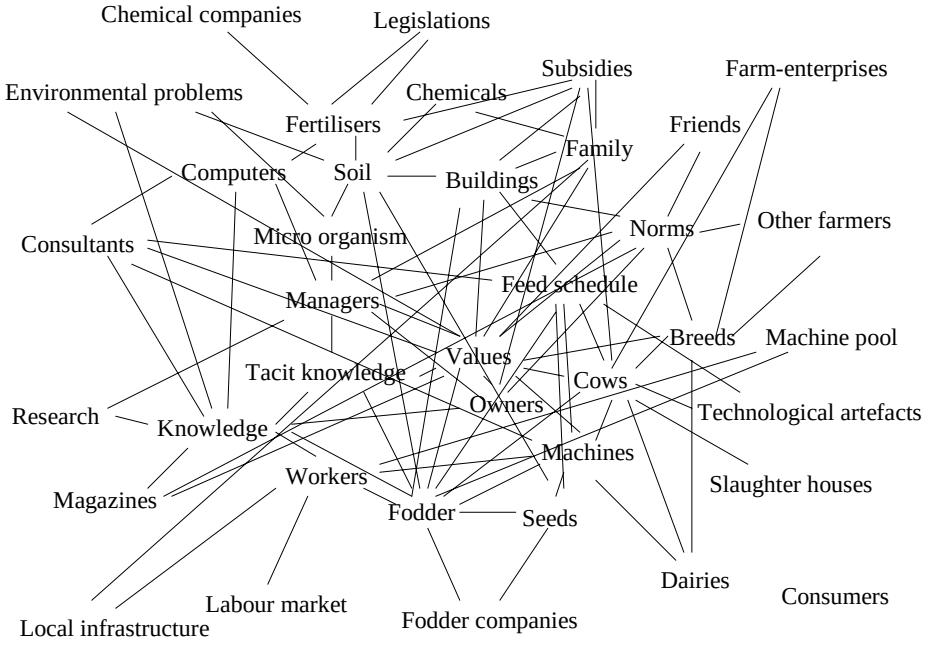

Figure 4: A simplistic illustration of a farm as a network of internal and external relations. It is important to notice that in Actor-Network theory there is no hierarchy of interaction, no macro and micro. Knowledge, machines, livestock and chemical products are all on the same level of interaction in the network. This makes the model both very simple and very complex simultaneously, because it means that no part of the farm can be studied as only a matter of biology, technology, economy or sociology.

In our understanding of ANT, actor-networks are mobilised into each other's heterogeneous strategies, but they are not organized or assembled by one another. An example: the network of the agricultural advisory service is organized in a particular way to provide service to farm enterprises, i.e. the farm enterprises are mobilised into the network of the advisory service, but the network of the individual farm is not organized/assembled by the advisory network. Artefacts of the advisory network are mobilised into the ordering strategy of the farm enterprises. A particular advisor may play a central role in the organizing process of a particular farm, but still the two network building processes may be seen as separated from each other.

The mobilisation and translation processes will always be connected with a negotiation process. A particular farmer's expectations to a certain consultant may differ very much from the consultant's ideas of her own role as an advisor. The same applies to technology, software, and knowledge. A certain artefact like a computer programme to optimize pest control is produced from one set of ideas of how farming is organized. The company producing the programme tries to mobilise the farmers to use their provided tools through advertisements, salesmen, policy, etc. and the farmer tries, if he is persuaded to buy, to translate the programme into the management processes of the farm enterprises, which may differ very much from the expectations of the company.

This analysis indicates that ANT is a useful theoretical framework for grasping the very heterogeneous character and relational openness of a farm enterprise. But a weak point of ANT (who sees an actor-network as an endless web of heterogeneous actor-network relations with local summing ups) is its theoretical

understanding of the self-organizing ordering of the network (Noe and Alrøe forthcoming). Therefore, we also include Luhmann's theory of social systems.

Social systems and self-reference

Where the ANT focuses on the heterogeneous openness of relations between the entities of the social, biological, and technical domains of the world, Luhmann takes the opposite position in his theory of social systems where he focuses on the operational closure necessary for any system to operate itself – and thereby he claims that all autopoietic systems are self-referential (Luhmann 1995).

Luhmann moves us away from traditional social system theories by introducing communication as the central element of the social system and not actions. By this step he provides for the possibility of operational closure of the social system. Social systems do not consist of actors, but of communication. Thereby Luhmann bypasses Maturana and Varela's rejection to extend the idea of autopoiesis to social systems[viii] (as they want to avoid the idea that the social systems are controlling humans like a body is controlling its cells) (Kneer and Nassehi 1997).

Luhmann distinguishes between three kinds of autopoietic systems: biological systems operating in life, psychic systems operating in thoughts, and social systems operating in communication. Both psychic and social systems operate in meaning.

> "The phenomenon of meaning appears as a surplus of references to other possibilities of experience and actions. Something stands in the focal point, at the centre of intention, and all else is indicated marginally as the horizon of an "and so forth" of experience and action" (Luhmann 1995:60).

The selection of meaning is not to be confused with the notion of meaningfulness, but refers more to the semiotic notion from ANT that an element gets its entity through its relational position. We are here extending Luhmann's theory of communication to heterogeneous, self-organizing semiotic systems. To illustrate this we will again use a cow as an example; a cow can be enrolled in a farming system in various ways that select different meanings, e.g. as an object of natural capital, as a pasture fodder harvester, or as a milk factory. Food production may be organized in numerous ways according to different goals and purposes, e.g. ecological or conventional production. The farm enterprise as a system has to select a meaning in order to be operational at all; otherwise, it will drown in internal complexity and will not be able to perform any kind of operation.

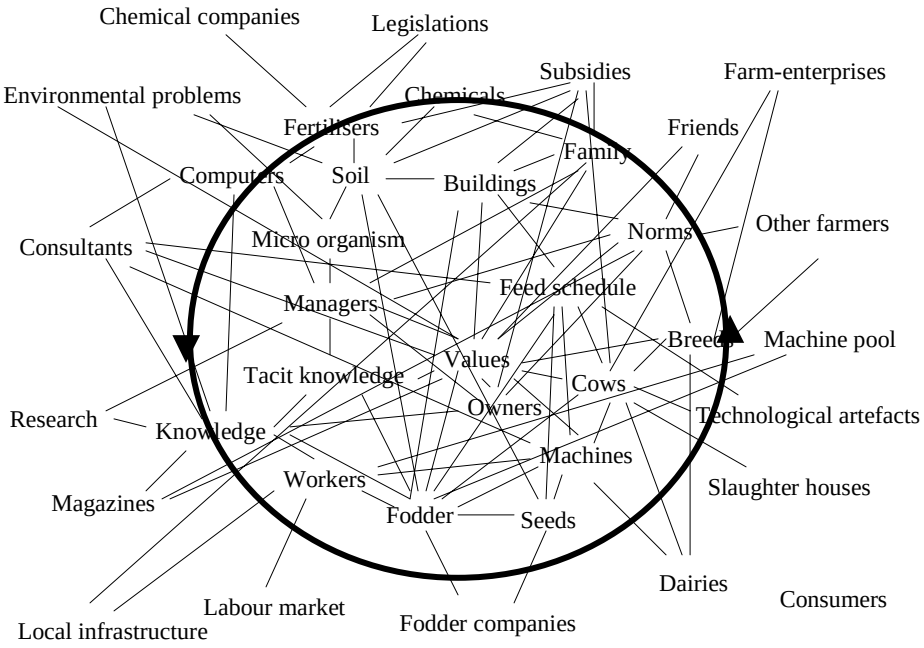

Figure 5: There needs to be a process self-reference and self-organisation to make the mobilisation and coherence of the farming network possible.

The self-organization of social systems as autopoietic is then a process of reducing complexity of possibilities by selection of meaning. From our point of view, the selection of meaning must be a system-

internal and self-referential operation by which the system draws its own operational boundaries, where the encompassing world will always offer a surplus of meaning.

From an autopoietic understanding, the self-referential process of selection of meaning, as a first step, will be hidden to the system, because it is not a social system until a selection has been made. This corresponds to Mol's (1999) findings, presented above that the decisive moment of an actor-network will be a place from where there seems to be no choice. Only through reflexive (re-entry) processes these choices can be made visible to the system.

This can be illustrated by an example: if you ask a farmer why she is farming the way she is, you will often get an answer the gist of which is 'because this is the only rational way of doing it'. Farmers who have been through a reflexive process (e.g. most farmers who have converted to organic farming), on the other hand, will often explicitly explain their choice in terms of values (Noe 1999).

Another characteristic of an autopoietic system is that it possesses its own internal rationality or schema. Autopoietic systems are operationally closed systems. This means that the system must produce its own input for operation. For example, a needle does not produce the feelings of pain, the person who feels the pain, does. The nerve cells only transmit the impulses and it is in the mind that these impulses are translated into pain. So it is the internal schema of the system and not the specific quality of the perturbation that defines how a system reacts to a certain perturbation. Translated into the theory of social systems, this means that it is the internal process of the system that defines what can be communicated and how the communication occurs as a reaction to a certain perturbation.

Luhmann's theory of self-reference makes possible a reinterpretation of Ploeg's notion of calculus or farming logic. A calculus belongs not only to a discourse; every self-referential system needs to possess its own system logic to be operational.

Luhmann's system theory makes it possible to observe and understand a farm management system as a self-referential social system that selects its own schema of differences, defends its logic, values, and meaningfulness. This will prevent us from being trapped in an 'actor-position' where farm management, as a process, is linked and limited to the consciousness of the farmer. In most cases many 'actors' are involved in the self-referential communication processes of a management system, but it varies much from one farm enterprise to another (Noe 1999).

In this framework, each farm is understood as a self-organizing node in a complex of heterogeneous socio-technical networks of food, supply, knowledge, technology, etc. This implies that a farm has to be understood in terms of the network relationships and the way in which they are organised by the farm as a self-organizing social system. Among all the different possible ways of interacting with the surrounding world, the system has to select a coherent strategy in order to make the farming processes possible at all.

Methodologically this theoretical framework implies that the self-referential and self-organizing processes of a farm enterprise can only be observed through the communicative processes of the management system. Or, through the outcome of the self-referential processes as different actors and artefact are translated and mobilised into the strategy of the farm enterprise. According to Luhmann, actions do not contain meaning; they are assigned meaning as a cognitive or communicative operation.

SUMMARY AND CONCLUSIONS

In this paper we have argued that the actor-network theory and Luhmann's systems theory in combination provide a better perspective on the ontological understanding of a self-organizing entity such as a farm enterprise. The actor-network theory focuses on the heterogeneous character of a farm enterprise as a social, economic, technical and biological system, and on the entities and actors mobilised and translated into the farming processes as actants. Luhmann's theory, on the other hand, offers an approach for understanding a farm as a self-organizing system (operating in meaning) that must produce and reproduce itself through demarcation from the surrounding world by selection of meaning. The meaning of the system is expressed through the goals, values, and logic of the farming processes. In this working ontology the boundaries of self-organising systems are not dependent on the choices of the external observer, but on the self-reference of the system/network, just as the cell membrane is a construction by the cell and not by the surrounding body.

How can this theory enlighten the sociological understanding and investigation of farm enterprises? Much work still needs to be done in the development of this framework (see Noe and Alrøe forthcoming) which, in our view, may offer a new perspective in rural sociology. The notion of a farm as a self-referential

autopoietic system has proved useful for studying farm enterprises as social systems, for observing the rationality and values around which farm enterprises are organized, for exploring what kind of internal and external observations are involved in the process of management, and for observing who and what are involved in the management processes. These advantages are helpful in understanding farm management from the inner system logic (Noe 1999). The self-organization framework can also add to the understanding of why extension systems have failed to develop their extension programmes and target their messages to diverse farmers (Vanclay et al. 1998). Such programmes may have ignored the fact that while the natural sciences in general operate with one logic/ rationality, there are different logics at work in farming. This paper provides the outline of a cohesive theoretical framework to understand such problems. Advising farmers and developing farming practices have to take the system logic (values and rationality) as a starting point, even if the goal is to de- or re-construct agricultural production, whether we are dealing with large commercial farm enterprises or small-scale dairy holders in the third world countries. Indigenous knowledge is transformed into the broader notion of system knowledge.

The self-organization framework does not reject Bawden's core idea of a farm as a learning system, but it helps to understand learning itself as a social and technological process and not only as mental process of the individual actor involved. Luhmann's theory thereby provides for a theoretical understanding of social systems as learning systems that can overcome some of the radical constructivist problems of the Bawden approach (Alrøe 2000).

The self-organization framework does not deny the social construction of farming practices, which is at the core of the farming styles methodology: It sees farming practices as coevolving rather than just an expression of cultural repertoires. The idea of self-reference could explain why, for example, Vanclay et al. 1998 found it difficult to apply the farming styles methodology to Australian conditions as farm enterprises can relate to different ways of farming without establishing an exclusive membership relationship with a particular social practice. On the other hand, the Actor-Network theory suggests that farming styles are a necessary reduction in the complexity of options making possible interactions and co-evolution between farm enterprises and the surrounding actors. Farming styles can then be understood as discursive environments of the farm enterprises, rather than as a social construction of the latter.

Finally the self-organization framework goes beyond Conway's call for multidisciplinarity to call for transdisciplinarity, because our theoretical framework rejects the hierarchical idea of a farm enterprise as consisting of different ontological system levels that can be observed from different angles. Even the microbiological processes in the soil (e.g. crop rotation, or the amount of fertiliser, manure, chemicals etc.) are interdependent as they interact with the system/network that enrols these processes. At the same time, there is no epistemological position from which the whole system/network can be studied. This calls for not only multidisciplinary studies but for transdisciplinary studies and thereby systemic research (Alrøe and Kristensen 2002).

Self-organizing as a theoretical concept has three important methodological implications for the study of farm enterprises:

1. The organization of a farm enterprise can only be understood and explained from its own system logic. This has implications for sociological, agronomic, and economic research on farming systems
2. A farm enterprise cannot be observed as a whole from one position. This rejects the idea of an epistemological holism.
3. The concept of self-organizing enables one to understand farm enterprises as actors in the co-evolutionary development of agriculture, food chains, knowledge, technology, etc.

While the self-organization framework is far from being fully developed, we hope that this paper would encourage the interested reader to join in the effort of further exploring and developing this framework.

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[i] The notion of multifunctional agriculture is mainly used by OECD to focus not only on the negative environmental side effects of agricultural production, but also on the positive contributions of agriculture in terms of local rural development, landscape, etc.

[ii] The difference between the terms multidisciplinary, interdisciplinary and transdisciplinary can be defined in the following way. “Multidisciplinary: disciplines working on the same problem or issue are autonomous and the work does not lead to changes in the existing disciplinary and theoretical structures. Interdisciplinary: the disciplines work on different themes but with a common framework, or methodology. Transdisciplinary: The interdisciplinary work is accompanied by a mutual interpenetration of disciplinary methodology and theory, and leads to a common theoretical understanding. The transdisciplinary work presumes self-reflection in the different disciplines on their role in the resolution of problematic issues and their relation to other disciplines. And transdisciplinary work thereby transforms the disciplines involved.” (Alrøe and Kristensen 2002, p. 19)

[iii] We use “working ontology” to stress that we are not using this notion in the context of realism. We mean that every epistemology must have an idea of the world, as it is, that goes beyond epistemology.

[iv] Autopoiesis means self-producing. Maturana and Varela have developed a theory about all living organisms as autopoietic systems, which are continuously producing themselves and their own input for reproduction. Autopoietic systems are organizationally closed but physically open (for an introduction see Maturana and Varela 1987). Luhmann applies the theory of autopoiesis to social systems as communicative systems, where he sees communication as a self-organising and self-referential system. See Luhmann 1995.

[v] Bawden (1991) explains his understanding of the notion of world view like this: “Each of us goes about “seeing” our “reality” through our own little “window on the world”; a weltanschauung of value-laden, psycho-cultural, experience-modified knowledge or beliefs or assumptions which shapes the way we handle issues in our world. It reflects the personal disposition which bring to bear as we go about our learning “.

