

INTRODUCTION

The second issue of Volume Ten (2002) brings together papers from international authors from Brazil, the United States of America, Mexico, the United Kingdom and New Zealand. This issue consists of five papers that encapsulate a variety of especially-relevant issues - including the agro-food system, fair trade, globalisation, biotechnology and food safety.

John Wilkinson, in the first paper, argues that the examples of genetically modified organisms (GMOs) and organics call for a critical reappraisal of demand and consumer theory as applied to agro-food studies. There is evidence of 'contested dynamics', with new players emerging in the agro-food system.

Following suite, *Aimee Shreck* focuses upon a case study of a certified banana-producer group and suggests that production for the Fair Trade market can provide much needed material benefits, strengthen producer organizations, and create market access for Fair Trade partners.

María del Carmen Hernández and *Carlos J. Maya* critically evaluate and review globalisation and pork raising in Mexico in light of the challenges of world market integration.

Vivien Walsh argues that past analyses of biotechnology have tended to come from the 'supply side'. In this paper, Vivien examines the demand side, focusing upon GM foods and the creation of what she terms a 'selection environment' in which biotechnological innovations are examined and ultimately approved/rejected.

Finally, *Megan McKenna* and *Hugh Campbell* review various attempts by New Zealand's apple industry to address the issue of 'food safety' and 'global market protection' in the fresh fruit and vegetables complex. Green food discourses – along with deregulation – have helped to shape regulation, production and bio-politics.

We take this opportunity to welcome and congratulate Manuel Belo Moreira as President, and Wynne Wright as Secretary Treasurer of RC-40, and also welcome the new executive committee members: Farshad Araghi; Salete Barbosa Cavalcanti; Mara Miele; and Yoshimitsu Taniguchi.

This issue of the *International Journal of Sociology of Agriculture and Food* is the second electronic edition of the journal (see <http://www.acs.ryerson.ca/~isarc40/>). Our sincere thanks are extended to: Janet Grice for her involvement in the production and publication of IJSAF; Marie-Christine Renard for kindly translating the author's abstracts into Spanish; Wynne Wright and Doug Constance for guest editing Aimee Shreck's paper which appears in this issue; and finally, to the authors for producing and maintaining insightful and critical debate in the sociology of agriculture and food.

Editorial Collective: Amy Cutter-Mackenzie (Editorial Assistant) and Co-Editors Farshad Araghi, David Burch and Geoffrey Lawrence

GENETICALLY MODIFIED ORGANISMS, ORGANICS AND THE CONTESTED CONSTRUCTION OF DEMAND IN THE AGRO-FOOD SYSTEM

John Wilkinson*

Agriculture and Society Federal Rural University, Rio de Janeiro

INTRODUCTION

Over the last two decades, from different disciplinary standpoints, the category of consumer has increasingly assumed analytical ascendancy over that of producer. For many cultural analysts, consuming rather than producing is now seen as the source of identity construction (Featherstone 1991, Bauman 1998). The politics of privatisation, in turn, has been fuelled by concepts of market democracy and consumer choice/sovereignty (Keat, Abercromby and Whiteley 1994). In economics, the market segmentation and flexible specialisation literature has viewed the mobilisation of rapidly changing demand as the key to economic growth (Piore and Sabel 1984). For its part, the innovation literature, both in economics and sociology, has increasingly focussed on the active role of the end-user (Lundvall 1988, Walsh 1996).

A similar attention to demand and the consumer in agro-food studies initially led to the identification of a shift downstream in the relative share of value added, which favoured the final foods industry *vis-à-vis* interests tied directly to farm inputs, production and processing (Bombal and Chalmin 1980, Audroing 1995). Greater attention was then given to the role of modern large-scale retailing which, it was argued, had assumed a dominant economic position in the food system as a whole (Filser, Garets and Paché 2001). Unlike the other economic actors in the food chain, the retail sector was seen to have no vested interests in specific commodity systems and was analysed as being uniquely oriented to the mobilisation of demand as the condition of its own growth (Fanfani et al. 1990, Marsden and Wrigley 1995).¹ The notion of a demand-oriented food system, therefore, captures not only the idea of a shift in economic power to actors directly involved in the promotion of final consumer demand but also the idea of an increasing subordination of the different phases of intermediary demand to those of the final consumer. The farmer must harmonise his interests with the processor who in turn must adapt to the food industry's demand for new ingredients, and all must attend to shifts in final consumer demand.

However, the current efforts to introduce genetically modified (GM) foods would seem to challenge this view of an increasingly demand-oriented agro-food system. Their principal promoters are upstream agrochemicals firms following explicit 'technology push' strategies, or strategies which, at most, are directed to demands at the farm level without taking into account their implications for the final consumer. While Monsanto has been the leading force here, the same strategy has been adopted by the other contenders in this increasingly global and oligopolised upstream sector, including Syngenta, Aventis (now Bayer) and Du Pont (Fulton and Giannakas 2002). In the US, the final foods and retail sectors have tended until now to absorb this new technology, and there was a similar initial response in Europe (Harvey 1999). However, in Europe, later opposition from consumer associations and then from the customer, captured by opinion polls and supermarket surveys (Durant et al. 1998) in a climate clouded by a sequence of confidence-sapping panics, led retail and final foods firms to distance themselves from genetically modified organisms (GMOs).

This contrasting response by differently positioned leading actors would seem to accurately represent their respective distances from the final consumer, with upstream actors being immune to differing final consumer responses while the retail sector and the food industry adjust their strategies to meet perceived consumer preferences. Nevertheless, the tenacity of the drive by the agrochemical company lobby to impose GMOs in countries and regions where opposition has crystallised into regulatory restrictions, suggests that these upstream actors exert greater economic power within the agro-food system than is suggested by the 'downstream shift of value added' thesis referred to earlier. We will argue that the case of GM foods also suggests that these same actors are able to mobilise powerful alliances outside the food system, particularly in sectors of the Government apparatus and the scientific community.

On the other hand, the unprecedented mobilisation against GMOs, most notably in Europe, Brazil and India (but assuming a global profile in the Seattle WTO negotiations), points not so much to a food system "oriented to demand" but

* Direct all correspondence to John Wilkinson, Centre for Graduate Studies in Agricultural Development (CPDA), Department of Development, Agriculture and Society Federal Rural University, Rio de Janeiro. Email jwilkins@uol.com.br. This paper is based upon a paper presented to the Symposium: "Agricultural Technology, Society and the Life Sciences" X World Congress of Rural Sociology, Rio de Janeiro July/August 2000. My thanks to the participants of the Symposium and to colleagues at the CPDA for their comments on the paper and especially to Julia S. Guivant for our many discussions of these themes and her constructive criticism of an earlier version of this article.

¹ As the supermarkets make a greater commitment to own brands, however, they also take on board more manufacturing interests, although often this strategy is pursued through outside contracting.

rather to the emergence of new actors representing consumer interests, who are challenging the historical position of producer associations in the definition of policies and the design of a new regulatory framework for agro-food. The renaming of the Germany Agricultural Ministry as the Agriculture and Consumer Protection Ministry is perhaps, the most striking indication of this shift. In their turn, these movements find support in the individual or day-to-day practices of more “reflexive” and questioning customers involved in an unending process of “food learning”.

At the other extreme, the 1990s have seen a major expansion in the demand for organic food, and although this has occurred largely at the margins of the dominant agro-food system, nevertheless the leading players have been forced to respond to this shift. While the radical potential of biotechnology for reorganising the agro-food system was identified almost simultaneously with its birth (Kenny et al. 1982, FAST 1984), there were no prospective studies which forecast the growth of organics from a niche into a mainstream activity, which provoked the dominant players into a major revision of their strategies. Since the late 1980s, large-scale farmers, food industry and retail interests have had to reposition themselves to exploit the potential of this unexpectedly dynamic market (Buck et al. 1997). Nevertheless, the definitional frontiers of organics are still in dispute and constantly threaten to spill over into less assimilable meanings: agroecological production systems, non-GMOs, animal welfare, social justice, family farming, sustainable agriculture (Guthman 2001, Lockie, Lyons and Lawrence, 2000)

The unexpected responses to GMOs and organics point to the need for a rethinking of the way demand is negotiated within the agro-food system, and this article is intended as a contribution in this direction. We will argue that both GMOs and organics represent a challenge to the view of a continuing shift of value added, and consequently of economic power, downstream in the food chain. In addition, we will show how both these developments draw attention to the increasing importance of events and actors outside the food system itself – expert systems, the scientific community, various government bodies, the medical professions, the media, NGOs – for defining the dynamic of food consumption. Social practices and identities – social and family networks, race, ethnicity, class and gender – are also crucial in defining food consumption options, but we will be primarily concerned in this article with identifying shifts in the relative weight of formally constituted interest groups and organisations.

Our analysis therefore, focuses primarily on: 1) the way demand is constructed within the food system; 2) the new alliances being established between leading agro-food actors; 3) the way in which food consumption practices have become a key focus of interest for strategic actors outside the food system; and 4) the ways in which the supply end of the agro-food chain is able to mobilise powerful new patterns of support both inside and outside the food system.

AGROBIOTECHNOLOGY: PARADIGM LOST?

Research into the application of genetic engineering to agricultural crops coincided with the commodity price crises of the early 1970s which marked the end of the long period of post-war growth. The revolutionary potential of this new technology was immediately recognised and it was seen as offering unique conditions for a renewal of the Fordist growth model through the provision of alternatives to petroleum-based energy and to a protein food regime based on intensive livestock. Biomass, it was thought, could break the OPEC stranglehold and single-cell proteins could similarly short circuit the seemingly impossible equation of a global transition to a protein diet based on animal re-conversion (Byé and Mounier, 1984)

The academic scientists responsible for the breakthroughs in gene transfer technology quickly launched agrobiotechnology start-up firms and reinforced the revolutionary image of biotechnology in their efforts to attract venture capital. The mass media confirmed this vision, which was captured most expressively in a *Time* magazine cover photograph of agricultural workers at a GMO field trial site dressed in the equivalent of space protection uniforms. The leading agrochemical firms which had assumed a dominant position in the agro-food system - both upstream and downstream - gave full support to this new wave of innovations, by financing company start-ups and moving into the seed sector (Kenny 1986).

The 1980s saw a cooling of enthusiasm in government circles as high costs undermined the perspective of alternative biomass energy routes. Venture capital funds also became nervous as longer than expected time-horizons to market led to increased costs and diminished the expectation of returns. By the late 1980s and early 1990s, as the first products came closer to market, scientists and business adopted a more cautious strategy. ‘De-dramatisation’ was the order of the day with the revolutionary character of genetic engineering being played down in favour of an emphasis on continuities with time-old genetic improvement and fermentation practices (Buttel 1993). Consumer surveys were already identifying warning signals - in Japan, genetic engineering was placed on a par with nuclear technology in terms of risk perception, while in Germany “Down with Genetic Engineering” slogans appeared on *autobahn* bridges. Food industry leaders captured these negative signals, particularly with regard to the use of genetic engineering on animals (Sorj and Wilkinson 1992)

In the late 1990s, NGOs and consumer organisations in Europe positioned themselves against genetic engineering for reasons which varied from the defence of peasant and small farmer interests, to bio-diversity, environment, animal welfare, ethics and consumer health issues. In the face of such opposition, at least one of the world’s leading food firms considered guaranteeing non-use of GMOs, but at that time the appropriate “identity kit” technology to enforce such a claim had not been developed (Sorj and Wilkinson 1992). Field trials of genetically engineered plants were later divulged on the internet and became systematically threatened with protests and sabotage.

When the first genetically engineered seeds came to market in the mid-1990s, the Fordist era had given way to the “economics of quality”, and food marketing in Europe became heavily identified with appeals to nature, health and tradition (AgBioForum 1998). Significantly, it was at this time that large supermarket chains committed themselves more intensely to the promotion of organic foods. By way of contrast, marketing of the first biotechnology seeds in the US was carried out by agrochemical multinationals, based on agronomic virtues and directed to farmers of commodity crops. Nothing could be further from the new profile of food demand in Europe, the US’s major export market. That the seeds were rapidly adopted by US farmers derives from the pattern of economic co-ordination prevailing in commodity markets, where traders and futures markets shield the agricultural producer from direct contact with the food industry and the consumer.

With no compelling virtues, genetically modified foods presented risks which were difficult to justify in Europe at a time when confidence in the industrialised food system and its scientific expert systems had been repeatedly shaken by listeria, salmonella and “mad cow” scares (Guivant 2001). This widespread consumer mistrust in Europe combined with vigorous NGO activism at first met little resistance in political circles, which saw that there were even some advantages to be gained from opposition to GM foods; domestically, such opposition meant that there was less pressure on the production of surpluses, while internationally, domestic opposition could be used as a bargaining weapon in trade negotiations. In addition, many farmers, for their part, were now increasingly identifying their interests with the development of quality markets rather than simply increasing output.

There is a growing literature on the different responses to GMOs, especially in the case of Europe and the US, but a similar analysis could be extended to India, Brazil, Argentina, China, Australia and Japan (AgBioForum 1998). The apparent lack of opposition to GMOs in the US has been attributed both to cultural factors, such as different views of agriculture and nature, and/or institutional factors, such as the authority of the Food and Drug Administration (FDA) and the weakness of NGOs. Evident differences of interest could also be adduced, such as the fact that US export farmers competing on world markets have traditionally welcomed technology which promised increased productivity and/or lower costs.

In Europe, many observers see current opposition to GMOs as a ‘teething problem’, or as an early phase of a new technology which can be overcome by a repositioning of GMOs in the direction of quality enhancing criteria, for example, through the integration of GMOs into the broader category of nutraceuticals (Joly and Lemarie 1998). In the US, on the other hand, increased opposition to GMOs is predicted to emerge, as agronomic claims are called into question and as the authority of the FDA comes under increasing scrutiny, for example, as a consequence of its “revolving door” policy (involving a continuous movement of personnel between government and industry), or its widely rejected proposals on organic food regulations.

While GMOs are popularly identified with Monsanto and are currently associated with only a few (mainly animal feed) crops, the agrochemicals/seed industry as a whole (both private and public), is committed to the application of genetic engineering, which is now being extended to food crops, including wheat, rice, fish and meat products. FDA data have identified the marketing of forty genetically engineered or ‘novel’ food crops, which include potatoes, tomatoes, chicory, papaya, melon, squash and linseed. In addition, it must be remembered that the soybean is the principal genetically engineered crop and soy-based products, as protein or functional ingredients, are to be found in an extremely wide range of industrialised foods. Second and third generation biotechnology products in the forms of speciality and therapeutic crops are being actively researched and tested in leading laboratories across the globe from Scotland, to Australia, China and the US. Both national and international public agricultural research systems (associated with the Consultative Group on International Agricultural Research, or CGIAR) are actively committed to exploring the application of genetic engineering and genomics to an increasingly wide range of crops.

Cultural and institutional factors must clearly be taken into account when analysing responses to GMOs, but it is not clear that a direct causal relation can be established between these variables and opposition or support for GMO’s. The US gave rise to a strong movement against using the genetically engineered bovine somatotrophin hormone (also a Monsanto product) in milk herds, and at the Asilomar Conference in 1975, its academic community established a moratorium (albeit short-lived) on genetic engineering research (Kenny 1986). On an institutional level, respect for the FDA in the US did not extend to acquiescence when this body tried to include GMO’s as permitted ingredients of organic food. In Europe, on the other hand, the many factors adduced to support the rise of an anti-GMO movement have not deterred the European Commission from adopting an increasingly determined stance in favour of ending restrictions on GMOs (see below).

ORGANICS: FROM PROTRACTED BIRTH TO EXPLOSIVE GROWTH

In earlier analyses, we have argued that, historically, the modernisation of agriculture took the form of the appropriation of different phases of the rural production process and their transformation into industrial inputs and machinery (Goodman, Sorj and Wilkinson 1987). On-farm sourced organic nutrients were replaced by synthetic fertilisers, and techniques of biological control gave way to insecticides, fungicides and herbicides. Organic agriculture therefore, represented the antithesis of the upstream inputs industry and also posed a fundamental challenge to the food industry. The organic movement was heavily identified with non-processed products whereas the food industry relied increasingly on the use of

synthetic additives to facilitate large-scale processing, restore taste and appearance, and preserve the final product. Organics, therefore, when not specifically identified with agricultural products, were associated with artisan food products.

The industrialised agro-food system, however, never fully replaced agriculture as a natural production system, permitting the latter to be both a potential competitor and a normative reference for quality (Wilkinson 1993). Organic agriculture persisted and took on an increasingly organised form on the basis of life-style groups in which production and consumption form an integrated circuit. Organic producers, together with committed "representative groups" (largely NGOs), consolidated farming practices on a decentralised basis, which were transformed into collective learning with the establishment of national and international networks. For example, the International Federation of Organic Agricultural Movements (IFOAM) was created in the early 1970s when certification also began to be systematised (Raynolds 2000).

In the 1980s there also emerged an affinity between organics and a diverse range of concerns around issues of health, environment, food processing, food safety, market segmentation and so on. As a consequence, this sector came to provide an alternative focus for the diffuse and pervasive anxieties created by the industrialised agro-food system (Fonte 1999). In Europe, between 1985 and 1995, the area cultivated to organics increased from 100,000 hectares to almost 3 million hectares, and similar developments are evident on a global basis, in the US, Japan, Poland, Australia, Uganda, Mexico, Argentina, Brazil (Lampkin 1999, Marsden 2000, Geier 1999). This widespread adoption of a productive system which emerged and developed on the margin of the industrialised agro-food system is the obverse of the equally massive rejection in Europe of a powerful transnational productive base in the case of GMOs.