[vi] For a more comprehensive introduction to the two theories see Noe and Alrøe (forthcoming).

[vii] In the context of Actor-Network theory enrolling means that an object is mobilised and translated into the actor network as an actor or actant. This means that actants do not exist outside actor networks, but that they, as entities, “achieve their forms as a consequence of the relations in which they are located. But this means that it also tells us that they are performed in, by, and through these relations” (Law 1999, p4).

[viii] See e.g. Mingers 1995 for a critical review of Luhmann’s use of Maturana and Varela’s theory of autopoiesis.

FARM CRISIS OR AGRICULTURAL SYSTEM CRISIS? DEFINING NATIONAL PROBLEMS IN A GLOBAL ECONOMY

Leland Glenna
Connell University

INTRODUCTION

Kleinman (1995) argues that "crises" offer sociologists unique opportunities to understand a society's tendencies because the people who assign the label to social conditions do so as they intensify efforts to make dramatic changes. The "farm crisis" of the 1980s fits this description because some agribusinesses and policy makers called for dramatic policy changes to address this 'crisis', even though United States Department of Agriculture (USDA) data on the decline in farm numbers indicated that the 'farm crisis' was not as bad as in past decades.[1]

A flow of newspaper stories in the 1980s described farm foreclosures and farmer hardships. A *Christian Science Monitor* headline in February of 1985 even described farm conditions in the United States as the worst since the 1930s Great Depression (Lyson 1986). Many policy makers, agribusinesses, economic analysts and farm interest groups claimed a need to overhaul New Deal agriculture policies because "US agriculture is at a crossroads in its evolution as an industry" (Joint Economic Committee 1983: I, 2).[2] Browne (1988: 218), a policy analyst who followed the 1980 agricultural policy debates closely, noted that "It was difficult to find any participants who did not express the opinion that the time for major agricultural policy reform was at hand." The popular image that has emerged is that of the Federal Government's passing of the 1985 Food Security Act, and the dramatic restructuring of New Deal farm policy in order to alleviate the suffering of American farmers. Some even claimed the Food Security Act was "revolutionary" for its efforts to solve environmental and economic problems on the farm (Glenna 1999).

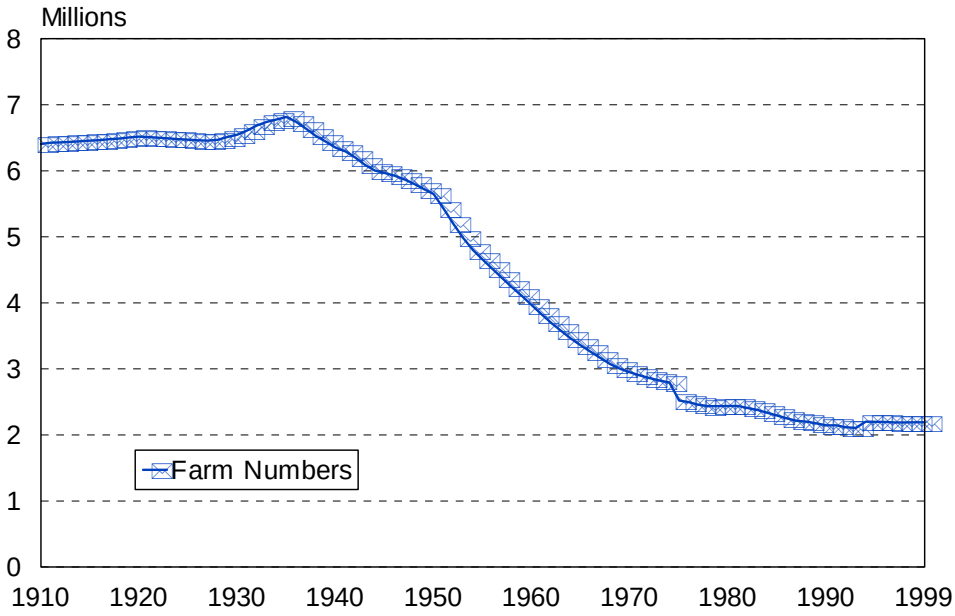
The problem with this portrayal is that is it contradicted by the evidence (See Chart 1). Although United States monetary and fiscal policies caused a dramatic drop in the value of farm assets in the early 1980s, farm numbers did not decline as they had in previous decades. Farm numbers declined by 1.7 million in the 1950s and over 1.1 million in the 1960s, compared to 294,000 in the 1980s. In fact, the decline in farm numbers in the 1970s, a decade considered good for agriculture, was nearly twice as high as in the 1980s. The Eisenhower and Kennedy administrations did make efforts to slow farm number declines through production and price controls (New Deal strategies[3]) in the 1950s and 1960s (Lauck 2000: 147; Fite and Reese 1965: 665), but policy makers in those decades did not call for an overhaul of the New Deal to end a crisis. Why then was there a push to restructure the New Deal policies at a time when declining farm numbers were fewer than they had been in the recent past?

One may argue that policy makers did not call the previous decades a farm crisis because farm interests had to compete with the Cold War, Civil Rights, the Vietnam War, and other pressing issues. Furthermore, unemployment in the 1960s stood at 4%, compared to 8-10% in the 1980s (Halcrow, et al., 1994: 286). The implications are that farmers in the 1960s were less likely to call for government hand-outs because they were able to find alternative employment more easily than in the 1980s, and that farmers were able to find public support in the 1980s because there were fewer competing claims from other interest groups. But even if farmers had pressed for more attention from the government in the 1980s because of the lack of employment opportunities, their cause failed to garner wide public support. Lyson (1986: 490) reports that despite dramatic headlines in newspapers about farmer woes and vague support for farmers in the 1980s, Americans did not list the farm crisis as a pressing issue. And many farmer advocacy groups had been claiming that they had been in a perpetual state of crisis and advocating for assistance since the 1920s (Fite and Reese 1965). Why would the policy makers listen to farmers in the 1980s, when farm numbers were not declining as fast as past decades and

[1] Michael Bell made this observation at the August 1999 Rural Sociological Society meetings in Chicago.
[2] The Joint Economic Committee's assertions are an important source of data for this paper because of the significance of the JEC. One of only four Joint Committees in the U.S. Congress, it includes both Senators and Representatives whose primary task is to review economic conditions and recommend policy changes, and its comments and recommendations are influential. See http://www.house.gov/jec/ The House of Representatives and the Senate each have agricultural committees and subcommittees to address agricultural and farm concerns. That the JEC would become concerned with agricultural issues reflects the importance of the topic.
[3] The New Deal refers to a collection of policies directed at improving economic conditions in the U.S. during the Great Depression of the 1930s.

when the public was apathetic? It would seem from this that a more complex analysis of the social construction of crises is necessary.

Chart 1: US Farm Number Declines 1910-1999



source: www.nass.usda.gov

Hilgartner and Bosk (1988: 55) contend that analyzing social problem construction requires an understanding of institutions within which problem formation and dissemination occur. They also point to the need to consider how those institutions may privilege some problem sponsors over others (Hilgartner and Bosk 1988: 64-65). Commentators have argued that the agricultural policies in the 1980s were about more than simply farm numbers. First, Harl (1990) claims that policy makers did not express concern for the decline in farm number prior to the 1980s because farm production continued to increase. And there is evidence to support his claim. According to a Congressional Joint Economic Committee (JEC 1984: 7) report released during the farm bill debates, between 1958 and 1981, farm productivity increased 32% in output per acre and 240% in output per farmer, while crop production and livestock production increased over the same period by 71% and 37% respectively. Therefore, although farm losses may have been painful for the individual farmers, policy makers were less likely to be concerned because agricultural sector productivity was expanding. However, policy makers became concerned in the 1980s when the farm financial problems affected even the most prosperous and efficient farmers, which in turn affected collateral agricultural industries and banks (Harl 1990: 19-26; See also Kenney *et al*. 1989; Murdock *et al*. 1986; Bultena *et al*. 1986; Green 1984).

These critical observations suggest that policy makers were interested in more than addressing a farm crisis in the 1980s. In fact, policy makers may have come to construct the agricultural conditions of the 1980s as an agricultural system crisis. I am not claiming that farmers who lost their farms in the 1980s were not hurting or that the loss of farms does not warrant a "crisis" label. Rather, I am offering a hypothesis that policy makers responded to what they considered to be a problem that extended beyond the decline in farm numbers, i.e. to a problem facing the wider agricultural system. If this hypothesis is accurate, there should be evidence in congressional hearings to support this distinction. To set the stage for this analysis, I will describe the location of the farmer in the agricultural system and explain how global economic changes were affecting that system. I will then use congressional hearings and USDA data to demonstrate how policy makers came to articulate the threat to the agricultural system and to interpret the farmer as an expendable component of that system. I will then explain how this analysis offers insights for better understanding how the nation-state conceptualizes and manages the human and natural resources within its boundaries in an era of globalization.

The US federal government's ability to manage the national farm production process and international agricultural exports in the face of the crisis of the mass-production/mass-consumption economic system was the critical question facing policy makers in the 1980s (Kenney *et al*. 1989). However, it remains to be explained how a farm crisis may be linked to "both the crisis of accumulation in the world economy as a whole and its

current restructuring process" (Buttel *et al*. 1990: 183). I believe that I can link the 1980 farm crisis to the more general crisis of accumulation and the agricultural restructuring process by revealing how policy makers defined the conditions as an agricultural crisis, not a farm crisis, and by documenting how policy makers developed strategies for bailing out agricultural input and processing industries by expanding world markets even as they generated rhetoric about helping the farmer.

THE FARM IN THE INDUSTRIAL AGRICULTURE SYSTEM

Although United States agriculture is often portrayed as a premodern or preindustrial system because of the persistence of non-wage-earning farmers, farmers and farms have in fact long been integrated into a sophisticated industrial process (Mooney 1988; Bonanno 1987). Pugliese (1991) has even suggested that the agricultural system implemented outsourced production before the manufacturing sector began using such strategies. The federal government regulated this outsourced agricultural system by stabilizing farm income while maintaining high production and by integrating rural people into the consumer economy (Kenney *et al*. 1989).

In the manufacturing sector, the ability to gain profits, produce cheaper products, and still meet union wage demands reached its limits in the assembly-line factory system, whereupon corporate leaders reduced production costs by replacing the unionized workers through contracting with smaller companies in the United States and other parts of the world (O'Riain 2000; Brenner 1998; Antonio and Bonanno 1996; Barnet and Cavanagh 1994; Reich 1992; Kenney *et al*. 1989).[4] Although they failed to attract as much attention, large agribusinesses had adopted strategies such as global sourcing before the manufacturing sector (McMichael 1996: 100). Agriculture may have attracted less attention because of the more subtle ways in which industrialization integrated agricultural processes. Using a strategy of "appropriationism", agribusinesses sought to replace natural processes on the farm and farm labor with industrial inputs and factory commodity processing (Pfeffer 1992). Agribusinesses then enhanced their control over these input and processing strategies by purchasing multiple segments of the production process and multiple processes, or what is referred to as horizontal and vertical integration (Heffernan 2000). Working with these agribusinesses throughout the 20th Century, the United States Department of Agriculture and the land-grant university system combined to transform farmers from petty commodity producers into purchasers of agricultural industry inputs and standardized suppliers of cheap raw materials for agricultural commodity processing industries (Glenna 1999; Danbom 1979).

Farmers were disciplined into this system through debt, tenant-landlord links, contracts, and other relationships (Mooney 1988; McMichael 1996; Heffernan 1994). More recently, transnational agribusinesses have gained control over the buyer-seller relationship by monopolizing markets, leaving farmers with only one potential buyer for their commodities. In addition, these agribusiness monopolies also use global sourcing mechanisms—such as taking a loss in one country to eliminate competition because they can reap profits in other countries—to manipulate prices (Heffernan 2000).

Despite these changes, farming is still considered preindustrial. Neoclassical economists, Jeffersonian agrarians, and the general public tend to think of farmers as independent producers who sell their products in a free market where prices fluctuate according to supply and demand (Hoag 1999: 4). Marxists contribute to this misconception by emphasizing urban industrial enterprises organized around class relations and ignoring those organized around property systems, thus overlooking the ways in which economic, technical, legal and political factors might influence decision making of even a private property owner (Stinchcombe 1965: 184-185). Since agricultural analysts tend to use one of these perspectives, they have expected to find that "…as industrialization proceeded, small-scale production would eventually be superseded by larger and more complex organizational forms" (Lazerson 1993: 403). They are then surprised and even emboldened to find that small-scale grain and livestock farmers persist.

Some labor theorists and sociologists emphasize how commercialization and industrialization effectively ended the low-input, family-based, self-sufficient petty commodity production system of American legend (Perry 1982; Braverman 1974). But instead of admitting that this is, in fact, an American myth, other commentators changed the definition of "independent family farmer," so that the legend might be maintained. As Wilkening and Gilbert (1987: 271) observe, "By World War II, influential analysts of the family farm had

[4] Brenner (1998) differs from the others when he argues that corporate competition, not labor power, generated the crisis of profit. However, his argument for how capital brought itself out of crisis by finding flexible ways to exploit labor coincides with these other theorists.

dropped the requirement of land ownership and the prohibition against hiring wage labor [as a requirement for the family farm label]. Soon, the family farmer became an 'operator [as] a risk-taking manager, who with his family does most of the farm work and performs most of the managerial activity.' "

A number of important studies relying upon a Kautskian version of Marxism (Banaji 1980) have pointed to the many ways that farmers can become integrated into an industrial system, despite the absence of a factory. First, Mooney (1986) and Green (1987) reveal that, even though farmers are not wage-laborers, surplus value can be extracted from farm labor through financing. The creditor technically owns the land and equipment, and the farmer labors to pay off the debt. Mooney (1988) also explains how surplus value is similarly extracted from farmers in tenant-landlord, contract, and part-time employee relationships. Second, Pfeffer (1983; see also Thomas 1985 and McMichael 1987) demonstrates that three distinct forms of agricultural production emerged in the United States based on the availability of surplus labor. The California fruit and vegetable industry has a wage-labor/foreman-management system because the influx of migrant labor created the conditions for proletarianization. In contrast, in the American South and the Great Plains, where surplus labor leaves rather than enters the agricultural labor pool, sharecropping and petty commodity production systems have persisted. Third, Bonanno (1987) explains how small farms are interconnected with the national wage-labor force, even if some of the small farmers are able to generate a modest income from the property they own. Fourth, Heffernan (1994: 5) has noticed that agricultural processing and input firms receive 20% return on their investment when farm producers receive only 3-5%, making agricultural firms second only to pharmaceutical companies in their ability to generate a return on investment. The implication is that agribusiness is able to exploit farm producers even though they lie outside a formal factory system.

The Federal government, railroads, banks, and agribusinesses collaborated at the beginning of the twentieth century to construct this industrial agriculture system. Agribusinesses chose this approach over the direct involvement in on-farm production because: farmland cannot be depreciated; the farm labor process is too expansive to be easily controlled; natural events like bad weather and pests are hard to control; and production cannot be shortened because of natural plant and livestock growth and reproduction cycles (Lewontin 2000: 94-95). However, the system has still come to resemble F.W. Taylor's scientific principles for factory management.

The Progressive Era was marked by a growth in efforts to convert Taylor's scientific-management logic into managerial hierarchies. Lash and Urry (1987) describe how occupations created an abstract body of knowledge, placed it in an educational institution, and made entry into that institution contingent upon obtaining a certain amount of that knowledge from the educational institution. The result was an institutional structure standing between the work and the planning of that work (Lash and Urry 1987). The agricultural system also reflected this trend. Under the guidance of the Country Life Commission (1911),[5] "The agricultural colleges along with the U.S.D.A. in the period 1897-1933 became the science-producing base upon which the modern highly productive agricultural system of the United States was built." And "...the county extension agent served as the principal conduit through which scientific knowledge and technological advances were transmitted to farmers from the state colleges of agriculture" (Cochrane 1993: 106).