There is no doubt that this shift of organics from niche to mainstream has depended on the entry of key actors (large-scale farmers, supermarkets, government agricultural policymakers) as has the shift from acceptance to contestation in the case of GMOs. This convergence of different actors, however, was only effective in transforming the scope of demand because of the long term, incremental accumulation of collective learning practices on the margin and in opposition to the industrial agro-food system. The force of this movement can be gauged in the (selective) adoption of organic strategies by the leading final food industries, such as Nestlé, Danone and MacDonalds. The tensions created by organics can best be illustrated by the decision of one of the world's leading transgenic seed producers to exclude GMO corn from its baby food products. In response to pressure from Greenpeace, Novartis, the owner of Gerber Products Company which specialises in baby foods, declared that it would no longer use genetically modified ingredients in its food products not only in Europe but throughout the world, and particularly in the US where its sales of baby food reach US\$700 million annually. According to the Wall Street Journal article which reported this issue:

"Gerber, going even further than what Greenpeace demands, plans to use corn flour and soy flour that are "organic" – that is, the crops not only aren't genetically altered, but they are also grown without the use of any insecticides or herbicides. Then, if the technicalities can be worked out, it plans to change ingredient labels on certain baby-food boxes and jars to include the word "organic". 'I want our mothers to be comfortable', says Al Perigallini, president and chief executive officer of Novartis's U.S. consumer health operation, which oversees Gerber.' (Wall Street Journal, 30 July 1999).

After the fusion of its seed activities with AstraZeneca to form Syngenta, Novartis is now the world's leading seed firm and second only to Monsanto in its promotion of GMOs. (ETC Group Communique 2001)

THE DUAL CHALLENGE OF GMOS AND ORGANICS

GMOs and organics therefore represent polar opposites in the study of demand in the agro-food system. The former was adopted at birth by hegemonic players and integrated into the dominant paradigm of the agro-food system, only to be opposed by the increasing political and organisational capacity of new actors emerging around the demand end of the system. Organics arose outside the organised agro-food system and was sustained over decades at the margin by committed farmers, NGOs and consumers. Coinciding with new sensibilities concerning food and health, it expanded rapidly in the 1980s on the basis of direct farmer/consumer sales circuits. Demand took off and organics moved from niche to mainstream status with its adoption by key downstream actors, aided by post-productivist public policies for agriculture and rural development. Both examples provide a radical challenge to uncritical notions of the move to a demand-oriented food system.

In the following sections the focus is on three areas which can contribute to a clearer understanding of demand formation in agro-food. The first of these concerns the way in which important changes in the organisation of the agro-food chain, particularly the reversal of trends to vertical integration, have facilitated a recognition of the differing interests at work among the leading economic actors. The second draws attention to the evolution of public regulatory and normative practices regarding food, and particularly to the way in which state dietary recommendations have increasingly distanced themselves from the interests of the industrialised food system. And, finally, we show how the economic power of upstream actors has been strengthened by new alliances inside and outside the agro-food system, in spite of the dominance of demand-focussed actors within the food chain, particularly large-scale retail outlets, and the increasing political weight of civic actors defending consumer and citizen rights.

INNOVATION AND DEMAND STUDIES IN AGRO-FOOD

The adoption of advanced biotechnology strategies by leading agro-food players led to the incorporation of neo-Schumpeterian innovation theory into agro-food studies which focussed on the emergence of a new supply-based

technology paradigm (Ducos and Joly 1986). At the same time, however, a transition in food consumption patterns in the industrialised countries from the 1970s promoted new lines of research on food industry strategies (product differentiation and market segmentation), and particularly on the emergence of new actors articulating demand (large-scale retailing). These two research programmes - the former highlighting technological innovation in the upstream industries and the latter organisational innovation downstream - reflected tensions emerging within the organisation of the agro-food system (Fanfani et al. 1990).

The classical agro-food chain analyses had argued that the increasing sophistication of the food system, or the successive addition of value in post-farming activities, had resulted in leading actors adopting strategies of vertical integration, moving along the food chain from supply to demand. Cargill was a classic example of this tendency, starting as an upstream supplier and trader and advancing along the meat and grains chains to the point of producing prepared frozen foods (Bombal and Chalmin 1980). No producer firms, however, showed themselves capable of moving into large-scale retailing, and the emergence of this latter sector to a hegemonic position (combined with the increasing liberalisation, deregulation and globalisation of agro-food markets) led to a strategy of re-focussing around "core competencies", identified with the major "stages" in the agro-food chain. This was then accompanied by horizontal rather than vertical integration, involving an increasingly wide range of products traversing individual commodity chains, but involving similar economic activities and competences. International oligopolies have now emerged around seeds, trading and primary processing, final foods, and retailing. Unable now to migrate along the food chain appropriating the evolution of value-added, leading firms anchored around its major stages try to impose their competitive advantage on the overall system – through GMOs (in the case of agrochemicals companies); through a recycling of the commodity system (by primary processors); through highly industrialised brand products (for final foods producers); and through own-products and demand-articulated supply systems (in the case of the retailing sector).

Whereas vertical integration tends towards the diffusion of homogeneous values, the current retrenching of oligopolies at different strategic axes of the food chain creates a proliferation of often conflicting value systems, exposing the varied "worlds of production" of convention theory which compose the agro-food system (Salais and Storper 1993). Industrial, market, domestic and scientific appeals to legitimation compete for consumer loyalty, revealing the sectoral economic interests behind what were previously considered to be common values. While the earlier vertically-integrated industrial agro-food system tended to spawn only minority opposition groups, the current conflicting and competing values of the leading agro-food players are propitious to the development of a more generalised dissatisfaction.²

This latent discredit has been activated both internally by the strategies of new retailing interests (e.g. the development of own products and the sourcing of niche, artisan and organic products from outside the mainstream suppliers), and externally as a result of the spate of food scares. The originality of retail strategy has been its ability to base itself on the promotion of a reflexive consumer participation. The sunk-costs of other agro-food sectors prohibit such a flexible interaction with consumer demand, whereas retailing has been able to introduce the just-in-time and tailor-made producer-consumer model within the food system precisely because it lacks specific assets (either material or knowledge based) in productive activities. As a result, the consumer has emerged as the major new actor in the food system, and inducement of consumer behaviour is increasingly combined with, and subordinated to, knowledge of consumer behaviour as the key to competitive advantage.

PUBLIC REGULATION, NORMATIVE PRACTICES AND CIVIC REPRESENTATION

Large-scale retailing may have been responsible for the "endogenisation" of the consumer as an actor in the agro-food system, but in the language of convention theory, along with the consumer, it is the civic world of justification of economic action which is introduced into agro-food and begins to have a decisive impact on strategies and policies (Boltanski and Thévenot 1991). Government and increasingly influential civic associations compete with the supermarkets for the representation of the consumer-citizen. Civic associations play a key role both in focussing the enemy (chemical inputs and ingredients, animal cruelty, transgenics and environmental damage), identifying alternatives (organics, socially and ecologically correct products) and pressurising both Government and leading agro-food actors.

In all countries, the Government for its part has been a decisive actor in the construction and maintenance of the industrialised agro-food system, from R&D and extension services through to financing and regulation. More than this, it has legislated the definition of different food products, thereby creating the conditions for outlawing and punishing adulteration. This legislation was complemented by hygiene and sanitation measures appropriate to the increasing separation in space and time between production and consumption of perishable goods. All these measures can be seen as reinforcing the industrialisation of the food system and even more as consolidating its oligopolisation, since only medium

² In agro-food studies, the commodity chain (Goldberg 1968, Friedland et al. 1981) and *filière* (Malassis 1979) analyses increasingly gave way to actor-network approaches (Long and Long 1992, Murdoch 1995) which were better able to capture the articulation of heterogeneous actors in the journey from farm to table. Convention theory, for its part, while it incorporates much of the actor-network approach, provides a more structured typology of the location of different interests and values (Wilkinson 1997, Murdoch et al. 2000). In the economic literature "cluster" and "local systems" and "industrial district" approaches have all tried to compensate the limitations of *filière* style analyses.

and large-scale operations could adapt to the costs of hygiene and sanitation requirements. This “hygienic regulation”, to use Marsden’s expression (Marsden 2001) has been reactivated in England in the wake of the foot and mouth outbreak.

Governments, however, also relate to the food system from a public health perspective. In the early years of this century in the industrialised countries, and still so in underdeveloped countries, the key problems identified were those of adequate access to food, which may be interpreted as being compatible with the profile of the modernised food system. However, a change emerges from the 1960s and 1970s, when public health concerns came to question the nutritional basis of modern diets. Nutritional science emerged in symbiosis with the modern food system, but its application to issues of public health brought it into increasing conflict with the dominant post-war trends in industrial food production (Mennell, Murcott and van Otterloo 1992). From the 1970s, dietary guidelines were established in most industrialised countries, supported by international bodies such as WHO and the FAO. These focussed on the diseases of affluence, such as overeating, and campaigned for a reduction in the consumption of sugars, fats and salt. Initially directed at individuals, these guidelines became transformed into national objectives in the 1990s. In addition to identifying as “killers” the fats and sugars which have been central to the industrial food system since its birth, the guidelines consistently favour less processed foods and extol the virtues of fruits and vegetables (Tansey and Worsley 1995). Since the 1980s, therefore, a public consensus has emerged, which views the industrialised food system as questionable in health terms. In this context, food panics can rapidly transform such latent dissatisfaction into alternative consumer demand patterns.

AGROCHEMICALS AND NEW ALLIANCES INSIDE AND OUTSIDE THE FOOD SYSTEM

If the anti-GMO movement finds strong support from tendencies both inside and outside the food system, this is no less true of the agrochemicals and genetic inputs sector. We have adduced four factors which help to explain the twin phenomena of opposition to GMOs and support for organics: 1) the normative role of “naturalness” for industrial food quality; 2) the economic strength of food sectors whose strategies are based (not unambiguously) on the negotiation of consumer demand; 3) the public sector, and the academic, nutritional and medical communities’ prescriptions on food and health; and 4) the emergence of new actors representing consumer/citizen interests (Guivant forthcoming).

Faced with this articulation of interests, the upstream and, until now, farmer-oriented strategies of agrochemical companies would seem to be weakly positioned. We pointed out earlier, however, how both GMOs and organics tentatively represented a reversal of the downward shift in value-added away from primary activities. Recent studies have identified the emergence of new strategic alliances spanning both agrochemicals and primary processing (and even the retail sector) for the production of speciality raw materials, based on patented genetic material, for which the final foods sector would have to pay premium prices and, increasingly, royalties (Heffernan 2001). Agreements between Monsanto and Cargill, between Novartis and ADM, the growth of United Agri-Products within the ConAgra complex, and Dupont’s Protein Technologies International (PTI) association with General Mills, all point in this direction. More significantly, Marks and Spencer, the British food retailer, has launched a line of products using PTI ingredients. These alliances are situated within the broader strategy of developing functional foods, for which advanced biotechnologies are seen to be a decisive tool (Wilkinson forthcoming).

Strategic sectors of the scientific community are also firmly behind the push to consolidate genetic engineering, and include the greater part of public national and international agricultural research systems, the molecular biology laboratories of the leading universities, and the burgeoning “expert system” of bioethics, largely created around and increasingly integrated into the life sciences industry³ (Elliott 2001). The privatisation and subsequent multinationalisation of germplasm banks and seed production has led to a greater inter-dependence and collaboration between the national agricultural research systems and the leading agrochemical/seed firms, and is responsible for an increasing share of contract funding. Many of the leading molecular biology laboratories are not only heavily funded by these global companies but a large part of their research programme is jointly elaborated with them. In its turn, the new bioethics community, which is responsible for monitoring life-science research and advising on relevant policy issues, is increasingly funded by the same global actors (Elliott 2001).

More important even than the support of these sectors of the scientific community is the adoption by governments of science and technology as the key to competitive strength in what the OECD refers to as “the knowledge-based economy” (OECD 2000). In this equation of science, technology and innovation with economic development, biotechnology comes a close second to, and in genomics is increasingly merged into, informatics. Given the relative concentration of informatics in the US, biotechnology is increasingly seen both in industrialised country competitor blocs (the European Union) and developing countries (Brazil and the Mercosul) as central to competitiveness in global markets (Wilkinson 2000). There is intense pressure in these blocs, therefore, on the part of key sectors of the state bureaucracy, to move towards a liberalisation of the marketing of GMOs:

‘In a strategy paper revealed yesterday, the Commission acknowledged that public concern over biotechnology was holding back its evolution in the EU. The paper sets out a 30-page action plan designed to overcome the problem by 2010. Europe’s biotech sector is currently worth just Eur7-8bn (US\$6.17.0bn), approximately a third of the US biotech industry. Concerns over the high-profile end of the sector, such as genetically modified food, have delayed consumer acceptance. The Commission clearly sees a business case for moving forward.

³ For a scathing account of US bioethics, see Elliott 2001

"Uncertainty about societal acceptance had stifled our competitive position, weakened our research capability and could limit our policy options in the longer term," the commission said in its strategy paper' (Just-Food.com, 24 January 2002)⁴.

Brazil's Green Paper "Science, Technology, Innovation" (Ministry of Science and Technology, 2001) reiterates a similar message and receives strong endorsement from the scientific community stimulated by recent indications of its international competitiveness in the cutting edge field of genomics (FAPESP 2001).

If we consider the bioethics community as a counterpart to the NGOs supporting the anti-GMOs alliance, we can see how the agrochemicals strategy is also firmly rooted in four key sectors, including also new alliances within the agro-food chain, important sectors of the scientific community and an increasingly influential sector of the state bureaucracy, particularly in those countries and blocs which have become strategic in their rejection of GMOs.

CONCLUSION

The monolithic character of the agro-food system has imploded in the 1990s, exposing heterogeneous interests organised variously around industrial, scientific, marketing, domestic and civic forms of justifying production and consumption practices. Its future profile now depends on the new alliances being formed both inside and outside the agro-food system. While the anti-GMO, pro-organic alliance would appear to be firmly based on the major tendencies detected in food markets (quality, naturalness, health), agrochemical interests are contesting these spaces through the development of "functional" alternatives and have fundamental support in the state bureaucracies identified with economic growth and competitiveness, now also couched in the language of ecology and sustainability. Given the strength of each coalition, polarised opposition will probably give way to a negotiated co-existence, with priorities shifting to the development of traceability and identity preservation production systems, a tendency already in evidence in private initiatives in the United States and at community level in the European Union.

REFERENCES

- AgBioForum.1998. *Public Acceptance of Ag Biotech*. Vol 1, No 2. <http://www.agbioforum.org>
- Audroing, Jean-Francois. 1995. *Les Industries Agro-Alimentaires*. Paris: Economica Editions.
- Bauman, Zygmunt. 1998. *Work, Consumption and the New Poor*. London: Open University Press.
- Boltanski, Luc and Laurent Thévenot, 1991. *De la Justification*. Paris: Gallimard.
- Bombal, Jacques & Philippe Chalmin. 1980. *L'Agroalimentaire*. Paris: PUF.
- Buck, Daniel, Christina Getz and Julie Guthman. 1997. "From Farm to Table: The Organic Vegetable Commodity Chain of Northern California." *Sociologia Ruralis* 37 (1):3-20.
- Buttel, Frederick. 1993. "Ideology and Agricultural Technology in the Late Twentieth Century: Biotechnology as Symbol and Substance." *Agriculture and Human Values* X, 2.
- Byé, Pascal and Alan Mounier. 1984. *Les Futurs Alimentaires et Energetiques des Biotechnologies*. Grenoble: Presse Universitaire de Grenoble
- Commission of the European Communities. 2002. *Life Sciences and Biotechnology – A Strategy for Europe*. Brussels.
- Ducos, Chantal and Pierre Joly. 1986. *Structure et Strategies de l'Industrie des Semences face à l'Innovation Biotechnologique*. Paris: Economica Editions.
- Durant, John, Martin Bauer and George. Gaskell (eds). 1998. *Biotechnology in the Public Sphere – a European Source Book*. London: Science Museum.
- Elliot, Carl. 2001. "Pharma buys a Conscience." *The American Prospect* 12, 17.
- ETC Group Communique. 2001. *Globalization Inc. Concentration in Corporate Power: The Unmentioned Agenda*. www.etcgroup.org.
- Fanfani, Roberto, Raul Green, Roberto Rodrigues-Zuniga and John Wilkinson.1990. "Changement Technique et Restructuration de l'Industrie Agralimentaire en Europe." Paris: INRA.
- FAPESP (Sao Paulo Foundation for the Support of Science and Technology). 2001. *Pesquisa FAPESP*. São Paulo.
- FAST (Forecasting and Assessment in Science and Technology). 1984. *Programme Report*. Brussels: European Commission.
- Featherstone, Mike. 1991. *Consumer Culture and Postmodernism*. London: Sage.
- Filser, Marc, Véronique des Garets and Gilles Pache. 2002. *La Distribution: Organisation et Strategie*. Paris, Éditions EMS
- Fonte, Maria. 1999. "Sistemi alimentari, modelli di consumo e percezione del rischio nella società tardo moderna." *La Questione Agraria* 76.
- Friedland, William, Amy E. Barton and Robert Thomas. 1981. *Manufacturing Green Gold*. New York: Cambridge University Press.
- Fulton, Murray and Konstantinos Giannakas. 2001. "Agricultural Biotechnology and Industry Structure." *AgBioForum*. 4, 2. <http://www.agbioforum.org>
- Geier, Bernard. 1999. *A Short Overview and Facts on Worldwide Organic Agriculture*. www.ifoam.org
- Goldberg, Ray. 1968 *Agribusiness Coordination*. Boston: Harvard University
- Goodman, David, Bernardo Sorj and John Wilkinson.1987. *From Farming to Biotechnology*. Oxford: Blackwell.