The portrayal of agriculture as a localized production system is also inaccurate. Friedman and McMichael (1989) observe that the industrial development in Europe in the 19th century, particularly in Great Britain, was dependent upon its colonies and former colonies to absorb their excess labor and to provide a steady supply of agricultural products. The United States emerged from colonial status to become the world's dominant agricultural supplier, and farms in the industrialized agricultural system became primary consumers of manufacturing sector products. This strategy became a model for developing nations around the world, even though it could never work in other countries, because they could never dominate agricultural exports the way the United States had initially.

Because of the emphasis on productive efficiency in this industrial system, farmers faced problems of overproduction, which placed downward pressure on prices through much of the twentieth century (Fite and Reese 1965). After the Second World War, the U.S. sought to address the problem of overproduction by exporting surplus commodities to the developing world. The claim was that one export policy could solve three problems: 1) overproduction in the U.S., 2) hunger in the developing world, and thus 3) undermine the spread of

[5] Under the title of the Country Life Movement, major manufacturing and financial businesses united with representatives from the land-grant colleges to reform rural institutions to enable industrial agricultural production. The United States was becoming more industrialized during the nineteenth century, and national leaders realized that agricultural production needed to be intensified and coordinated if it was to supply the growing urban centers with food (Scott 1998: 286-287; Danbom 1979).

communism. As economic problems emerged in the 1970s, the Nixon administration hoped to expand agricultural exports to offset the decline in exports of manufactured goods (Constance *et al*. 1990). At the same time, transnational agribusinesses were pushing a global sourcing strategy, striving to find lower-cost raw material supplies (e.g. unprocessed grain and meat) in other parts of the world (Constance and Heffernan 1991). They were also advocating trade liberalization to facilitate global sourcing, as well as commodity dumping. However, the U.S. had insisted on the protection of agriculture under the General Agreement on Tariffs and Trade in 1955. Since this protection was inhibiting globalization, the U.S. suspended the supply constraints and began promoting trade liberalization under the Uruguay Round of the GATT in the 1970s (McMichael 1996).

International currency developments further eroded the ability of the U.S. to defend its national agricultural system. McMichael (1996: 115-117) describes how the formation of the Organization of Petroleum Exporting Countries (OPEC) cartel created turmoil in financial markets, which in turn, fostered the trend towards globalization. Transnational capital flows had been constrained by the Bretton Woods gold-standard agreement until the Nixon administration broke from this policy. The ensuing floating currency markets greatly reduced the capacity of nation-states to regulate capital flows, and enabled transnational corporations to seek out new production and consumption markets. As OPEC raised oil prices, the industrialized world experienced a sharp rise in inflation, following the transfer of "petrodollars" from the industrialized world to the OPEC nations. The OPEC countries deposited this money in "offshore" banks which lent the money to developing nations. This injection of capital in developing countries gave transnational corporations an added incentive to pursue global sourcing.

These same global economic conditions which led to the mass-production/mass-consumption system crisis in the manufacturing sector in the 1970s, also laid the foundation for the threats to the U.S. agricultural system in the 1980s (Kenney *et al*. 1989). Bonanno and Constance (2001) describe how transnational agricultural corporations, such as confinement hog operations, are able to use global sourcing to pressure and manipulate farmers/laborers, environmental citizen groups, and governments. Transnational corporations force nation states to focus on international competitiveness over employment and to emphasize increasing production over citizen rights (Jessop 1999). But state structures have had to be changed to enable this kind of coercion.

In this paper, I argue that the initial restructuring of the agricultural system in the U.S. occurred in the 1980s, and that policy makers responded to the agricultural conditions in the early 1980s with policies consistent with the New Deal. For example, policy makers quadrupled farm subsidies (McMichael 1996: 164). However, since the New Deal programs contradicted the globalization project and the transnational agribusiness interests, policy makers needed a "crisis" to justify an overhaul.

METHODOLOGICAL APPROACH

As noted above, Hilgartner and Bosk (1988) assert that when analyzing how a social problem is constructed, it is necessary to locate the institution where the problem is being defined and how that institution may privilege some groups over others in the effort to generate a definition and solution to the problem.

A number of institutions could serve as the focus of an analysis of social problem construction in the U.S. For example, Lyson (1986) examined how public opinion and the popular press came to view economic conditions for farmers in the 1980s. However, these subjects of study are relevant because of their influence over government policies. The U.S. government is the most important institution to study when attempting to understand the social construction of problems in agriculture because it creates and modifies the public policies that define the rights of farmland owners and tenants, generate and regulate commodity markets, and set the rewards for appropriate behavior and penalties for unlawful behavior in the agriculture and food system (Halcrow *et al*., 1994: 205).

According to Halcrow, *et al*., (1994: 35-38), there are two basic elements to the public policy process: policy formation and policy implementation. For this paper, I focus only on the process of policy formation, and concentrate on the discussions held in Congressional subcommittees, committees, and joint committee hearings, because it is in these forums where the reasoning behind a policy is expressed and where policy makers field reactions from various interest groups and administrative representatives.

Each House of Congress has an agriculture committee, and there are eight subcommittees within each agricultural committee (Knutson, *et al*., 1990: 46). One of the other committees where agricultural policies were debated was a Committee of the Senate and the House of Representatives, the Joint Economic Committee and its subcommittee, the Subcommittee on Agriculture and Transportation. In fact, the Joint Economic

Committee's hearings, entitled *Towards the Next Generation of Farm Policy*, were where many of the significant issues facing agriculture were discussed and the reasoning for solutions were outlined.

To explain how the "crisis" was eventually defined, I analyze congressional hearings surrounding the 1985 Food Security Act in relation to USDA data on agricultural production and export conditions in order to determine how policy makers came to define the problems facing agriculture and recommend solutions. Examining how policy makers discuss the agricultural conditions during Congressional committee and subcommittee hearings reveals whether or not the definitions and solutions of transnational agribusinesses become more prominent than those of farmers.

The major data source for my analysis is the collection of transcriptions of all the congressional hearings leading up to the passage of the 1985 Food Security Act. I recognize that any qualitative analysis is susceptible to bias regarding what to include and exclude, and that preconceived notions might influence my interpretations (Neuman 2000: 436). Since policy makers discussed a wide range of issues, often in great detail, it simply would not be possible to report everything. Therefore, some criteria needed to be constructed for sorting and coding the data. As I read the transcriptions, I took note of any reference that speakers made to a crisis, or to the need to make dramatic changes in agricultural policy to rectify a crisis. These references were then coded according to any emphasis on farmers and farming conditions (i.e. 'farm crisis'), or on broader agricultural concerns, including the national economy, collateral agricultural businesses, or international competitiveness (i.e. 'agricultural crisis').

The challenge was to determine the extent to which policy makers were using farm rhetoric even though they were actually referring to agricultural system conditions. Knutson, *et al*., (1995: 216) offer a number of conditions that tend to be associated with a farm crisis: low farm income, overproduction, declining farm numbers, high debt-asset ratio, market instability, and market structure. If policy makers focus on such problems, it would be accurate to say that they recognize a farm crisis. In contrast, if policy makers construct the problem to be one of international economic competitiveness, and if they raise concerns about how efforts to improve farmer income would affect agribusinesses and economic competitiveness, it is more accurate to state that they are defining the problem as an agricultural system crisis. Furthermore, determining which actors are making the arguments that policy makers come to adopt assists in determining the relative power of competing actors to influence the definitions.

To address the issue of preconceived notions that might have influenced my interpretations, I used USDA data to provide internal validation for the comments made by policy makers and other participants at the hearings. And by comparing assertions made during congressional hearings to the USDA data, I was able to evaluate the accuracy of my interpretations.

DATA AND ANALYSIS

Context and Cast of Characters

After describing how three classes of farmers (sharecroppers and farm laborers; family farmers and small landowners; and capitalist farmers and plantation owners) competed to shape New Deal farm policies to suit their own unique interests, Gilbert and Howe (1991) conclude that the state structures were not captured by any particular social group. They demonstrate how each class of farmers scored some policy victories in the forms of production controls, long-term agricultural planning, and rural social reform. But only production control policies survived in the long term, guaranteeing that commodity and soil conservation programs favored the larger and higher output capitalist farmers over laborers, sharecroppers, and small farmers.

After these New Deal programs were established, U.S. farm policy was set through a process of competing farm interest groups promoting legislative specifications in a series of Senate and House of Representative agricultural committee and subcommittee hearings. Early drafts of legislation were presented in these settings, and various farm and commodity groups (falling into the categories laid out by Gilbert and Howe (1991)) attended hearings to advocate their specific interests (Halcrow *et al*. 1994). This tradition changed in the 1980s. The first difference was that the Joint Economic Committee held hearings on the agricultural situation. It was a mark of the importance of the agricultural situation in the 1980s that the JEC, a body representing both Houses of Congress, would supplement the work done in the agricultural committees and subcommittees in the House and Senate. The second difference concerned the composition of the list of interest groups attending the hearings.

By the 1980s, the list of groups competing for control of the state structure had expanded. The American Farm Bureau Federation, the largest farm lobby group in the United States and the representative of

the large capitalist farming interests, was weakened by the financial problems facing farmers. This created space for the entry of smaller farm organizations which tended to support broader New Deal policies. There were also new groups on the list. Environmental and conservation organizations began to shift their interests from issues of pollution and waste to the effect of agriculture on soil and water. And with an increased awareness of how agricultural policies affected the supply and marketing of agricultural products, agribusinesses and related industries became more aggressive in agricultural policy hearings (Browne 1988: 223-227).

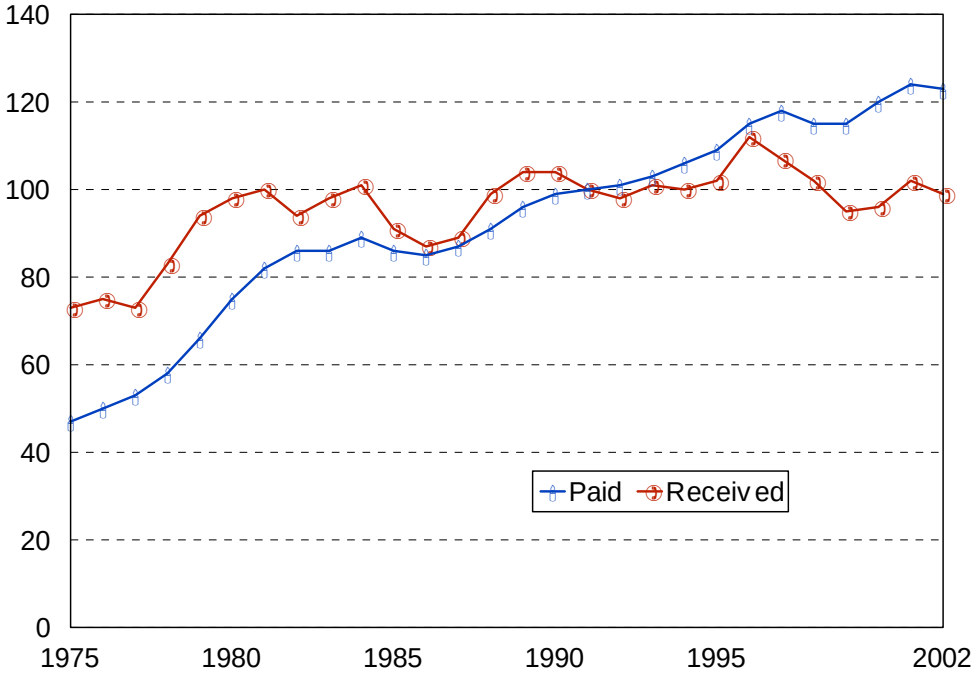
The Joint Economic Committee (JEC 1984: v) summarized the situation that Browne describes: "Future farm policy will be determined largely by those having control over the policymaking agenda….Clearly farmers are not only outnumbered, but also represent only a small share of total food costs….Because of dramatic changes in the agricultural, domestic and international economies, the farm policy agenda will be an ambitious one, certainly challenging traditional farm policies and perhaps resulting in a radical departure from the status quo."

The Initial Implementation of New Deal Programs

Policy makers did have a heightened interest in boosting farm income in the early 1980s, which reflected an initial farm crisis perspective. They noted that the Nixon administration's efforts to increase production in the 1970s were so successful that farm production was well above demand by 1982. They also recognized that decreasing land values undermined the farm debt-asset ratio. Since a bumper crop in 1983 would have led to plummeting commodity prices, and a subsequent dramatic decline in farm numbers, the USDA implemented acreage set-aside programs in 1981 and 1982. In 1983, the USDA responded with the Payment-in-Kind (PIK) program, whereby farmers were given certificates which they could trade for surplus commodities or cash in exchange for agreeing not to grow surplus commodities (Knutson, et al., 1995: 277).

However, the early farm crisis focus began to shift to broader agricultural concerns as the years passed. If the goal had been merely to slow farmer exits, policy makers could have declared success after implementing the acreage set-aside and PIK programs. Farmers had reduced acreage by 50 million, leading the USDA to expect grain prices to rise dramatically between 1983-1984. A 1983 drought reduced stocks even more, adding another boost to farm income (JEC 1984: 22-23). Chart 2 shows that prices received by farmers increased between 1982 and 1985, and prices paid by farmers leveled off, suggesting that the policy makers' evaluations of the New Deal programs as successfully improving farm conditions were accurate.

Chart 2: US Farm Price Index 1975-2002



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The Policy Debate Shifts

Why would policy makers decide to end the set-aside and the PIK programs? Even if it was considered a temporary measure, and the 1983 drought did reduce production to lower than expected levels, it met its goals

"of putting farmers on a sounder financial footing" (Lesher 1984: 48). Why terminate a program that was working? Policy debates reveal it is because there was a growing recognition that the efforts to help farmers had broader effects than merely improving farm incomes. As the Joint Economic Committee put it, "Farms and agriculture are no longer isolated and unaffected by what happens in the rest of the economy" (JEC 1985: 33). In fact, what unfolds is a realization that holding down production to improve farm incomes negatively affected agribusiness.

Policy makers offered many reasons for abandoning the PIK program. They claimed that the farmers' enthusiastic response made the program more expensive than originally estimated. And some of the farmers benefiting from the program seemed less deserving of receiving government subsidies; since there were no acreage limits for entry into the program, the wealthiest farmers were often receiving the largest payments. Stories about farmers receiving multi-million dollar payments upset taxpayers and policy makers (JEC 1984: 22-23). However, it was the effect that production controls had on the agricultural system that became the dominant concern expressed in policy hearings. Agricultural-input company profits were hurt when farmers cut production; commodity processors and livestock producers did not appreciate the higher prices that accompanied lower supplies of grain; lower production put an upward pressure on domestic food prices; and lower production meant that the United States would forfeit control of international markets (JEC 1984: 23-24). The JEC (1984: 24) summarized the situation: "The problems of farm policy have spilled over to taxpayers and consumers as well, and their interests in farm policy are equally well defined. Control over farm policymaking agenda is now a serious political contest with significant long-term implications."

Policy makers showed hints of an agriculture system perspective even before they decided to terminate the PIK program. An emphasis on "debt restructuring" intended to "bailout" the "debt-ridden farmers" (Harl 1990: 51) in the early 1980s, revealed a concern for the effects of the farm debts on agricultural lenders as much as on the farmers *per se*. But bank failures continued to increase between 1982 and 1987 (Harl 1990). Between 1981 and 1987, there were 638 bank failures, and just over one-third were agricultural banks (Albrecht and Murdock 1990: 132). Because the PIK program did not slow the rate of bank failures, the Federal Government officially bailed out the Farm Credit System with the 1988 Agricultural Credit Act.

Agribusines Make Its Case

Since the PIK program did not improve the farm credit situation and was costly to taxpayers, it had few supporters when agribusiness companies attacked it. Appearing before the House Committee on Agriculture in 1985, Gary D. Meyers of the Fertilizer Institute, which represented 95% of the makers, dealers and distributors of fertilizers, stated that the PIK program caused a 23% drop in their product sales and a US$2 billion loss in profits. He argued that the government ought to be enhancing export markets instead of limiting production (HCA 1984: 247-248). Barry Jarrett of the National Fertilizer Solutions Association, which represented 1300 fertilizer companies across the U.S., reiterated Meyers's point.

> As a fertilizer retail dealer, we are in business to make a profit. We recognize that the best way to insure this in both the short and long term is to make certain that our farmer customers are profitable...We sincerely believe that the future of the U.S. farm program must be profit and growth oriented, for there is no such thing in agriculture as status quo. Under a no-growth program, our Nation's most productive segment is destined to give up its vital role in feeding all of us and providing jobs for hundreds of thousands of American workers. We believe, without a doubt, that the key to profit and growth for U.S. agriculture is in aggressive export market expansion and development program (HCA 1984: 249).

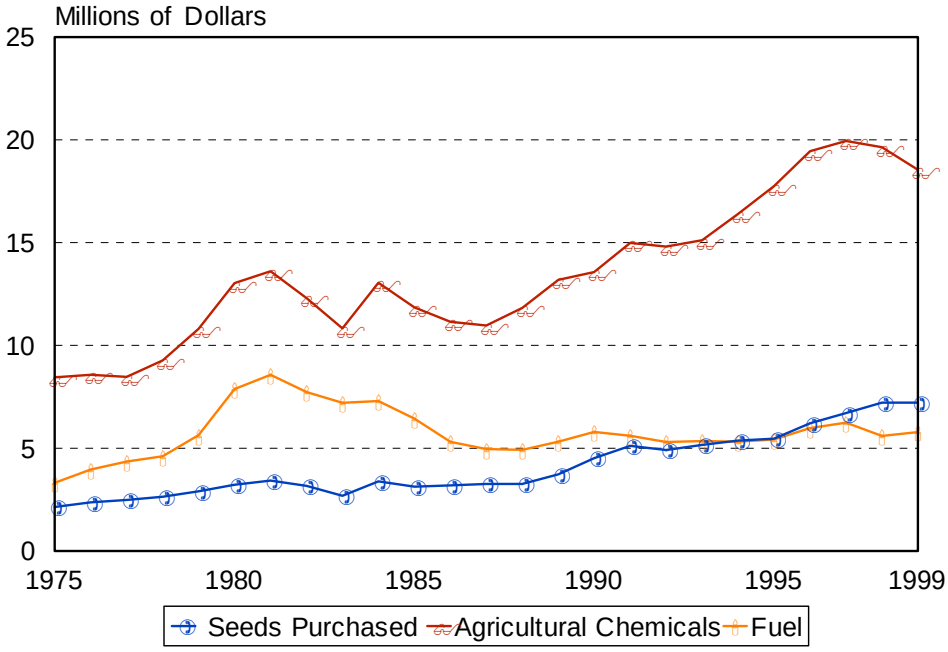
Although they couched their arguments with rhetoric about supporting farmers, these agribusiness representatives depict farmers as their customers in a broader agricultural production system. And they view supply-control measures as a threat to the proper functioning of that agriculture system because it undermines input industry profits.

Chart 3 reveals the reasons for the concerns. After a steady increase in dollars spent on agricultural chemicals, seeds, and fuel, there was a drop in those sales in the early 1980s. Fuel expenditures never did rise again, but seed expenditures began to rise at the end of the decade. Expenditures on chemicals rose sharply after 1987. This is most likely because the 1985 Food Security Act sought to solve the soil erosion problem by promoting conservation tillage practices, which relied upon chemicals (Glenna 1999).

Agricultural commodity processors joined the input agribusiness companies in calling for an end to supply controls and the expansion of export markets. Appearing before the Joint Economic Committee in 1984,

Vernon McMinimy of A.E. Staley Manufacturing Co. claimed that his corn and soybean processing company is "dependent on a reliable and reasonably priced long-term supply of corn and soybeans for our raw material source. Therefore, it's very important for us that the farm program of 1985 contain reasonable programs for those products" (JEC, 1984: 162). "Reasonable" here refers to programs that would increase the production of corn and soybeans. This comment is also important because it is an explicit reference to farmers as raw material suppliers.

Chart 3: Farm Production Input Expenses 1975-1999



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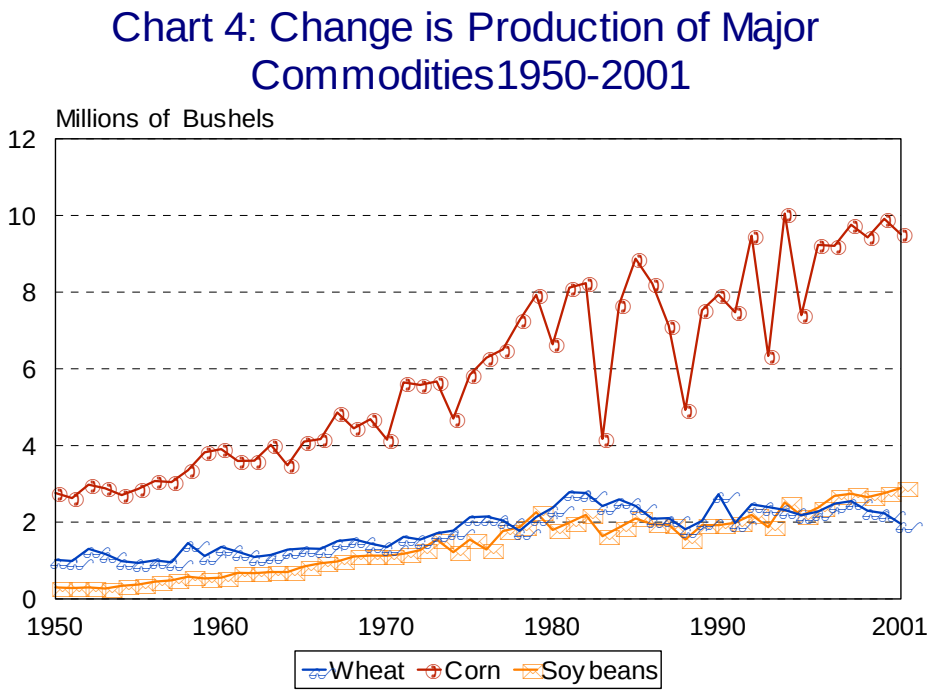
John Reed, vice-president of Archer-Daniels-Midland Co., agreed that they needed a steady supply of raw materials. But recognizing that increasing production might hurt his raw-material suppliers, he offered a bold recommendation for how to maintain farm incomes.

> We're not arguing that the economic needs or the small farmer should be ignored, but I think we would argue that perhaps it's time to separate the welfare component, if you will, of the price support system from the loan itself and provide the welfare component through some form of direct payment to the people for whom it is deemed necessary to provide support, either in the form of target prices or in the form of some other kind of direct payment program. Let the loan be at levels which will keep us competitive in the export market and meet the income needs of the small farmers in another way (JEC, 1984: 166).

This comment reveals that ADM viewed the farmer as a laborer in the national agricultural system and the USDA as its manager. To standardize the relationship and smooth out the bumps in the supply of raw materials, he recommended that the USDA pay farmers directly for the service of supplying raw materials to his company. Such a strategy would foster the continued dominance of United States agricultural export companies in international markets.

Chart 4 shows the reasons for these commodity processors' concerns. After steady increases in wheat, corn, and soybean production over the previous three decades, output declined in the early 1980s. In 1983, corn production dropped to 1970 levels. Such production fluctuations in raw material supplies, with the accompanying fluctuations in prices, were not in the interests of the commodity processing business.



ADM's ideas for maintaining an oversupply of raw materials while also stabilizing raw material suppliers were listed as policy options in a congressional report under the headings "Revenue Insurance" and "Income Insurance" (JEC 1984: 31-33). Although these specific policies were not fully adopted until the 1996 Farm Bill, the conception of the agricultural system that lay behind the idea of separating the goal of maintaining farm incomes from the goal of maintaining an oversupply of raw materials became part of the political discourse in the 1980s. In the 1996 Federal Agriculture Improvement and Reform Act, policy makers replaced target prices, deficiency payments, and acreage reduction programs with loan deficiency payments, non-recourse marketing assistance, and "production flexibility contracts," which allowed farmers to receive deficiency payments without concern for base acreage (Public Law 104-127, Section 111). A precipitous event in the formation of the 1996 law was a study which argued that opening 38 million of the 65 million acres of land in Acreage Set Aside and Conservation Reserve programs and adopting the flexibility contracts would increase grain supplies, which would benefit farmers and the U.S. economy. That influential study was conducted by the National Grain and Feed Association, which represented "over 185 companies, most of whose profits are geared substantially to volume of commodities handled or processed…" (Schertz and Doering 1999: 4). Of course, claiming that increasing grain supplies would benefit farmers was not plausible, since such increases would almost certainly depress prices. Perhaps that is why the study *omitted* comparisons of farm prices and government expenditures if the 38 million acres were not released (Schertz and Doering 1999: 5).

The important point here is that the agribusiness coalitions and agricultural-system discourse that would lead to the elimination of many New Deal farm policies in 1996 originated in the 1980s. It was during the 1980s that policy makers began debating how to manage the system of outsourced production so that agribusiness companies would continue to dominate in the international markets. The challenge became one of maintaining enough outsourced producers who could purchase agricultural inputs, provide a return on investment for agricultural lenders, and overproduce cheap raw materials, even though achieving these goals would drive many farmers out of business.

State and Agribusiness Interests Converge

Policy makers expressed their interests in wanting agribusiness profits to increase. Chairman of the JEC Senator Jepson stated,

> With agriculture generating 20 percent of this country's gross national product, one-fifth of its jobs, accounting for $1 trillion in assets, and as our largest positive contributor to our balance of payments, there is no question that agriculture and its associated industries is a major and dominant sector of the U.S. economy (JEC 1983: I, 2).

But portraying this as an example of a captured state would be too simplistic. Gilbert and Howe's (1991) portrayal of how groups compete to convince the policy makers that the state's goals are the same as their goals presents a more accurate representation of the process.

I have already noted that the heightened interest on the part of agribusiness companies represented a new variable in the farm policy debates. Another important change occurred when the state began pressing for more international markets. Increasing American agricultural exports was the Nixon Administration's strategy for handling the surplus production problem without imposing production controls, thus satisfying both farmers and agribusiness. Increasing agricultural exports also served as the one bright economic light in the otherwise dim economic conditions of the 1970s, because expanding markets would help to offset the trade imbalance, while also containing the spread of communism by distributing cheap food to developing countries (Constance, *et al*. 1990: 57). Thus, declines in exports not only upset agribusiness companies, but also the representatives of the state. This common interest on the part of agribusiness and the state became the central topic in deciding to abandon farm crisis remediation measures.

South Dakota Senator James Abdnor's response to news of a drop in U.S. exports during the early part of the 1980s reveals the state's interests. A *Wall Street Journal* article appeared on the morning of the opening day of Joint Economic Committee's "Toward the Next Generation of Farm Policy" hearings, and that article became the centerpiece of the hearings:

> By cutting prices and taking advantage of political discord between the U.S. and some of its customers, other grain exporting nations are muscling in on the traditional U.S. dominance in the world's farm trade. The U.S. share of the world trade in grains, its biggest farm export by far, has fallen to about 53% this year from a high of 60% in 1980. The U.S. faces rough sledding in years to come (Shellenbarger & Birnbaum 1983: 1).

Blaming price-support programs and aggressive international competition for the decline, the article argued that export losses threatened the entire agricultural system because "agriculture, more than any other industry, is hooked to exports."

Noting the "great coincidence" that this article appeared on the morning of the opening day of hearings, Senator Abdnor criticized the government's attempt to increase commodity prices through supply-control measures, because other countries simply respond by increasing their production. He asserted, "Agriculture recovery programs cannot be solely supply side...." (JEC 1983: I, 4). Chart 5 reveals that United States agricultural exports dropped sharply in the early 1980s and that they did not recover until 1986.

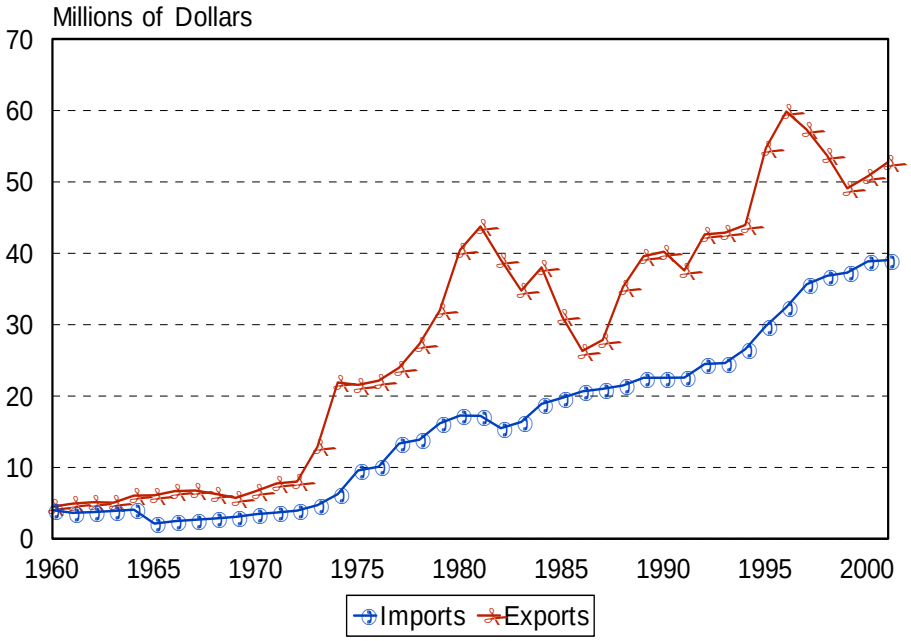
Secretary of Agriculture Block responded to Senator Abdnor's concerns by stating that he intended to drop the PIK program even though "The PIK program is expected to add $2 to $3 billion to net farm income…" The reason Secretary Block offered for this policy change was that "We are in the business to produce in agriculture in the United States" (JEC 1983: I, 8). Since Secretary Block admitted that the PIK program had helped farmers, he had to offer an ideological argument for ending it. He asserted that supply control is flawed because it "…rewards, in my opinion, inefficient producers, penalizes the efficient producers, locks in production patterns and technology, and assures that the agricultural system does not adjust to change" (JEC 1983: I, 10).

Secretary Block urged Congress to end production-control policies and recommended continuing the "market-oriented approach" intended to increase production: "To do this, we must establish policies that assure the farmer feels the market, allows the farmer to receive accurate and timely market signals and to be free to react accordingly". He confessed that the drive towards greater efficiency and market susceptibility would lead to a drop in farm numbers. "There will be some come and some go. Some would prosper and some would not—depending on where we would put the support level and put the safety net. But that's part of the American system. The American system provides the opportunity to take a risk and the opportunity to profit if successful". Recognizing that farm interest groups would not like this position, he stated, "We must all rise above the pressures of constituencies that place demands on us on a daily basis. We must do the right thing for agriculture....To preserve the most efficient agriculture in the world is our challenge" (JEC 1983: I, 12).

Secretary Block's comments reveal an agricultural system crisis perspective. He claimed that the system was designed to promote production, which benefits the agribusiness companies that employ and feed people, even though it also generates social costs in the form of declining farm numbers. Perpetual farm crisis is

acceptable within this system, as long as productive efficiency is preserved, which explains why the government did not consider the three previous decades to be a crisis even though farm numbers declined more steeply. The government's responsibility in this system was to manage the farm numbers and farm production to enable the proper functioning of the broader system (JEC 1983: I, 9).