⁴ The CEC Document referred to in this quote is Commission of the European Communities (2002).

- Guivant, Julia. S. Forthcoming. "Heterogeneous and Unconventional Coalitions Around Global Food Risks: Integrating Brazil into the debates." *Journal of Environment and Planning*.
- Guivant, Julia. 2001. "Global Food Risks: Environmental and Health Concerns in Brazil" in Daniel J. Hogan and Maurício T. Tolmasquim (eds.), *Human Dimensions of Global Environmental Change. Brazilian Perspectives*. Rio de Janeiro: Brazilian Academy of Science.
- Guthman, Julie. 2001. *Commodified Meanings and Meaningful Commodities*. Paper presented at a Workshop Rethinking Production and Consumption. Santa Cruz.
- Harvey, Mark 1999. *Genetic Modification as a Bio-Socio-Economic Process: One Case of Canned Tomato Purée*. Manchester : Centre for Research on Innovation and Competition.
- Heffernan, William 2001. *Consolidation in Food Retailing and Dairy*. National Farmer's Union: Denver and Washington D.C.
- Just-Food.com, 24 January 2002.
- Joly, Pierre Benoit and Stéphane. Lemarie. 1998. "Industry Consolidation, Public Attitude and the Future of Plant Biotechnology in Europe." *AgBioForum*. <http://www.agbioforum.org>
- Kenny, Martin, Jack Kloppenberg Jr., Frederick Buttel and J. T. Cowan. 1982. « Genetic Engineering and Agriculture : Exploring the Impacts of Biotechnology on Industrial Structure, Industry-University Relationships and the Social Organisation of U.S. Agriculture. » *Rural Sociology Bulletin No. 125*, Cornell University
- Kenny, Martin 1986. *Biotechnology : The University-Industrial Complex*. New Haven :Yale University Press.
- Keat, Russel, Nicholas Abercrombie and Nigel Whitely. 1994. *The Authority of the Consumer*. London: Routledge.
- Lampkin, Nicolas. 1999. *Organic Farming in the European Union*. Baden/Vienna.
- Lockie, Stewart, Kristen Lyons and Geoffrey Lawrence. 2000. "Constructing "Green" Foods. Corporate Capital, Risk, and Organic farming in Australia and New Zealand." *Agriculture and Human Values* 17, 4: 315-322.
- Long, Norman and Ann Long. 1992. *Battlefields of Knowledge*. London: Routledge.
- Lundvall, Bengt-Ake. 1988. "Learning Through Interaction." In Giovanni Dossi et al. *Economic Theory and Technical Change*. London: Macmillan.
- Malassis, Louis. 1979. *L'Économie Agroalimentaire*. Paris: Cujas.
- Marsden, Terry. 2000. *Producción, Mercados, Regulación y Tecnología en los Rubros Organicos*. PROCISUR: Montevideo.
- Marsden, Terry. 2001. *New Communities of Interest in Rural Development and Agro-food Studies: An Exploration of some Key Concepts*. Paper presented at the Workshop Rethinking Production and Consumption. Santa Cruz.
- Marsden, Terry and Neil. Wrigley. 1995. 'Regulation, Retailing and Consumption.' *Environment Planning A*, 27:12
- Mennel, Stephen, Anne Murcott, and Anneke Van Otterloo. 1992. *The Sociology of Food*. London: Sage Publications.
- Ministry of Science and Technology. 2001. *Livro Verde: Ciência, Tecnologia e Inovação*. Brasília: MCT.
- Murdoch, Jonathan. 1995 "Actor-Networks and the Evolution of Economic Forms." *Environment and Planning A* 27:731-57
- Murdoch, Jonathan., Terry Marsden and Jo Banks. 2000. "Quality, Nature and Embeddedness. Some Theoretical Considerations in the Context of the Food Sector." *Economic Geography* 76. 107-125
- OECD, 2000 *Science, Technology and Industry Outlook*. Paris: OECD
- Piore, Michael and Charles Sabel. 1984. *The Second Industrial Divide*. New York: Basic Books
- Raynolds, Laura. 2000. "Re-embedding Global Agriculture: The International Organic and Fair Trade Movements". *Agriculture and Human Values* 17 3: 297-309.
- Salais, Robert and Michael Storper. 1993 *Les Mondes de Production*, Paris, Éditions de l'EHESS
- Sorj, Bernardo and John Wilkinson. 1992. "Strategies of Leading Firms in Agro-food." *Biotechnology, Agriculture and Food*. Paris: OECD.
- Tansey, Geof and Tony Worsley. 1995. *The Food System*. London: Earthscan.
- Walsh, Vivien. 1996. "Design, Innovation and the Boundaries of the Firm." *Research Policy* 25:509-529
- Wilkinson, John. 1993. "Adjusting to a Demand Oriented Food System: New Directions for Biotechnology Innovation". *Agriculture & Human Values* 2 10:31-39
- Wilkinson, John. 1997. "A New Paradigm for Economic Analysis?." *Economy and Society* 26, 3.
- Wilkinson, John. 2000. *Demandas Tecnológicas, Competitividade e Inovação no Sistema Agroalimentar do Mercosul Ampliado*, Montevideo: Procisur/BID
- Wilkinson, John. Forthcoming. The Final Foods Industry within the Changing Face of the Global Agro-food System. *Sociologia Ruralis*.

JUST BANANAS? FAIR TRADE BANANA PRODUCTION IN THE DOMINICAN REPUBLIC

Aimee Shreck*

University of California, California

Guest Edited by Wynne Wright and Doug Constance

INTRODUCTION

The intensification of corporate-driven globalization and liberalization of trade in the agro-food system is creating an environment in which viable alternatives for marginalized producers in the South are becoming ever more important. In an effort to counter a “race to the bottom” in which corporations with the lowest social and environmental costs appear to fare best, Fair Trade is being adopted for a number of commodities such as coffee, tea, cacao, and bananas. Proposed as an alternative system of trade, Fair Trade initiatives seek to create positive social change by altering what happens at each end of the commodity chain while shortening the social distance between producers and consumers. For small-scale banana producers, the Fair Trade market represents a critical export outlet for their product, and perhaps the last hope for their future as independent banana producers.

Increasingly promoted as a strategy for rural development in the South, Fair Trade initiatives attempt to alter the ecologically and socially exploitative relations that characterize the conventional agro-food system. To do so, Fair Trade organizations have created a system of certification and labelling that provides consumers with a guarantee that products are grown by disadvantaged producers under healthy social and environmental conditions. In return, consumers are willing to pay a premium for this guarantee with an expectation that it will be returned to producers. Growing interest in alternative trade over the past few years is noted not only by its success in the market, with global sales estimated at \$400 million each year (Fair Trade Federation 2000), but also by the increasing support it is receiving from a wide range of actors including the FAO, European Parliament, various NGOs, and even corporations (FAO 1999; EFTA 2001a; TransFair USA 2000).

Nonetheless, a question which is frequently asked is; ‘do these efforts represent real alternatives capable of fostering positive change in international trade relations?’ Following Murray and Reynolds (2000), I also argue that a fundamental question to ask of Fair Trade is; ‘does it bring about progressive and transformative change in the global agro-food system, and if so, how?’ In other words, does Fair Trade represent something more than a label that permits wealthy, socially- and environmentally-conscious customers in the North to continue to consume commodities they have grown to enjoy and expect? Thus far, much of the analysis about alternative trade addresses the ways in which the Fair Trade movement is understood by activists and consumers, primarily in the North (Brown 1993; Whatmore and Thorne 1997; Renard 1999a; Murray and Reynolds 2000). It is also important to consider the impact Fair Trade initiatives have in the South, yet much of the available documentation is limited to anecdotal accounts published by alternative trading organizations (for exceptions, see Renard 1999b; Fisher 1997; Tallontire 2000).

In this paper, I draw on fieldwork conducted in the Dominican Republic with banana farmers currently exporting Fair Trade bananas, to examine the implications of their participation in a Fair Trade initiative. After discussing the Fair Trade movement and its relationship to other forms of opposition to the current agro-food system, attention is directed to a case study analysis of one Fair Trade producer group to discuss the potential and the limits of Fair Trade banana production as experienced at the local level. The analysis of this case supports observations that Fair Trade is “not a panacea for all the injustices in global exchange” (Nash 2000:179), but that it nonetheless represents a “promising, though not unproblematic avenue for molding a more environmentally sound and socially just world agro-food system” (Murray and Reynolds 2000:66).

RESEARCH DESIGN

Sociologist Peter Evans has argued that a primary question to be asked of initiatives such as Fair Trade is “how they might affect the lives of the world’s most marginalized citizens?” (Evans 2000:231). For this reason, this research focuses on the implementation of Fair Trade at the level of production. Focusing on this level of analysis will not, of course, capture the complete story of Fair Trade. However, if we wish to understand the potentials of this promising movement, it may be the best level from which to start.

The case study presented here is part of a larger study of alternative banana production initiatives in the Azua Valley of the Dominican Republic. This site was chosen because of the Dominican Republic’s importance as a leading exporter of both Fair Trade and organic bananas. The province of Azua, is home to approximately 800 small-scale banana producers and

* This article reflects the helpful suggestions of two anonymous reviewers and comments from Doug Murray and Laura Reynolds on earlier drafts. I am grateful for the helpful guidance of Wynne Wright while revising the paper. Correspondence may be directed to the Dept. of Human and Community Development, University of California, One Shields Avenue, Davis, CA 95616; or email aimeeshreck@hotmail.com.

roughly two-thirds of them belong to a certified, Fair Trade Producers Organization. I conducted the field research in two stages, between October 1999 and August 2000, using multiple methods to gain a rich understanding of how producers interact with each other, their associations, exporters, and the Fair Trade initiative. In particular, I relied on unstructured, in-depth interviews with key informants, semi-structured interviews with a random sample of producers (n=115), participant and non-participant observations, and document analysis.

In this paper, I focus on the experiences of producers from Finca 6, one of three groups included in the larger study. Data comes from observations in the community and packing stations, interviews with key informants (including representatives from Fair Trade organizations, the exporting company, and producers), and the semi-structured interviews (n=39) conducted in Finca 6.

THE FAIR TRADE MOVEMENT AND OPPOSITION TO THE AGRO-FOOD SYSTEM

Trends towards increasing trade liberalization and the dominance of powerful transnational corporate actors that characterize the global economy are reproduced in the contemporary global agro-food system. Over the past several years, this system has been increasingly subject to private regulation as transnational corporations (TNCs) have become the key agents involved in the organization of production, distribution, and consumption of agriculture and food on a global scale (Friedmann 1993:52; McMichael 2000). Yet, as global demand and the internationalization of the agro-food industry continue to drive the production and distribution of food, we are witnessing a deepening polarization at the level of consumption in the North and South alike (Watts and Goodman 1997:2-3).

The neoliberal economic policies that structure the agro-food system encourage free trade and favor the large-scale, high-input agriculture widely practiced by TNCs. Moreover, this industrial model of agriculture is kept profitable through the use of labor and environmental practices that are both exploitative and destructive. Thus, as the process of globalization in the agro-food system intensifies, agricultural producers all over the world are finding it ever more challenging to compete and survive doing what many have been doing for a long time past.

In response to these tendencies, the global agro-food system is increasingly identified as a critical target of contestation and opposition. Discontent with its present configuration is manifested in an impressive and diverse range of new initiatives, one of which is Fair Trade. This proliferation of alternatives to the industrial agriculture paradigm is being conceptualised, promoted and implemented at varying scales by a range of public, private and civil society actors (Magdoff, Foster and Buttel 2000). Implicit in these attempts to develop alternatives that are “more just” or “greener” is agreement that present conventional practices are *unsatisfactory* to at least some segments of the population. Though the alternatives vary in their scope and approach, the activity in this sector shows a growing public awareness of the contradictions perpetuated by the contemporary agro-food system.

These alternatives and the social movements supporting them are providing citizens with new and different choices regarding how food is grown, distributed, and traded. For instance, the organic agriculture sector offers an alternative form of production to the industrial model characteristic of the dominant agro-food system. It is one of the most dynamic sectors in the agro-food system, growing at a rate of twenty percent per year over the past decade (Klonsky 2000). The growth in community supported agriculture (Imhoff 1996; Cone and Myhre 2000) and farmers markets (Hinrichs, Gillepsie and Feenstra 2001) are two examples of alternatives approaches which favor local distribution of food, in preference to the thousands of miles that most conventional meals travel. In contrast to these local food systems approaches, there is also a range of alternative or fair trading efforts emerging to challenge further intensification of the present agro-food system (Renard 1999b; Murray and Raynolds 2000; Barrientos 2000).¹ Alternative trade approaches reject dominant trading patterns in favor of a model that is concerned with principles of equity and social justice. These initiatives are market-based options that take advantage of both the international market structure through which they operate, as well as the space alongside it in which a parallel network of trading partners committed to providing a more equitable form of global exchange, is being formed. Considered together, these alternatives reveal the growing dissatisfaction being expressed by a wide range of actors.

Numerous recent publications have reflected the attention that is being given to these emergent alternatives by social scientists who are engaged in debates about why, how, and where these alternatives are developing. Most importantly perhaps, researchers are considering what these alternatives mean and how they should be studied (see for instance, Goodman and Goodman 2001; Magdoff et al. 2000; Marsden 2000; McMichael 2000). This paper seeks to contribute to this discussion by focusing attention on the particular implications of Fair Trade.

Fair Trade labelling initiatives are promoted and coordinated by Fair Trade organizations and activists who together comprise an international Fair Trade movement. They are overseen by the Fairtrade Labelling Organizations International (FLO), an umbrella organization for national Fair Trade organizations from seventeen countries in Europe, North America, and Japan. FLO also coordinates the selection, monitoring and certification of the Southern producer groups whose products come to bear the Fair Trade label.

As an oppositional social movement (Raynolds 2000), the Fair Trade movement seeks to expose what William Tabb calls the greatest myth of all, that “the market has as its principal purpose the service of human needs rather than the aggrandizement of capitalists and their corporations” (Tabb 1999:2). Thus, Fair Trade initiatives attempt to reveal to consumers the journey their food takes before it arrives in the supermarket, by demystifying the relations of capitalist production of agriculture and food and shortening the chain along which these products travel. To do this, Fair Trade organizations rely on a strategy of working “in and against” the market (Brown 1993), thereby posing a fundamental contradiction as Fair Trade comes to be seen as an attempt to reform the same market in which it operates. This strategy has both advantages and disadvantages, as this and other studies demonstrate, yet it is clear that working within the same system that the movement seeks to change is a complicated task which poses challenges to both ends of the commodity chain (Murray and Raynolds 2000; Renard 1999a).

However, it is also perhaps the adoption of this very strategy that has enabled Fair Trade to achieve apparent success thus far. Until now, analysts have expressed cautious optimism about the potential of alternative trading initiatives. For instance, Nash (2000) notes that such initiatives can play an important role in sustaining producer groups in the South and may have the potential to overcome the fetishism of commodities. But Nash (2000) also cautions that Fair Trade will not alone solve all the inequities produced by conventional patterns of international trade. Moreover, these strategies are unlikely to radically transform the system, yet they can nonetheless be understood as oppositional since, as Evans suggests, “they constitute challenges to ‘business as usual’ both globally and locally” (Evans 2000:231).

BACKGROUND

Consistent with its history as a colonial commodity produced for the North by the South, the contemporary export banana industry continues to extract profit for transnational corporations while returning little to the communities producing the fruit (Raynolds and Murray 1998). The sector epitomizes all that is being denounced by oppositional movements as unfair, unsustainable and pursued for the sake of corporate profit at the expense of people and the environment. Moreover, the entire banana industry is in a state of crisis resulting from overproduction (Banana Link 2000).

As the crisis intensifies, small-scale producers and plantation workers are the most seriously affected. During the mid-1990s, roughly 15,000 small farmers were forced out of the banana sector in the Windward Islands and in the latter half of 2000, approximately 10,000 plantation workers were laid off in Costa Rica alone (Banana Link 2000). While the large scale plantations, on which bananas destined for export markets are typically grown, have never been ecologically sustainable, agrochemical abuse has intensified, especially in the past fifty years. Intensive production methods and pesticide overuse in the banana industry has proven devastating to both communities and ecosystems (Bourgeois 1989; Henriques et al. 1997).