Chart 5: United States Agricultural Imports and Exports 1960-2000



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Some policy makers dissented from this approach. For example, New York Representative James Scheuer challenged Secretary Block's decision to ignore information about the benefits of small-scale, organic, and alternative-energy farming (JEC 1983: I, 38). And farm advocacy groups continued to press for supply-control measures (JEC 1984: 26). However, the policy makers who shaped the policy agreed that any efforts to manage social and environmental consequences associated with agriculture would only be considered if those policies enhanced production (Glenna 1999: 151).

The USDA data support this assertion. Charts 3 and 4 reveal that purchases of agricultural inputs and commodity production increased in the late 1980s, and Chart 5 reveals that agricultural exports also began to increase. Furthermore, if the crisis had been a farm crisis, we should see the decline in farm numbers level off in 1987, and farm expenses and farm incomes grow closer together. Although Chart 2 reveals that farmers did receive a slight increase in prices received, the prices they paid also increased steadily. And Chart 1 reveals that farm numbers continued to decline into the 1990s. Policy makers called the 1980s a farm crisis and called the 1985 Food Security Act a solution to that farm crisis. But that is a misnomer. It is more accurate to say that the policy makers recognized and responded to a system crisis.

CONCLUSION

Buttel *et al*. (1990) recognize a need to connect the 1980s farm crisis and the subsequent restructuring efforts to the crisis of accumulation in the world economy. The U.S. policy makers' response to agricultural conditions through the 1985 Food Security Act reveals a connection. The mass production/consumption crisis of the 1970s combined with the growing power of transnational corporations to use global outsourcing techniques forced nation-states to focus on international competitiveness over employment and to emphasize increasing production over citizen rights (Jessop 1999; Bonanno and Constance 2001). This paper reveals how the United States government came to share common interests with the transnational agribusinesses in maximizing exports in the 1980s and changed the policy framework to promote those interests. Policy makers generated a *rationale* to explain how it was in the national interest to sacrifice natural resources and farm livelihoods to enhance international competitiveness. Calling this shift a radical effort to rectify a farm crisis in the 1980s masks the convergence of state and transnational corporate interests.

The farm crisis rhetoric implied that policy makers were responding to the plight of a large group of farmers who supply much of the labor, management, and capital in the agricultural system. Although farm numbers were not declining as sharply as they had in past decades, farmers were hurting in the 1980s. Heffernan and Heffernan (1986) describe how foreclosures left many farm families socially isolated, unemployed, and often facing long-term poverty. Farmers needed assistance in the 1980s and they received some assistance early. But as the decade wore on, it became clear that the policy makers were less concerned about farm numbers and the survival of the family farm than about the agricultural system. Policy makers decided that the traditional policies for protecting farm incomes threatened the agricultural input and processing industries that linked American farmers to international markets. Despite the rhetoric about helping farmers, policy makers abandoned policies that had improved farmer economic conditions and commented on the need to sacrifice farm livelihoods in order to maintain the agricultural system in the globalizing economy. Policy makers constructed and responded to an agricultural system crisis, not a farm crisis.

Early studies of the global economy predicted the state's eventual demise, but that prediction has given way to a recognition that the state will persist, albeit in a transformed existence (Weiss 1997). Scholars now claim the need to move beyond the simplistic state-centered vs. captured-state theories in order to begin to characterize how the state-society-market relationships are renegotiated at the local, national, and global levels (O'Riain 2000). This analysis of the construction of the 1985 Food Security Act reveals how the actors at the national level restructured the state's responsibilities to its citizens and to agribusiness companies within the globalizing economy. It represents a watershed in United States agricultural policy to the extent that it marked the emerging prominence of the transnational agribusiness in agricultural policy debates, the beginning of the end of New Deal farm policies, and the rise of a neoliberal ideology in favor of limiting state intervention to enable farmers to "feel the market." When policy makers agree with agribusiness that farm livelihoods need to be sacrificed for the sake of global competitiveness, it is inaccurate to say policy makers addressed a farm crisis.

This analysis may offer insights for examining how the globalization project unfolds in developing countries. Many liberal economists and Marxists have overlooked important changes in the restructuring of agriculture in industrialized societies, such as the United States, because of assumptions that agricultural production is premodern or preindustrial. Similar biases may prevent researchers from recognizing the multiple ways that production processes in developing countries might be integrated and exploited in the globalizing economy. Recognizing how transnational agribusinesses and other corporations penetrate production processes in various ways while national policy makers foster these processes as they pledge to enhance competitiveness and efficiency, may help to overcome these biases.

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AUTHORITY, POWER AND VALUE IN CONTEMPORARY INDUSTRIAL FOOD SYSTEMS

Jane Dixon

National Centre for Epidemiology and Population Health, The Australian National University

INTRODUCTION

Currently, three explanations compete in rural sociology and agro-food studies more broadly to explain the restructuring of national food systems. The first concerns processes of globalisation and specifically the role of transnational corporations and multilateral governance mechanisms. At the heart of globalisation lies an openness to trade in commodities, technologies and knowledge, which leads national governments to pressure commodity complexes to reorganise so that they comply with rules set in international bodies like the World Trade Organisation (McMichael 1994; Burch, Goss and Lawrence 1999). The second explanation implicates reflexive consumers: those who use their knowledge, buying power and organising capacity to demand certain attributes (nutritional benefits, safety, convenience) of the market (Gabriel and Lang 1995). The third explanation is a belated recognition of the activities of actors engaged in the distribution and exchange of goods and services. Retail capital is portrayed as highly available, mobile and flexible, unlike the capital of primary and secondary producers which is more contingent upon the sunk costs of labour and location (Wrigley and Lowe 1996). The unique features of retail capital are argued to coincide with, and to contribute to, the increasing concentration in food retailing sectors worldwide, thus providing a foundation from which giant retailers can contest the power of producer groups and even the power of multinational processing firms (Hendrickson et al. 2001).

Despite the growing influence of the sociology of consumption on agro-food studies, the generation and use of cultural power by producer groups, transnational corporations retailers and governments is seldom addressed. Researchers continue to emphasise the economic power of major institutional actors, and when they do mention culture, it is in relation to consumers.

This article uses a case study of the Australian chicken meat commodity complex to explore the cultural power of food retail chains. The study supports the proposition about the growing influence of retailers, but not for the widely accepted reasons of the specific nature, and concentration, of retail capital. Instead it points to the ways in which retailers mobilise 'intangible assets', including corporate reputations, so as to operate free from regulatory constraints. In order to be self-regulating, a most important reputation to acquire is that of an authority figure, an entity whose influence is taken-for-granted. For this reason, I return to the sociology classics and more recent social theory to delineate the concept of 'authority' and to describe how authoratitive processs play out in market economies that are founded on constant innovation. Based on the case study and the product category termed Home Meal Replacement, I suggest that market based authorities are beginning to usurp the influence of other long-established authority figures. It is within this context, that an assessment is provided of consumer authority in contemporary industrial food systems.

REPRODUCING POWER: THE EMERGENCE OF MARKET-BASED AUTHORITIES

In the main, explanations for the power of retailers have been confined to their capacity to act, and specifically in relation to having superior access to finance capital (a notable exception being Humphery 1998). But as sociologists of power point out, capacity to act is but one dimension of the exercise of power; the other precondition is the right to act — to be seen as a legitimate exerciser of power (Hindess 1996; Lukes 1974). A perception that retailer actions are legitimate has an important consequence: it allows food retailers to dominate the terms of the debate by which food systems and food practices become acceptable and, ideally, unchallengeable.

If one of the bases for the legitimate exercise of power lies in having the status of an authority, then it is appropriate to revisit the concept of authority, or what has been termed "the emotional expression of power". Sennett (1980) argues that authority is an emotional bond between people who are unequal, while Watt notes that "[a]n authority is always a superior of some kind, to be obeyed in some cases, in others to be followed, consulted, attended to, deferred to, or conformed to" (Watt 1982: 7). The definition of authority that makes sense in the context of food systems is of deference to advice or "counsel that ought to be respected" and "unthreatened and un-persuaded compliance" (Watt 1982:15-29).

Richard Sennett lays the groundwork to explore how new authorities come into being when he reminds us that authority "is itself inherently an act of imagination — it is a search for solidity and security in the strength of others" (Sennett 1980:197). Sennett's historical overview of authority figures confirms the ephemeral nature of authority; for when authority figures are found ethically wanting, they provide lightning

rods for discontent and resistance. Civil society challenges to the injunctions of governments and professionals have created the basis for a new authority figure, the consumer (see discussion in Keat, Whiteley and Abercrombie 1994). The authoritative consumer exercises influence, it is argued, through being reflexive. By making deliberative choices and through questioning the ethics and production practices of market-based providores, consumers generate signals that suppliers ignore at their peril.

However, the authoritative consumer occupies an ambiguous space. The corporate creation of confusion around diets (Nestle 2002), coupled with a mass media barrage of nutrition science, leads consumers to search for guidance in the act of food consumption (Fischler 1993; Falk 1994).

The pre-eminence of market-based experts in modern food systems has arisen at a time when both traditional and rational-legal figures, to use Weber's distinctions, are losing their aura of authority (Weber 1947:57-58). As women become subject to the authority of the employer and their paid work activity becomes more important to labour markets and household economies, the mother's traditional food authority diminishes (Goodman and Redclift 1991). Thus, as the actor most central to household food provisioning moves to the periphery of that activity, a greater fluidity is introduced across social arrangements more broadly. As traditional authority in respect of culinary cultures becomes dis-embedded from the moral economy of the household, people look to a range of specialist fields for replacement authorities. While this is happening, the rational-legal authority of governments is under threat. As the numbers of tasks which require regulatory oversight proliferate, government capacity to coordinate popularly received responses on any one front is duly diminished (Offe 1996:63). And although government food authorities continue to regulate aspects of food safety and some limited areas of food quality - primarily in relation to nutrition (exemplified in dietary guidelines) - the decline in numbers of public sector employees, including agricultural extension officers, environmental health personnel and public health nutrition specialists means greater emphasis is laid upon the self-governing corporation and subject (Lawrence and Gray 2000; Tonts 2000).

Building relationships between the two new authorities of the second half of the twentieth century (the reflexive consumer and the corporation) has evolved incrementally, thanks largely to the "intermediary sector of the economy", the term used by Sassen to refer to the numerous experts who engage in "organis[ing] and adjudicat[ing] economic exchange for a fee" (Sassen 1991: 90).

For decades now, large corporations have fostered the growth of a producer services sector – these are the experts and professionals engaged in agricultural extension, financing, marketing boards, legal advice and lobbying. A more recent development is the emergence of a consumer services sector to assist people to consume particular goods and services and not others. Consumer services sector actors, including nutritionists and psychographic researchers, are contracted by corporations to liaise directly with consumers and to provide the companies with cultural insights that are assimilated into marketing and product development (Miller and Rose 1997). The combined producer-consumer services sector makes a living out of providing an interface between producers and consumers and by supplying logistical support for production activities, retail operations and household consumption operations. The sector provides legitimacy for company actions, through their members' identification with traditional and rational-legal institutions: professional bodies, medical science and government standard-making bodies. They legitimise "by giving a normative dignity" to the practical activities of operating in the marketplace (Scott 1995: 46)

These functionaries were described by Bourdieu (1984) as "new professionals" working in a "substitution industry" where words are exchanged rather than goods. Unlike officials who used to occupy bureaucratic positions, the new professionals are mobile and lack any durable allegiance to a particular locale or source of income. Thus they are "as disruptive of hierarchies of authority as [they are] a stabilizing influence" (Giddens 1994: 85). "New professionals" perform this dual function by simultaneously being the primary "evacuators" of traditional or customary content as well as being vehicles for supplying alternative knowledge and ideas. They act "as powerful translation devices between 'authorities' and 'individuals', shaping conduct not through compulsion but through the power of truth, the potency of rationality and the alluring promises of effectivity" (Miller and Rose 1990:19). It is these symbolic analysts, in the employ of commercial firms, who are responsible for Keat's assertion that markets are "the most powerful transgressor of boundaries, the most active dissolver of meanings [and] the most radical challenger of social authority" (Keat 1994: 39). They constitute part of the technical fraction of the transnational capitalist class, described by Sklair (2001) as fuelling globalisation in tandem with corporate executives, bureaucrats and politicians, merchants and the media.

Table 1 depicts this sub-fraction as laying the foundation of an emergent fourth type of authority. Because this class fraction is largely responsible for defining the standards around the qualities that make "food good to think", it tips the authorial balance of power in the direction of the market.

Table 1 Types of authority

Type of Authority	Nature of the Command	Administrative Staff
Traditional	Substantive and ethical precepts	Servants, subjects, dependents
Rational-legal	Enacted rules	Officials
Charismatic	Duties	Disciples, followers
Market	Expert defined standards	"New professionals"

The remainder of this paper provides and overview of a study of the Australian chicken meat commodity complex, and reinterprets the findings in terms of the concept of authority. It then teases out how market-based actors, including large food retail chains, are acquiring authority status. Understanding the processes that are leading to the emergence of market-based authorities illuminates the challenges faced by consumers in assuming this status for themselves. The material also amplifies why agro-food researchers should investigate the interpenetration of cultural and economic power if they are to understand the forces behind agro-food restructuring.

THE BALANCE OF POWER WITHIN THE CHICKEN MEAT COMMODITY COMPLEX

In the mid 1990s I embarked upon a study of the popularity of chicken meat in Australia and elsewhere, in order to understand the types of power that shape modern food systems. A commodity systems analysis framework (Friedland 1984; Friedland 2001) was chosen to shed light on the balance of power within the system and a cultural economy approach was adopted to explore the full range of processes responsible for the hierarchical ordering of power relations (Dixon 1999).

Very briefly, because a full account of the study can be found in *The Changing Chicken* (Dixon 2002), the Australian chicken meat industry has grown spectacularly over the last quarter century with approximately six and a half million chickens coming to market each week. Producing this number for a population of nineteen million Australians is a relatively small number of chicken farmers (about 820), processing plants (about 90), employing a modest number of labourers (about 13000) (Fairbrother 2001). State governments regulate farmer pay and conditions, and hence provide a measure of stability for the industry. And under Australian quarantine regulations, chicken meat cannot be imported for human consumption. As a consequence of this protective regulatory regime, contract farmers in Australia have an incentive to invest in the latest technology and processors continue to invest in the best avian stock for Australian conditions. Because of the production-side efficiencies, some claim this to be Australia's most successful agri-food industry (Cain 1990).

Producer efficiency has helped to keep wholesale prices low and, for this reason alone, some observers credit the success of chicken relative to other meats, to its cheapness. However, my focus group research showed that the esteem with which chicken is held by consumers is more complex. Among the explanations provided were: a personal liking of chicken meals; it is healthier than red meat; it is easy to prepare and easy to chew, which was a particularly important attribute with children; and, above all chicken is versatile, which extended to its acceptance by vegetarian family members. It was a particularly 'family friendly' food. Chicken also emerged from the group discussions with several negative features: removing chicken fat was viewed with disgust, and the use of growth hormones and the conditions under which chickens were grown caused anxiety. Despite these misgivings, chicken was purchased because it contributed to easing the pressures on the family cook. This finding makes sense in the context of the general concerns shared by family food providers in an era when women's labour force participation is so pervasive. Social and market research indicates that at the end of a busy day, Australian women are looking for opportunities for casual eating (Mackay 1992), relief from the burden of cooking (Santich 1995), and meal solutions (Steggles 1996).

Given some of the consumer misgivings about this most popular of foods, it seemed imperative to understand how chicken was made 'good to think', and this entailed examining the operations of actors who mediate producer-consumer relations. It was not sufficient to understand the exchange of material goods—money and meals—but the impacts of a trade in cultural goods such as time, quality, rituals and authority, appeared to be equally noteworthy. Subsequent fieldwork was undertaken with the major supermarket chains, KFC and specialist poulterers, and interviews were conducted with nutritionists, psychographic researchers and those responsible for advertising campaigns featuring chicken.

Like others undertaking agro-food studies over the last decade, I emerged with a finding about the significant influence of large food retailers. Supermarkets and fast-food chains currently anchor the supply chains of numerous agricultural commodities through the contracts they enter into with producers (Parsons 1996; Burch and Goss 1999). A rather extreme version of this has been operating within the chicken meat commodity complex in Australia: for over thirty years the largest processor (Inghams) has sold the majority of its produce to the largest food retailing chain (Safeway/Woolworths), while the second largest processor (Steggles) has been the preferred supplier for the second largest chain (Coles). This has had the effect of creating a marked level of concentration on the production side of the industry[1], with the medium sized firms forced to invest in flexible systems so that they can provide the more innovative lines demanded by retailers as well as filling in the gaps when the major processors are unable to meet orders.

In addition to their ready access to producers, retailers directly engage with consumers. They shape demand for individual commodities through their pricing policies (such as loss-leading practices, especially of rotisserie birds and of the prized chicken fillet) and the ways in which they foster commodity contexts around groupings of products (such as specialist providore sections for poultry). In relation to chicken meat, and unlike the red meat complex where thousands of independent butchers are still prominent, corporate retail traders have almost exclusive control over the producer-consumer interface.

The symbiotic relationship between the supermarkets and chicken meat producers has been to the mutual advantage of each. Supermarkets have provided these particular primary producers with an extremely efficient distribution network and chicken meat has provided supermarkets with a valuable 'intangible asset', a food endorsed by health professionals as a 'good food'.

According to Pritchard (2000: 3), a key facilitator of global agro-food restructuring "has been the capture, management and exploitation of intangible assets – brands and other trademarks, patents and corporate know-how – that expedite the transformation of production capital into mobile financial capital". The major function of brands and marketing is to communicate not only something about the values of the goods and services to which they are attached, but also to announce the existence and status of the corporation that produces and sells the commodities.

In the case of chicken meat, Australian consumers said that they assumed that chicken meat was healthy because it featured so prominently in nutritional advice, and because it received the National Heart Foundation's 'Pick The Tick' logo, which was widely accepted as a symbol of a healthy food item. For more than a decade, chicken meat products have appeared in supermarket chill cabinets emblazoned with The Tick, while whole chickens and chicken fillets, along with red meat cuts, lie unpackaged and unbranded in butcher shops.

This form of nutritional branding-by-association has been far more effective than the more direct advertising campaigns of the red meat industry body.[2] The chicken meat study revealed that consumers' generalised confusion about food magnified their cynicism about the self-interested claims made by producers, and thus reproduced a role for the professional expert as an interpreter and judge of market-place offerings. What appears to be happening, at least in the case of supermarkets, is that they are using dietary guidelines and nutritional branding devices to claim *de facto* authority while the *de jure* authority of the family cook and state regulation are on the wane.[3] Given the recent popularity of foods that carried a health claim, it is no surprise that Kentucky Fried Chicken rebadged itself "KFC" in the mid 1990s to lose its "fried food" image (Dixon 2002, Ch 7).

THE AUTHORITY OF THE RETAIL TRADER

Some years ago Hughes (1996) posed a question that has still not been satisfactorily answered: how do corporate retailers inhabit benign regulatory environments? This question is the more pressing given that both the UK Competition Commission (Flynn et al. 2003) and a Joint Select Committee on the Retailing Sector in Australia (1999) found that despite high levels of supermarket concentration in their respective countries, there was no need to cap market share. Perhaps some explanation for a hands-off approach is provided by Flynn, Marsden and Smith (2003: 42) when describing the power of corporate retailers in the UK: "while continuing to develop their economic power as the main representatives of progress, the corporate retailers are also regarded as the main custodians of quality in the eyes of both consumers and government". In other words, their cultural role offers some protection from regulatory oversight.

I believe that considerable insight for the cultural and economic power of large food retail traders lies in an examination of the question: how have supermarket chains acquired a status of custodian of quality and pre-eminent food authority? Social histories reveal that retail traders have been incrementally acquiring multi-

dimensional forms of authority (Kingston 1994; Humphery 1998: Seth and Randall 1999). Eighty years ago the large family grocers and retailers located on the high streets - the Sainsburys in the UK, the Waltons in the USA and the Myer family in Australia - exercised authority of a charismatic kind. Their showmanship was built upon the boldness of their vision and the fact that they offered novelties, such as in-store eateries for working class customers and self-service. By all accounts, these firms had their disciples in advertising who helped them to successfully influence ideas about the act of consumption and of household duties: for example, the earliest supermarkets are credited with creating Mrs Housewife. By trading in necessities and through the philanthropic and public good acts of successive family members, the corporations have over time gained the traditional authority of patrician and guardian. In addition, since the Second World War, the largest retail chains have acquired a quasi rational-legal authority to promote the public's health and well-being by administering food safety codes of practice. This development is due to trends in government deregulation of business activities and the gradual shift towards self-regulation, requiring company expenditure on quality assurance systems and experts to replace the officials employed by government to perform these functions. The Hazard Analysis Critical Control Point, or HACCP, is a case in point.

It is within a context of small government and market abundance, that the producer-consumer services sector identified earlier, flourishes. They provide the basis for an administrative system that serves the corporation. In competing with governments and family food providers for authority status, food retailers use their 'administrative staff' to undertake a number of strategies to forge authority relationships.

First, the staff negotiate partnerships with rational-legal authorities to promote new practices and products. In this context, they write submissions to government enquiries, brief corporate executives who sit on government consultative committees, and lobby members of parliament. They also negotiate partnerships between corporations and non-government organisations and charities, such as the National Heart Foundation, and organise the sponsorship of scientific research, publications and events (Nestle 2002; Dixon, Sindall and Banwell 2004). Being associated with scientific respectability, particularly with medical science, is arguably the most valuable expertise of the current era (Scott and Worsley 1994). Market-based actors appear to be allying themselves with health and medical professions and sciences to re-embed trust in a food system that is increasingly comprised of novel items (Dixon et al. 2004). The '7-a-day' fruit and vegetable campaign jointly promoted by Coles supermarkets and the Dietitians Association of Australia, is but one example of Australian supermarkets forming alliances with health professional bodies in order to acquire expert authority (Anonymous 1999*)*.

Through these third party associations, market-based actors brand themselves, and use this branding to become more respectable. Corporation-professional body partnerships are most obvious in the side-by-side positioning of logos on conference programs, lists of sponsors of scientific journals and at the launches of new products. These events and sponsorships are an important plank in mobilising symbolic capital. Like the brand management of products, the brand management of corporations plays a role in establishing consumer loyalty in markets where thousands of new products enter annually (Pritchard 1999).

The second function performed by the administrative staff is to develop a range of communications to continuously renew the charismatic persona of the retailer. Weber argued that charismatic authority differs from rational-legal and traditional forms because it does not assume a routine character. "It is, by definition, a kind of authority which is specifically in conflict with the bases of legitimacy of an established, fully institutionalised order" (Weber 1947: 64). Weber described how charismatic authority is transformed into a more bureaucratic form through the routinisation of novelty, which is a feature of charismatic figures.

The functionaries employed by retailers routinise charisma by manufacturing highly responsive marketing plans that both keep pace with consumer thinking and that encourage new ways of thinking about the marketplace (Humphery 1998). While large retailers have a sound charismatic foundation through offering the excitement of the new, they have to attach serious intent to their efforts. If, as Sennett (1980: 165) alleges, the work of authority is "to convert power into images of strength", then the producer-consumer services sector is required to cultivate this particular 'intangible asset'. Thanks to the efforts of countless advertising and marketing professionals an image of strength is stage managed at every opportunity; at shareholder meetings, in supply contract negotiations, through store routines, nightly television advertising and prominent siting at the heart of suburbs and shopping precincts. The discourse of corporate citizenship is paramount (Probyn 1998). These contemporary cultural economy activities have a long lineage, as Evers and Schrader (1994) note when they describe the centuries-old practice of traders transferring wealth into symbolic capital in order to become respectable as they make money. A vital process in the food system is the symbolic regulation of markets through mobilising reputations.

However, these days a multi-dimensional reputation is required because increasingly markets are coordinated through discourses of convenience, relationships to nature and health. Freidberg (2003: 28), for example, describes how supermarkets in the UK "have joined the country's Ethical Trading Initiative in order to demonstrate their commitment to social welfare and environmental standards in their supply chains". In this way, 'ethically traded' product lines simultaneously operate as a capital accumulation strategy and as a sophisticated form of organisational marketing, projecting attributes with which the corporation hopes to be identified.[4]

The third function performed by the 'new professionals' is to simultaneously dis-embed and re-embed culinary cultures. They communicate that previous culinary orders are *passé* and that there are alternative forms of food provisioning more congruent with contemporary lifestyles. They sell their expertise both up and down stream in order to broker the producer-consumer interface. Notably, the authorities who are most accessible (visible, available, understandable) and least challenging of consumer behaviours are those in the marketplace with food-related expertise.

As foods have taken on values in addition to safety, price and social status, the range of groups with an interest in what is eaten has increased markedly. In addition to the government authorities responsible for food safety and security, the scientists who provide evidence of food's properties, and the community members who are gatekeepers of the culinary culture, the claimants to some special knowledge and expertise in relation to food has enlarged to include celebrity chefs, animal welfare activists/ethicists, specialist food producers and vegetarian consumers.[5] It is little wonder then that in an era when there are many claimants to authority, the quest to be perceived as legitimate is onerous (Giddens 1991: 194-196), and that consumers are confused.

Corporate mobilisation of intangible assets is apparent not only in the Australian chicken meat commodity complex, but is currently being exposed through the discourse of Home Meal Replacement (HMR). For this particular product portfolio of heat-and-serve meals and ready-to-go meals to be acceptable, traders must renegotiate with family cooks the ideal site for food preparation — they need to shift this aspect of food provisioning from the household kitchen to the so-called community kitchens of fast food outlets and the industrial kitchens supplying supermarkets. HMR is, however, fraught with tensions because it cuts across enduring understandings of female domesticity and the relationship between home-based cooking and nurturance. For this reason, the portrayals of HMR must invoke acceptance by mothers, primarily, that this is an acceptable form of nourishment and nurturance. Through communicating what constitutes a 'proper' meal, homelife is being reworked by an untidy rabble of celebrity chefs and government employed dietitians as well as corporate nutrition divisions, corporate sponsored scientists and myriad food outlets.

It remains to be seen how accommodating or resistant consumers will be towards this new way of life. What we do know is that the 'new professionals' taking over the inner cities are a significant market for all forms of HMR (Zukin 1991). Greater resistance may come from farm producers because HMR poses a dilemma for them too; will they make more money supplying millions of households which will continue to cook from raw ingredients, or from supplying a few giant food processors and fast-food chains who will prepare household meals? As with consumers, producers are not an homogenous entity. It is possible that fats, oils, sugar and salt producers will look favourably on HMR, while horticultural industries may be more inclined to fight for household food preparation (Carson 1995). A lack of unity between producers has repercussions not only for retailer hegemony but for consumers. According to Abercrombie (1994), authority between producers and consumers is best conceived as a cyclical process in which competition between rival producer groups temporarily empowers consumers. Having said this, he elaborates a counter-trend: "…commodification, the intrusion of market relations, is corrosive of all traditional or existing authority relations" (Abercrombie 1994: 56). In other words, consumer authority can never be more than fleeting. For consumers to consolidate their fledgling authority would involve the acquisition of particular attributes: a limited and clearly defined membership or inherited status and claims to some special characteristics that justify their making and enforcing decisions (Keat et al. 1994: 3). Without an administrative staff dedicated to serving the consumer sector (where there is such an entity), the capacity for consumers to routinely assert the basis of their claim for authority status seems remote.

CONCLUSION

Whether a food is acceptable to consumers encompasses a wide range of considerations. Numerous sociologists have interpreted this trend as indicating consumer influence over food systems while others have noted an increase in consumer demand for help in making food related decisions. This demand has coincided with a long list of claimants to food knowledge, expertise and responsibility – celebrity chefs, food activists, food producers and retailers.

There is a growing appreciation in agro-food studies that relations of power between producers, retailers and consumers are produced, transformed and reproduced through a series of processes including capital accumulation, consumer manipulation of material practices and the symbolic regulation of markets. In a situation where markets organised around price systems have been displaced by markets based on hierarchies of values (Appadurai 1986), capacity to influence the ordering of values is of strategic importance.

In the Australian context at least, the influence of government food regulatory authorities is diminishing, as is that of the home cook, thereby tipping the authority relation toward market-based players, in particular those who sit at the interface of the culinary culture and the economy. It appears that major retailers are using Weber's three bases of authority to manufacture a fourth type of authority. Market players are increasingly entrusted to coordinate and adjudicate competing claims about the safety, security and quality of the food supply. In this way, they embody the Latin definition of an auctor, or authority, as "he that brings about the existence of any object, or promotes the increase or prosperity of it, whether he first originates it, or by his efforts gives greater permanence or continuance to it" (Watt 1982: 11). While generally not responsible for bringing about the material existence of objects, retailers play a greater role than producers and consumers in promoting an increase in the value of objects. Retail chains produce economic and cultural values by employing an administrative staff to recommodify foods. The staff also reconceptualise values by promoting particular standards or principles of judgement to apply to food decision-making.

As this paper shows, achieving authority status is much more than having acknowledged expertise. It involves creating an aura of strength, forming emotional attachments and having a body of people willing to serve the enterprise. Consumers *en masse* do not have the machinery to manufacture a reputation of solidity beyond the claim, gradually evaporating under the strain of women's labour force participation, that they exercise a moral or traditional authority for food provisioning in the family context.

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[1] In 1996, the top three processors (Inghams, Steggles and Bartter) had control of 76% of the chickens sold on the market. With the sale of Steggles to Bartter in 2000, three quarters of the market is currently controlled by two family owned companies.

[2] My claim is supported by the fact that the recent campaign by the Meat & Livestock Australia, which uses butchers to promote red meat, has been credited with reversing declining beef consumption (Shoebridge 2003). This is not surprising when market research shows that butchers are viewed by consumers as trustworthy and dependable (ASI/ACNielsen 1998).

[3] The former refers to authority by virtue of the existence of rules and traditions, while the latter refers to claims to rightful authority.

[4] Mark Harvey (1998) found that large supermarket chains coupled flexible labour markets with product differentiated retail systems. Such systems are the result of a single chain segmenting into different types of stores which contain distinctive product ranges, determined by consumer incomes and lifestyles: budget, own-brand, super-brand and niche products.

[5] Some of my focus group participants deferred to vegetarians because they were perceived to be especially knowledgeable of the food system and to be ethically admirable

PESTICIDE USE, RISK PERCEPTION AND HYBRID KNOWLEDGE: A CASE STUDY FROM SOUTHERN BRAZIL

Julia S. Guivant[1]
Federal University of Santa Catarina

INTRODUCTION

Although the issue of pesticide use has received less international media attention in recent years, it is clear that there is still a world-wide overuse of synthetic pesticides, caused by farmers applying them as a pre-emptive measure, or without considering recommended doses or synergetic effects (Barrow l995; Pretty 1995)[2]. To achieve the desired effect and to avoid risks, the pesticide industry and scientists argue that the appropriate pesticide should be applied in correct amounts, at the right time, and with appropriate precautions in terms of storage, preparation and application, and the cleaning of equipment (Sweet et al. 1990).

There is a scientific consensus that the effects of an inappropriate use of pesticides can seriously affect human health and the environment (Hayes and Laws, 1991). According to estimates by the World Health Organization and United Nations Environment Programme, pesticide poisoning injures 1.5 million agricultural workers a year. At least 20,000 workers die from exposure to pesticides every year, most of them in developing countries. Chemically polluted run-off from fields has contaminated surface and ground waters, damaged fisheries, destroyed freshwater ecosystems, and created growing "dead zones" in the ocean (World Bank 2004)

But why are problems of contamination so frequent and why are pesticide residues in food and water resources so frequently found? (Ward 1993, 1995). Beck (l992) suggests an answer to these questions: the recommended use of pesticides is a social fiction. Moreover, there are no objective or agreed parameters of safety in relation to pesticides, because of the infinite number of possible combinations of pesticides in the human body, including those of farmers who are directly exposed to them, or consumers who ingest them in food and water.