The international banana trade is oligopolistic in structure, with two vertically integrated corporations (Dole Food and Chiquita Brands) controlling over 50 percent of the world market (Banana Link 2001). Production for export is concentrated in Central and Latin America and international trade is valued at roughly five billion dollars (FAO 2000). Between 1988 and 1998, world exports doubled to 12 million tons (Liddell 2000). Only twelve percent of revenues from this market, however, remain in producing countries and small farmers receive a small fraction of the profits (Chambron 2000).

Alternative production and marketing in the banana sector has taken off dramatically since the mid-1990s, in part as a response to falling profit margins in the conventional trade. More than simple marketing strategies, the FAO concludes that these initiatives attempt to improve the exploitative conditions of production (FAO 2000). Currently, there are at least five different certification schemes in operation, each of which makes claims about improving the social and/or environmental soundness of banana production.² The diversity of these efforts and the participation of industry giants in these schemes, suggest that we may be witnessing the transformation of the alternative trade market from a niche activity operating at the margins, to a mainstream operation.

The FLO Fair Trade banana initiative is one of the more widely known efforts. Bananas from both independent small-scale producers and plantations can be certified to carry the Fair Trade label, though each group must meet a different set of criteria. The first Fair Trade bananas arrived in the Netherlands from a plantation in Ghana in 1996. They were an instant success, gaining ten percent of the market within a few months of going on sale (Banana Link 1997). Five years later, Fair Trade bananas from seven registered producer groups were available in eight European countries. By April 2002, FLO reported banana sales from 2001 reaching 29,065 tonnes, signalling the third year in which growth of 25 percent was recorded (FLO 2002).

The following analysis is based primarily on a detailed case study of one community’s experience producing and exporting Fair Trade certified bananas (see Table 1). The Dominican government established this community as an agrarian reform district in 1993. Its name, ‘Finca 6,’ refers to both a community and the area of land on which its residents farm. Just a few miles outside the city of Azua, Finca 6 hosts about 275 banana producing households (representing approximately one-third of the banana exporting households in the region). Most members of this community were relocated from a very poor, mountainous region close to the Haitian border where they burned wood to sell charcoal. When the government moved the

community to Azua, each family was provided with a house and a provisional title to a section of 400 ha of irrigated farmland (about 1.6 ha per household).

Table 1: Profile Of Finca 6 Growers (N=39)

percent male	100.0
mean age in years	46.0
mean years of formal education	2.5
mean household size	5.1
mean size of land (in tareas; 1 ha=15.9 tas)	25.9
mean percent of land planted with bananas	85.8
percent relocated to Azua with establishment of Finca 6	74.4
percent who rely on additional hired labor	66.7
percent currently exporting (during month of interview)	46.2
mean price per 40-pound box in RD\$*	51.8
percent reporting price does not cover costs of production*	78.8

*for producers currently exporting only, n=33 source: author's interviews

The community is still young and relatively inexperienced with respect to agricultural commodity production. When asked about Finca 6, agronomists and exporters quickly respond that the Finca 6 growers are not traditionally agriculturists. After moving, many of the families began their foray into agriculture by cultivating crops for household consumption and sale on the local market.

Soon after Finca 6 was settled, an exporter approached the new producers with a proposal for them to cultivate and sell organic bananas to the company. Guarantees of a contract, high prices and promises of a rapidly expanding market for a new specialty product spurred initial excitement about this proposal. As a result, many producers signed up, and formed the Association of Banana Producers of Finca 6 so that they could better negotiate with the company. Today, the Association is governed by a seven-person *junta directiva*, which is democratically elected every two years. In 1997, the Association was certified to export Fair Trade bananas. At that time, they were the only Fair Trade producers growing organic bananas.³

After just a few years, banana production had become a way of life for members of the Finca 6 community, with most households having some connection to the industry. The commitment of members of the Finca 6 community to banana production is strong. On average, these producers have only about 1.6 ha of land, with 86 percent of it dedicated to banana production. Roughly 70 percent of the farmers dedicate all of their land to bananas. Bananas are favored especially because of the relatively high price they can receive *when they are able to sell for export* and because they can be harvested every two to three weeks, providing year-round income.

Fair Trade Banana Production

Without Fair Trade, the small producers would not be able survive.- Fair Trade banana exporter

They talk about Fair Trade, but there is nothing fair about the price we get. - Fair Trade banana producer

A central objective of Fair Trade initiatives is to offer increased protection to Southern producers against price fluctuations and other unfavorable conditions that prevail in the conventional agro-food system. As noted above, the global banana industry has been in a state of crisis since the summer of 1999, when producers witnessed an unprecedented decline in farmgate prices. During a period of just nine months (December 1999 - August 2000), the net price to producers for a 40 pound box of bananas in Azua fell by 33 percent, from RD\$60 to RD\$40. This crisis, compounded by overproduction and efforts to further liberalize the global banana trade, makes the benefits promised by Fair Trade, particularly market security and guaranteed prices, very attractive to growers.

As recipients of the benefits, how have the Finca 6 banana producers and their community fared? Does Fair Trade make a difference? As the above remarks suggest, the implications of Fair Trade are not necessarily straightforward. The apparent paradox about the effect of Fair Trade reflects a number of factors that characterize banana production in the Azua Valley, but perhaps more importantly, results from a tension within the Fair Trade model. As already suggested, since the strategy relies on working both "in and against" the market, Fair Trade organizations must constantly seek a balance between demands which are in opposition: demands of the global agro-food system which relies on impersonal capitalist relations and exploitative practices on the one hand, and demands of an alternative model of trade based on social and environmental justice on the other. Within

this framework, a central question is whether Fair Trade organizations are able to successfully address their objective of supporting disadvantaged producers while complying with strict expectations of powerful importers and distributors upon whose cooperation the success of Fair Trade depends.

This analysis of Fair Trade at the level of production provides new insights into the complexity of producing and exporting a Fair Trade banana, suggesting that the successes of Fair Trade organizations are being realised but are limited. During the spring of 2000, the Finca 6 Association began a process of change as they started to recognize some of the benefits from their Fair Trade certification, making their case particularly instructive for enhancing our limited understanding of the impact of Fair Trade at the local level. In the remainder of this paper, I consider the potential the Fair Trade banana initiative holds for fostering positive social change and the limitations it faces. In terms of specific examples, this discussion is framed around three important and interrelated aspects of Fair Trade production; material benefits, organizational capacity building, and the Fair Trade export market.

MATERIAL BENEFITS

To explain the benefits Fair Trade brings to producers, advocates typically emphasize the guaranteed minimum prices and social premium promised to Southern partners. These two forms of material returns are promoted as key components of what makes Fair Trade a promising alternative to conventional trade relations. Each of these, however, is distinct with unique implications for producers.

The Fair Trade social premium is set by FLO at \$1.75 per 40-pound box and is paid by certified traders (in the North) to registered Fair Trade producer groups (in the South). It is intended to finance projects that will benefit growers and their communities. When producers from the Association of Finca 6 export an average of 2,000-2,500 boxes of Fair Trade bananas each week (as they were at the time of this research), the premium can bring significant and consistent economic returns which can reach upwards of \$4,000 per week.⁴

Initially, the exporter managed the social premium for the Association. In doing so, the company pre-financed several projects (including road preparation and the purchase of irrigation equipment) with the understanding that these loans would eventually be repaid with funds from its Fair Trade social premium. In 1998, when Hurricane George destroyed much of the banana production in the region, the company also pre-financed recovery efforts in the *parcelas* in Finca 6, permitting the producers to replant their fields quickly. Altogether, this financing proved crucial for Finca 6 in the longer term, but created a substantial debt the Association would need years to repay. In addition, because of the way the premium was managed, the reality of a Fair Trade premium tended to elude some producers who charged that the exporter was stealing their premium.

During the spring of 2000, the Association finished paying its debt to the exporter and received its first direct payment of the premium. The initial installments were used to make much needed improvements in the Association office and later invested in the maintenance of the infrastructure on the farm and for projects to improve fruit quality. These projects allowed producers to finally observe first hand that the Fair Trade premium in fact existed and that it could have a positive impact on their production. Together with other efforts by FLO and local organizations to educate members about Fair Trade, this has helped producers gain a better understanding about their participation in an alternative trade system.

FLO also requires importers to pay a guaranteed minimum price. At the time, prices were defined as minimum FOB prices and varied according to country of origin. In the Dominican Republic, the price was \$11.00 for a 40-pound box of organically grown Fair Trade bananas. Guaranteed prices serve as a buffer against unfavorable price fluctuations and can thus provide direct income to producer households. For growers though, the benefits from a minimum price guarantee are not always obvious.