The criteria for the safe and effective use of pesticides established through research in laboratories tend to be far-removed from the farmer's everyday decisions and practices in both industrialized and less industrialized countries. In addition, the recommended levels of pesticide use does not allow for the complex social factors that influence their actual use (Wynne 1996).

These complex variables involved in the use of pesticides by farmers do not eliminate the need to understand their reasons for their overuse, or the adoption of unsafe practices. To address these issues, two main positions can be identified. One is based in the presupposition that farmers lack the correct or sufficient information about health and environmental risks, as well the capacity to undertake a rational calculation of input costs. It is argued that with more expert advice, knowledge, and management orientation, pesticide applications could be lowered. The emphasis here is on the ignorance of farmers versus the knowledge of experts, and the need to diffuse more information about adequate farming practices (a classic example of such diffusion-adoption studies is Rogers 1981).

The other argument focuses on farmers as victims of economic constraints, pressure by salespeople or the operation of a 'technological treadmill', which leave them no significant room for manoeuvre. From this perspective, this situation could be changed through economic incentives and the adoption of new technologies which are environmental friendly. The farmer is presented as eager to change the model of production, and open to be training in holistic agriculture such as agroecology (Altieri 1989, 1990).

These arguments and the related strategies present serious limits to understanding farmer's practices, and consequently to the formulation of more effective proposals for sustainable agriculture (either through the use of fewer external inputs or an orientation towards organic production). From these perspectives, farmers are not considered as knowledgeable agents, with their own reasons for behaving as they do, and with their own perception of the risks relating to pesticide use. Within a macro-structural context, marked by natural and socio-economic pressures, constraints and opportunities, the implementation of pesticide technology by farmers involves a special cognitive dynamic, a learning-by-doing process, which involves conflicts and negotiations between it and the knowledge of the technical experts, whether these are extension agents or agrochemical industry sales representatives (Lowe et al. 1997).

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1 Dept. of Sociology and Political Science, Universidade Federal de Santa Catarina, Florianópolis, Brazil. The author would like to thank the anonymous reviewers for their insightful suggestions.

2 For a definition of pesticides, see FAO (2003).

The central focus of this article is on the analysis of farmers' knowledge and their perceptions of risk as they exist in the dynamics of legitimisation of pesticide use. Instead of working with the dichotomy between traditional/local and expert knowledge, I will argue that farmer's knowledge has a heterogeneous character, as part of processes of transformation, invention and re-appropriation of other knowledge, in a situation of permanent flux.

In order to discuss alternatives to those approaches, I analyse a case study in a rural area in Southern Brazil, where for almost thirty years, there has occurred a widespread intensive and inappropriate use of pesticides in horticultural production. Current farmers' knowledge can be conceptualised as a mixture of past and present experiences, resulting from the interaction with expert knowledge, and finally revealing a "cognitive dependency" on pesticides. Although the original data was collected over ten years ago, nevertheless it remains relevant because it presents an extreme case in the spectrum of differing pesticide practices. To this extent, it enhances our understanding of the dynamics of pesticide use and assists in the more effective formulation of participatory strategies for sustainable development. Importantly, this study also allows for a discussion of how to avoid any idealization of local or traditional knowledge. To frame the research theoretically, I integrate the contributions from the actor-oriented theory of rural development, especially the key concept of local knowledge (Long l992; van der Ploeg l993a) as complex, reflexive, dynamic, fragmentary, experimental and innovative. The contrasts with technical knowledge are revealed in the way that problems are articulated and in the factors selected as relevant. This implies that there is no simple opposition between lay and expert knowledge, with the former being irrational or uninformed, and the other rational and scientific. We are dealing with different types of rationalities, without idealizing either one as superior to the other. This critically-informed perspective stands in contrast to studies on rural development that are more oriented to a "rescue" of traditional knowledge.

The characterization of complex and heterogeneous local knowledge converges with constructivist and cultural theories about perception of risk associated with modern technology. These theories emphasize that there is no final definition of those risks provided by scientific explanations, but a plurality of definitions, resulting from different rationalities and assumptions, including lay knowledge (Hannigan 1995; Wynne 1996). It is necessary then to appraise risk as socially selected and defined, and thus capable of being perceived differently by social actors (Adam l995). Also central to this approach are the contributions by Beck (1992, 1999) and Giddens (l990, 1991), which bring risk issues to the centre of contemporary social theory, and from this centrality establish a critical analysis of the limits of science and technology and its relationship with lay knowledge (Guivant, 1998).

EXPERTS AND LAY KNOWLEDGE

According to Beck (l992) no one is an "expert" when it comes to assessing risks with consequences that are global, evade perception, and are difficult to avoid once identified.. However, we should be careful not to idealize lay knowledge or, as in the case of this article, local farmer's knowledge, as better or more appropriate than technical expertise. This is a common problem both in the literature on sustainable agriculture and on recent risk theory.

I would like initially to consider the issue of sustainable agriculture. Among the main criticisms of the linear, top-down diffusion of innovations strategies characteristic of modern agriculture, is its ignorance of local knowledge, and its privileging of expert knowledge. One reaction to this tendency to put the farmers' knowledge last has been to propose recuperation and vindication of farmers' local knowledge as a key factor in establishing participatory models of sustainable agriculture (Chambers 1983, 1994; Bebbington 1994). From the point of view of agroecology, farmers' traditional knowledge contains the seeds for a better use of natural resources. The problem is that expert and local/traditional knowledge are presupposed to be homogeneous totalities, without significant internal differences or conflicts (Altieri 1990).

Murdoch and Clark (l994), discussing the concept of sustainable development in its epistemological and political dimensions, questioned how sectors of the environmental movement express a reductionistic and mechanicistic image of science. According to them, the search for alternatives to this type of science led some environmentalists to a valorization of traditional or local knowledge as a base for the diffusion of sustainable agricultural practices. This led to a reification of this knowledge, putting it in a 'black box', and far removed from any problematization. The consequence of this reification is to reduce sustainable knowledge to a confrontation between right and wrong, without assuming the values behind this affirmation (Murdoch and Clark l994: 118).

An interesting alternative proposed by Murdoch and Clark (1994) involves the analysis of the ways in which both types of knowledges are constructed. By appealing to actor-network theory (for example, the work of Callon l986, and Latour l994), the relations between scientific and lay knowledge are characterized as subtle, dichotomized, without assuming any superiority but with interdependency, a hybridation or fusion. But Murdoch and Clark (1994) concentrate their analyses on opening the black box of expert knowledge, without paying enough attention to the hybrid character of the local one.

Long's actor-oriented approach (1992) contributes to the opening of this other black box, which I refer to as hybrid local knowledge, which is fragmentary, partial and provisional in nature. Knowledge of this kind emerges as a result of accommodations in situations of interface among different actors' worlds, where power relations are involved (Long and Ploeg, l994, 83).

From this perspective, I consider that the hybridization of knowledge, emerging in situations of interface (between farmers and experts), can assume different forms within a broad range of possibilities. Hybrid local knowledge can assume a traditional character, related to a pre-modern agriculture, and also more complex formulations, that can involve adaptations of expert knowledge typical of modern agriculture through local experiences. Included within this can be perverse types of local knowledge, which are not consistent with proposals for sustainable agriculture. The identification and recognition of such knowledge is a pre-requisite for a better understanding of the possibilities and limits of sustainable agriculture, as this case of hybrid local perverse knowledge demonstrates.

PESTICIDES IN EVERYDAY LIFE

The field research for this study was carried out between l989-l992 in the district of Santo Amaro da Imperatriz, in the green belt of Greater Florianópolis (Santa Catarina), Brazil. The study area is characterized by an intensive use of pesticides (fungicides, insecticides and herbicides) in horticultural production, on family farms located along the margins of the Cubatão River and its tributaries. Since the end of the 1980s and beginning of the 1990s, the region was at the centre of an environmental debate related to the level of pesticide contamination of the river. The Santa Catarina State Water and Sanitation Company (CASAN) utilized the Cubatão River as a complementary source of drinking water for the urban population of Great Florianópolis (numbering approximately 500,000 people).

The process of agricultural modernization in the region began in the late 1960s, and involved an increased diversification into vegetable production. A particular set of conditions favoured this type of production: scarcity of land in combination with excess labour supply, appropriate climate and soil type, proximity to an urban market and a reasonable road network. Currently, subsistence farming has been nearly completely abandoned and food consumption is dependent on purchases in supermarkets and local shops. As a consequence of increased incomes, particularly from tomato crops, consumption patterns in some areas have approached middle-class urban standards in recent years.

Horticultural production demands a heavy use of chemical inputs, because of the high incidence of pests and diseases. Although strict legislation regarding pesticide use has been introduced in Brazil, it is poorly implemented and enforced. Products that by law require a licensed company to be responsible for purchase and application are frequently sold without any professional supervision. Farmers can find at the local chemical stores already-signed, blank prescriptions which allow them to buy any type of pesticide, without legal control, mainly because of the few officials available to enforce the law.

The data on pesticide residues in food is very limited. It was only in 2003 that the National Agency for Sanitary Control (ANVISA) issued two research studies about this problem. Among other things, the data showed that in a sample of 1,278 lettuces, bananas, carrots, apples, tomatoes and strawberries in four states, 81.2 percent were contaminated with pesticide residues. Serious irregularities were found among 233 samples of that group, with 94 revealing pesticides residues in excess of allowable doses, and 74 revealing the presence of pesticides which were not registered for use (ANVISA 2003).

In the farming area under study, pesticides are usually sprayed in a preventive manner, although this is not recommended, and farmers tend to spray a mixture of different formulas in a single application. The application of such "cocktails" is conducted in periods during which the residual effect of the previous application of the same pesticide is still active, without considering the rest period required, thus increasing the risks of residues being consumed. A common practice in the area is the regular application of pesticides every four days, as the minimal frequency. Other agricultural practices that lead to excessive use include: sprayer

pressure nozzles that are not adjusted, remaining in the same position for different applications and causing the application of greater doses than necessary; application at times of high evaporation or on windy days; application of pesticides not appropriate for the pests and diseases that are to be combated; and the use of the wrong volume of mixture to the unit of area to be sprayed.

The farmers with more cultivated land - above 5,000 tomato plants for example - normally use a sprayer with a constant pressure pump and a 100m spraying hose, linked to a mini-tractor. Farmers with less area to cultivate usually spray manually with a backpack sprayer, with non-constant pressure. A motorized backpack is very rare in the area due to its cost. For both systems it is recommended that farmers use protective equipment - gloves, boots, hats, coats and masks, but few do[3]. Most of the available equipment is not suitable for the high temperatures which are usual in the area for a great part of the year, although some of this equipment - gloves, hats, long pants and long-sleeve shirts – could be utilized in spite of weather conditions. Other practices not recommended but observed among those interviewed include eating, drinking and smoking during application, spraying against the wind and the preparation of pesticide mixtures with bare hands. In relation to environmental pollution, the watercourses are considered the most accessible places to dump pesticide containers and plastic bottles and to wash spraying equipment. The rivers could also be polluted by contaminated soil washed out by rain or irrigation.

Face-to-face interviews with open and closed questions were applied to a non-probabilistic sample of operators of 48 small- and medium-sized family-run enterprises, of about 10 to 25 hectares, all devoted to vegetable crops, principally tomatoes and potatoes, sold at the local and national markets (Guivant 1992; 1997; 2000). The open questions focused on the importance of agricultural practices, which allowed for a qualitative analysis. The research also involved interviews with other key informants (agronomists, doctors employed at the Regional Hospital, agricultural supplies sales agents and representatives of the local banks). The interviews were directed at men, because pesticide use is a totally masculine activity (on some occasions other members of the family were present, but gender differences were not considered in this study). All of the interviewees were owners of their land, or at least a part of the land they worked.

THE SOCIAL CONSTRUCTION OF KNOWLEDGE

The farmers interviewed tended to oppose their knowledge to that of the experts or technicians (both salesmen and extension agents) because they considered their knowledge to be more appropriate to the everyday needs of the crops. Farmers showed a significant level of confidence in their ability to handle chemical inputs. For example, reading labels was seen as something that was not very difficult, although many of the farmers had attended no more than 3 years of school and labels were presented in small letters and used technical terms. The farmers openly rejected being considered ignorant and inferior, and came to develop a stereotyped image of the technicians, as they imagined the technicians did of them.

For their part, the technicians working in the area found it very difficult to influence farmers to use lower doses and less toxic pesticides. They came to learn that farmers found it preferable to eliminate all of the emergent pests, while neglecting the simple practices that could avoid infestation. The salesmen also complained about the farmers, who seemed to demand more toxic pesticides (in noting this, it is not my intention to suggest that salesmen are neutral actors, but to expose the tensions involved in the relationship with the farmers).

In the interface situations, we found what Long (1992) referred to as a “battlefield of knowledge”, where farmers could find a social advantage in the unregulated use of pesticides which they considered to be better, and in this way reinforcing their identity as social agents, with competence, against the negative image they considered technicians have about them.

This criterion was supported by some basic beliefs, which were frequently referred to by farmers in order to legitimise their use of pesticides:

1) *It is preferable to eliminate all of the emergent pests*. "The idea is not to let the insect get in," explains one of the farmers interviewed. This type of belief stimulated the lack of differentiation in relation to the types of insects that could appear in a crop. It also led to pesticides being used for any situation, without the farmers developing a sharp observation of the level of infestation and without implementing practices that could prevent infestation.

[3]In spite of the fact that farmers tend to overuse pesticides, very limited data exists about cases of poisoning among farmers and consumers. Some authors consider that nearly 2/3 of the farmers have suffered acute intoxication from pesticides (Bull and Hatway l986; Dinham l993).

2) *The more intensive the dose of pesticide applied, the better it is for the crop*. The farmers affirmed that if they were applying too much, this would always be good. The possible application of a dose above that recommended in the instructions was, collectively, not considered a problem or as something irrational. On the contrary, the problem would emerge if the application was below recommended levels. The belief that "the more the better" was reinforced by what the farmers considered to be certain practical "evidence." Even when applying higher doses of pesticides than recommended, the farmers might lose many tomatoes which were thrown out because they did not have the cosmetic appearance required for sale, and because there was no local practice of re-using such tomatoes in an industrial process or for domestic use. Without any economic incentives from the governments to reduce pesticide-use, the majority of farmers concluded that if they used less pesticide, they would lose even more tomatoes and suffer significant economic damage. However, the most important evidence in support of their practices was their ability to obtain satisfactory profits. The purchasing power that they maintained was the most convincing evidence that what they were doing was right. When the results were not as expected, this was considered as something normal in agricultural production, and an experience to be learned from.

3) *There are no alternatives to the way in which the pesticides are utilized*. The farmers interviewed arrived at what they considered a optimal level of use of chemical inputs. This can be summed up in the idea that the form in which the pesticides were applied is "the way". This belief represents a kind of "chemical fatalism", which one farmer summed up in the following manner: "Every plant has to have a remedy," meaning that one could not leave any crop without an application of pesticides, if one intended to produce. Given the pragmatic goal of obtaining high yield, it was deduced that whatever act was consistent with this goal must be pursued. There was no space within the farmers vision for the possibility of overspending because to save costs with pesticides was seen to increase economic uncertainty.

Pesticides are applied to the degree that they are judged necessary to guarantee the investment, with the criteria for the quantities to be used determined in practice, in the various situations confronted. Practically all decisions about the use of pesticides, such as doses, mixtures, which brands to buy, etc., are customary, routine decisions, rather than situation-specific procedures, that occupy what Ilbery (1985) calls the "grey area," located between programmed and un-programmed decisions. Once the decision to plant some crops that are highly vulnerable to several pests is made, the costs of pesticides are seen as inevitable, and part of open planning. Given that the pesticides are part of this daily routine, a constant re-evaluation of what to do, how to do it and what brands to use can mean a loss of time, and an increase of uncertainty, which is exactly what farmers seek to reduce with the use of these inputs.

Farmers are unanimous in accepting one main positive difference between agriculture in the past and the present: that greater control over nature - climatic fluctuations, ecosystemic factors and depleted soil - is made possible by the use of pesticides and chemical fertilizers, with less time at work in the fields. Within the guidelines for maximizing production, a central criterion in the choice of innovations is to "not waste time." Pesticides do not disappoint the farmers in this respect. To repeat, from the farmers' perspective there is no such thing as "overspending," because saving pesticide costs is synonymous to increasing economic risks.

Some procedures are common in the social construction of local knowledge. One of these is "accumulation," which makes possible the formation of knowledge through a process of trial and error. One farmer described it in this way: "One who studied, learns by studying. One who didn't study learns the hard way." The farmers justified the frequency of weekly and daily applications in much the same way. A standard became established at the level of local knowledge which achieved what the farmers determined to be the best possible results. In this regard, the distance between what was recommended by the agronomists and the effective practices of the farmers is very significant. It is difficult to find farmers applying just one product on the areas of most intensive production, and they justified this practice as labour saving. A second rule observed is that of "association." For example, the practices concerning pest and disease control in tomato plants can be extended to other crops. The same process of transference occurs between the knowledge that the farmers have about the use of fungicides, to the use of insecticides and vice versa. Another rule that fundamentally influenced the diffusion of knowledge acquired in combination with the other two procedures is that of "imitation", which is observed especially in the use of pesticides. For one farmer, "everything is copied from one thing to the other." The results are not always recognized as effective, but this does not stop the practice being widely followed. Other knowledge spread by imitation is the association of the effects of an insecticide used by veterinarians for mites, to the combat of a tomato pest. There is no formal study or technical advice concerning such use, but one farmer decided to experiment and other farmers evaluated the result as positive (for another type of experimentation, see Ploeg 1993b).

PERCEPTION OF HEALTH RISKS

The tensions between farmers and experts also permeate perceptions of risk. Farmers were asked if they had information on how pesticides should be used, and the dangers involved. The answers can be grouped as follows:

1) *The technical recommendations that the farmers claim to be acquainted with and which are being respected*. The interviewees claim not to disregard the rest period between pesticide applications, although most of them claim that "other" farmers do disregard such recommendations. This practice is emphatically considered as socially irresponsible, which shows that farmers know that pesticide applications should be done in a less intensive way because of the risks to the health of the consumers. Around 20 percent of farmers indicated that they were concerned about the effect on their production of measures for stricter control on the quality of the water from the river, following public debate on this issue. These issues are important because they relate to what the farmers know about risks - the information they have - and what they considered themselves at least obliged to mention in their interviews, even though their actual practices and beliefs might be far removed from this discourse.

2) *The technical recommendations that farmers claim to be acquainted with and which they know are being neglected*. Examples of this include the disposal of used plastic and glass pesticide containers in the river, failure to vary spraying according to the weather conditions, and a failure to use safety equipment. It is at this level that a significant tension emerges between the knowledge of the technicians and that of the farmers, in terms of understanding the rational and safe use of pesticides (this issue is considered in more detail below).

3) *The technical recommendations with which farmers are demonstrably not acquainted.* These include the dangers from dermal penetration of pesticides, the need for regular control and adjustment of spraying equipment, and knowledge of any alternative practice that could allow a reduction in pesticide use.

From these responses, it is clear that farmers have some information about pesticide risks. So, why they do not conduct safer practices? One answer relates to the lack of trust in the information sources, as noted earlier. Another answer has to do with the risks themselves. For many farmers there is not enough evidence to confirm the existence of risks. They argue that if the risks were "real," these would have already resulted in their own and other farmers' deaths. In other words if a farmer has handled pesticides without any harmful consequences that he could relate to pesticides, he draws the conclusion that they are not hazardous. If nothing has happened to him so far, nothing will ever happen in the future.

Cases of poisoning, dizziness, vomiting, headaches, are not considered harmful, and are symptoms farmers believe they have to put up with. Those symptoms are incorporated as part of "normal" daily conditions. When they occur, the farmer simply waits for them to pass, usually without going to the doctor, because he considers their cause is known. The body is not an object of everyday concern to the farmer, because disease will manifest itself as such only when it prevents him from working in the field. Health is very much appreciated by the farmers, but it is an abstract category that occurs as a natural gift, not necessarily as something that is conquered through care and prevention. Going to the doctor because of pain or illness is usually a last resort, and is not pursued as long as the body can work. If the symptoms last for more than one day, the farmer may go to a doctor and stay in the hospital for a couple of days. The presence of these occasional symptoms is not enough to stop using pesticides. However, it was possible to observe a more frequent use of protective gear among the interviewees who had already been to the hospital and who continued to have a direct contact with pesticides.

Risks are thus ruled out because they are abstract, remote and invisible. Much the same is true of diseases, which can appear in the long run because they tend to evade perception. The possibility of preventing diseases caused by the cumulative use of pesticides is not - and cannot be – considered, because farmers have only a remote idea of such problems. The absence of visible health problems reinforces the farmer's reliance upon his strength and on the idea that pesticides are not as dangerous as they are claimed to be by the technicians. There are even local anecdotes that refer to farmers who try to commit suicide with highly toxic pesticides, yet apparently suffer no serious problems.

Only a limited group of farmers defined the dangers from pesticides as "real" but non-existent if the recommendations were followed. However, risks were restricted to highly toxic pesticides or those that were sold in the past. In general, the farmers tend to evaluate what was said about risks as an exaggeration: "What they [the technicians] say makes it seem like a volcano," said one farmer.

The widespread denial of any serious risk originates in the way farmers deal with pesticides, and can be considered as an adaptive strategy which enables farmers to carry on with their work routine. For the farmers, the adaptation to risks is a fundamental pre-condition to continued production according to a strategy aimed at maximizing results. The dangers are partially known, but thinking about them could interfere negatively in the labour process. In the psychopathology of work, similar attitudes have been observed in other risky jobs. Dejours (1987) for example, has described how workers in civil construction in France do not usually adopt minimum measures of security, even though these are close at hand. In this way, workers neutralize risks in order to allow completion of tasks while diminishing anxiety; in Dejour's words, they adopt a kind of "defensive occupational ideology".

Therefore, denying the risks involved is a necessary and appropriate adaptive strategy. By not following the recommendations for handling pesticides, farmers are, to a certain extent, provoking risks in order to prove their resistance, and to confirm that danger exists only for those who want it or are not strong enough to withstand it. Adaptation to risk is efficient as long as it reproduces itself as a collective process, shared by farmers in the region. Each social actor finds in his neighbour a mirror image confirming his own experience, and it is unusual for them to discuss among themselves accidents or problems related to risks. In other words, following the recommended safety measures would imply an acknowledgment of the danger that is to be neutralized and remind farmers that danger exists, but this would only serve to make tasks more difficult and laden with anxiety.

This minimization of the possibility that something harmful may happen during the daily exposure to risks, is a way of bringing it under control. According to Douglas (l994), this is related to a "sense of subjective immunity", which is expressed as the ability to expose oneself to pesticides without suffering - at least immediately - any harm. Such "resistance" tends to be interpreted as proof of strength and masculinity. As spraying is typically a male job, the way a farmer deals with pesticides has a central role in establishing a masculine identity. "Being a man" requires, in addition to intrinsic resistance to the effects of pesticides, that the farmer is not afraid to face possible risks. Those who use protective equipment are, therefore, subject to facetious remarks from their peers, who regard them as being "womanish," or "not man enough" and are accused of "chickening out."

Notwithstanding the widespread belief that health problems affect just a small number of farmers, how are these cases assessed? I found three non-exclusive types of explanation. One of the most frequent explanations is that the contaminated person (whether seriously ill or not) is responsible for neglecting, abusing and disregarding recommendations. The victim is to be blame for making a mistake. Pesticides themselves are not criticized.

There is another type of explanation for cases of contamination of farmers who have followed what they consider to be proper recommendations. Contamination is attributed to the individual characteristics of the victim: allergies, "weak blood" and exposure to pesticides since childhood. The problems are not caused by pesticides themselves, but depend on the physical structure of the individual. Blood is referred to as the centre of vital strength and blood diseases are considered to be the main cause of weakness and susceptibility to pesticides. Underlying this is an association between those who are resistant to pesticides and physical strength. Farmers who believe they do not have a weak condition deduce that they can even prepare pesticide mixtures barehanded, without harmful consequences. Such a practice is justified by farmers who not only regard themselves as strong, but who also tend to consider pesticides as weak, inefficient and even falsified in their formulas, compared to chlorinated hydrocarbons, defined as the "true pesticides." These farmers suspect that the representatives of agrochemical companies could be offering them products with expired validity dates, inappropriate mixtures and even inadequate products, in order to make a profit. Farmers are not completely wrong when they claim that some chemical inputs not very efficient, but this depends on the farmer's evaluation of "efficiency" of a pesticide. This is usually based on the assumption that if a product does not kill "everything" it is inefficient and not so dangerous. This possible ineffectiveness of the pesticide is not related to the resistance it could have generated in the pests, as will be analysed below.

The third type of explanation points to the possibility of getting poisoned by chance. A farmer can follow the minimal recommendations that are consensually defined as "precautions," he can even be strong, but he may not, nevertheless, be protected against fate.

For these different reasons, pesticides end up being "absolved" as a source of risk and, consequently, farmers tend to deny they are running risks because risks simply do not exist. Pesticides are part of the daily life of the field and, paradoxically, are converted into a kind of "natural" resource, obvious and unquestionable. The

name used among the farmers to refer to the pesticides is “remedy”, which reinforces the image of the pesticides as a resource which is “on their side” in the fight against the farmers’ natural “enemies.” When referring to pesticides, only a small number of farmers use the term “defences,” the official name used by the petrochemical industry, and only a very few use the term “poison.”

In summary, the adaptation to risks is socially shared among farmers and can be related to the need to keep a sense of ontological security, which guarantees the continuity of routines and everyday life as it is, and avoids anxieties (Giddens, 1991, 1992). Farmers did not want to talk about cases of contamination, showing in this way also another aspect of the adaptation to risk. According to Douglas (1985), this can be reinforced by a lack of memory regarding past accidents, because what is registered in memory can depend on social pressures. If risk is not collectively registered as significant, cases of contamination can easily be put aside. Another important aspect to guarantee ontological security is trust, in this case trust in pesticides.

MISTRUST OF EXPERT SYSTEMS

The statements of the sales representatives and of the farmers indicate that farmers in general preferred to continue using the commercial formulas already tested, avoiding experimenting with new products There is a double relationship established by farmers with pesticides, as part of what Giddens (l990, 1991) defined as abstract systems on the one hand, and with the technicians with whom the farmers have a direct social relation on the other. This relationship corresponds with the two processes described by Giddens (l990) as characteristic of modernity. The first refers to the plane of the “disembedding” of social systems, through mechanisms that remove social activity from localized contexts, reorganizing social relations over great distances in time and space, in which social commitments have no “connections established in circumstances of copresence” (Giddens, 1990: 80). The second corresponds to the position adopted by the farmers who defend their skills against the technicians, and is situated in the plane of the “reembedding” in which there is a reappropriation or redefinition of the social relations, or of knowledge and know-how, according to certain local conditions of time and place. The two processes do not develop independently. In spite of the tensions in the farmers’ relationships with the technical skills of experts, they keep trusting in technology itself and, therefore, the way the “reembedding” takes place does not threaten its continuous implementation

When I asked if pesticides are becoming less effective, the majority of the farmers expressed the view that the problem they have was related to the weak pesticides they were using. They “missed the good old pesticides,” such as DDT, which they considered to be much more effective. According to the farmers, the power of these pesticides still represents the symbol of efficiency when compared to the pesticides which are currently on the market. The positive returns which they associated with the more toxic pesticides, is a source of resistance to the adoption of the generally cheaper, less toxic pesticides, with focused and non-systemic effects, which have been on the market in recent years.

This dissatisfaction with the result of pesticides leads farmers to look for stronger pesticides in the black market, because these cannot be obtained in the regular market. The long-term effects of these stronger products on the agro-ecosystem are beyond the perceptive horizon of farmers, who consider only their immediate effects in the control of pests. The farmers do not have enough information on the environmental effects of pesticides, which differs from the situation observed in relation to health effects. Nevertheless, in relation to the information they did have, they still expressed disbelief about the environmental impacts of pesticides.

The main problem seems to lie in the socially constructed cognitive dependence on a pesticide’s effectiveness, plus a distrust of the sources of information. Farmers rejected the views of expert advises because the farmers felt that they had been considered as ignorant, and also because the experts did not bear any economic risk. Therefore, farmer’s risk perception cannot be characterized simply as a deviance from expert knowledge, to be transformed with the communication of more information. As Renn (1991) observed, the top-down communication of risks, which still permeates the extension agencies in Brazil even when more sustainable practices are being diffused, can be a central source of social distance between lay and expert people which can be hard to overcome.

DISCUSSION AND CONCLUSIONS

Through a case study among family farmers in Southern Brazil, I have discussed how the problems in the use of pesticide did not appear to reflect concepts of economic irrationality, ineffective instrumental strategies, reluctant adoption or lack of information. In the case examined here, farmers legitimise their pesticide practices by reference to two main benefits; firstly, from their point of view, pesticides are inputs that can be controlled in the fields by farmers (in terms of doses, brands, spraying frequency, mixtures, etc.), which emphasises their identity against that of the experts; secondly, pesticides are central tools for controlling the production process, through minimizing economic risks and maximizing production.

Hybridization of farmers' local knowledge in relation to pesticide use takes place in face-to-face situations, especially between farmers and technicians, and between farmers themselves, and can assume a broad spectrum of possibilities. It can include perverse forms of knowledge which are very distant from the parameters of sustainable practices. The recognition of these forms, in which farmers stress the benefits of pesticides while disregarding the health and environmental risks, is a necessary step towards establishing strategies to change the intensive and dangerous use of pesticides. As the case study reveals, a top-down communication of risks is not effective because it implicitly situates farmers as ignorant or passive social actors, without the capacity to choose and take decisions (Guivant, 1998; 2002a; 2002b). That is, farmers are considered as social actors without agency. Risk communication also needs to consider the relationship between farmers and experts, be they salesmen, rural extension agents or the institutions they represent, which make communication difficult because of the past and present tensions and conflicts.

A different approach to communication of risks is central in participatory methodologies for rural sustainable development. And at this point it is possible to establish a connection between some of the recent literature on rural development and that concerened with cultural risk analysis. The cultural framework demonstrates how people's beliefs change very slowly, even when they are confronted with contrary evidence (Slovic, 1995; Douglas, 1994) or when they are dealing with risks of high consequences which are not immediately obvious (Beck, 1991). One important conclusion for participatory methodologies is to start with an understanding of farmer's risk perception, their hybrid local knowledge, and the power and conflicts that are present in the relationship between farmers and experts. For example, it would seem to be necessary to take into consideration the masculine values involved in pesticide use. In this regard, information related with the effects of pesticides on sperm reduction and consequently on sexual reproduction can be more efficient than the communication of the long-term risk of cancer.

But the establishment of different parameters for participation and communication of risk is not an easy task for extension agents or representatives of NGOs working in rural areas. First, they may be resistant to the fact that farmers are not eager to change, that they have their own rationalities, and that the proposals made by external agents are not seen by farmers as obviously better. As Pretty (1995) suggests, sustainability needs to be considered as a ongoing and open learning process, which includes all the social actors involved, and eschews ready-made solutions. This process demands that the experts take a critical perspective in relation to their own values, perceptions and knowledge (Reijntjes et al, l992; Cornwall et al. 1994). Second, development and rural extension institutions need to be permeated by a participatory decision process, open to the formulation of programmes, strategies and goals in collaboration with the farmers. Third, public policies are necessary to stimulate the transition to an agricultural system which relies less on external inputs, and which also monitors more effectively farmer's practices, and enforces the existing laws in relation to pesticide use.

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