The producers' contract specified a base price of \$5.00 per box to be paid by the exporter. This price was then subject to various reductions to cover costs of production materials supplied by the exporter and, sometimes, individual loans. Since the net price per box sometimes varied and was falling over time, it was not difficult for producers to wonder to whom the supposedly "fair price" was being paid. A lack of transparency about this process prevented producers from knowing when their fruit was being sold as Fair Trade, since the base price per box was always the same and not all of the bananas were sold on the Fair Trade market. Thus, since an FOB price refers to the price paid to an exporter, the producers are not the direct beneficiaries of the guarantee.⁵ In Azua then, the primary material benefits come from the social premium at this time. This is in contrast to findings from research on other Fair Trade commodities like coffee, where minimum prices can be of critical importance to growers, especially during times of crisis (Renard 1999b; Oxfam 2001).

ORGANIZATIONAL CAPACITY

Producer associations are central to Fair Trade initiatives and consequently an understanding of the role they play can help determine the implications of and challenges to the initiatives. According to FLO's certification criteria, small-scale producers can participate in Fair Trade through collective organizations (i.e., democratically-controlled cooperatives and/or associations) (FLO 2000b). The relative strength or weakness of such organizations however can affect the potential of Fair Trade. Below I discuss some examples from the experiences of the Finca 6 Association.

The contractual agreement between the Finca 6 Association and the exporter marked the start of a close relationship between the company and the community. According to the exporter, working with inexperienced growers has been quite challenging. Yet, even though the head of this company suggests exporting bananas from Finca 6 may be an unwise business decision, she renewed a contract with the growers for another five years at the end of 1998 and insists the Fair Trade market will be critical for the small farmers as competition intensifies (personal communication, J. van den Berg, 4/26/00).

The close contact between the producers and the company is unusual when compared with the relationship between other exporters and growers in the region, notably because none of the other exporters offer contracts to producers. On any given day, the Production Manager for Finca 6's exporter can be found making the rounds to the packing stations and throughout the community. Whether to spot check the quality of the fruit being selected or to respond to questions that inevitably arise, these trips also ensure close contact between the company and the producers. This relationship, however, has fostered a situation of dependency for Finca 6 that prompted one observer to remark: "So pervasive is the influence of [the company] that I wonder whether it doesn't sometimes feel like their employer" (Ransom 1999:22).

At the same time, many producers blame the exporter for their problems, particularly when they are unable to sell their harvest. Nevertheless, some recognize that "the company can withdraw from us whenever it wants to ...[so] we have to remain organized" (Association member, quoted in Ransom 1999:22). Though they are formally organized, like many of the other producers' associations in the regions, the organization is relatively weak. Just over half (51.3 percent) of the Association's producers perceived benefits from their membership. This may reflect the fact that one of the major reasons for forming an association, according to the President of the Association, was external, namely, the exporter insisting that they organize so she could negotiate with producers collectively.

Over the course of several months, however, the Association began to take on greater responsibilities, which has resulted in an overall strengthening of the organization and a lessening of their reliance on the company. For example, the Association took over the duty of selecting and packing the bananas and financial disbursements to members. A great deal of what is being accomplished coincides with the arrival of a Fair Trade organization representative to the community. Sent by FLO with the daunting task of "organizing the producers of Finca 6," this representative was originally scheduled to spend three months in Finca 6. More than a year later, her contract had been renewed twice and she was still there. Her commitment to working with the Association proved to be critical. Without guidance, the Association may not have been able to realize many of its recent accomplishments, nor would the company have felt it could shift the control over important tasks to the Association without the assistance of the Fair Trade representative.

As the Association takes on more of the tasks that the company had previously done, it is beginning to learn about the difficulties of satisfying both growers and the market. During the period of my research, the Association was experimenting with several projects aimed at raising overall and individual quality to increase the volume of their sales. One involved forming collective worker brigades to improve conditions in the farm so that fruit quality would be both better and more consistent. Establishment of these worker brigades was part of a larger collaboration between FLO, the Association and the company to institute a "Plan for Quality Control." Under this plan, the Association agreed to oversee elements of production most critical to quality. Producers who did not sign on were taken out of the pool of those eligible to sell to the Fair Trade market, on the grounds that their fruit would fail to meet required quality standards, thereby jeopardizing the group's future market share. This Plan represents one of the first efforts of the Association to take on a major project.

THE FAIR TRADE EXPORT MARKET

Small-scale production of a highly perishable fruit like bananas for a market dominated by a few multinational corporations is challenging, and is one of the reasons Fair Trade is being adopted in this sector. It is difficult for small farmers to compete with plantations in the conventional market, and exporters in Azua believe the Fair Trade market may represent the only viable option for these growers to continue cultivating bananas. The reasons for this are closely related to difficulties that small farmers have meeting the export market's quality expectations. In general, smaller producers lacking the resources of larger plantations are unable to benefit from expensive technologies like cable systems for transporting stems or from a permanent and trained labor force to care for the trees prior to harvest. A shortage of capital may also prevent growers from applying the optimal amounts of inputs or irrigating regularly. Each of these factors contributes to a consistent harvest of acceptable quality.

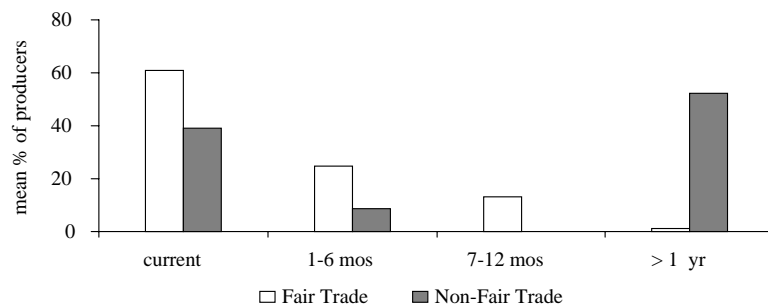
The market's quality requirements refer largely to the cosmetic quality of the bananas. In Azua, the selection process is a rigorous one that frequently results in the rejection of more than 50 percent because "fingers" (the individual bananas) are cosmetically defective. Banana stems must also be cut at a precise time: late enough so that the fruit is large enough to meet the size requirement (e.g., 8-10 inches long) but early enough so that the fruit will arrive at the port still green. Once received by an importer, the bananas can still be rejected for numerous reasons.

Though bananas are the preferred crop for these growers, many voiced complaints about the insecurity of the export market. Indeed, 80 percent of producers in Finca 6 recalled market-related concerns as among their greatest problems (including quality, price, the market, and rejection rates). This suggests the market access the Fair Trade initiative provides may be the most critical advantage producers receive from their certification.

Moreover, since they first began exporting, Finca 6 producers have seen both the demand and price for their bananas fall. This is partially a result of the entrance of new, larger competitors (especially from Mexico and Ecuador) in the organic market. It is also a reflection of the “exportable quality” stipulation specified in growers’ contracts, which releases the exporter from its commitment to purchase any bananas which fail to meet the high quality demanded for export. As a result, quality requirements effectively limit the volume of supply available for export, particularly from small-scale growers, while increasing competition simultaneously pushes prices down.

Nonetheless, bananas are preferred over other commodities, for as one grower stated, “when bananas are good, there is nothing better.” That is, when the fruit can be sold for export, there is no alternative in the region that will bring the kind of consistent and high returns that bananas can. In light of the current conditions in the region, which one producer described as a “*situación calamitosa*,” this support is crucial. A comparison of export data from interviews with Fair Trade and non-Fair Trade producers is telling. As illustrated in Figure 1, producers who have access to the Fair Trade market are 21 percent more likely to report having sold bananas (to an exporter) within the month previous to the interview (described here as “currently exporting”). These findings, based on the entire sample (all 115 producers interviewed), show an inverse relationship in which Fair Trade certified producers are more likely to be exporting consistently while non-Fair Trade producers are more likely to have not exported recently. Perhaps even more striking is the fact that over half (52.2 percent) of the non-Fair Trade producers had not exported in over a year. Significantly, many of the growers in this situation come from communities whose land never quite recovered from the hurricane in 1998, and which did not receive the assistance provided to the Finca 6 producers. As a result, even though they still have bananas growing, the quality of their fruit is unacceptable for exporting.

Figure 1: Months Since Last Exported, Fair Trade And Non-Fair Trade Producers (N=115)



Source: Author's Interviews With Producers

This analysis suggests the market access provided by Fair Trade certification is a significant and positive benefit to the growers, even though, when asked about the benefits of Fair Trade, many responded, “not very large.” In terms of economic support for individual households, the increased market security is most important, for even when farmgate prices are high, if producers are unable to export then they must settle for whatever they can capture on the local market. Yet, this price oftentimes fails to even cover the cost of harvesting, let alone production.

LIMITS AND POTENTIALS

The Finca 6 case is helpful in providing insight into the implications of Fair Trade initiatives for participating producers. It suggests that such initiatives have great potential and can have a positive impact in several different ways. At the same time however, a close look at the producers’ experiences also reveals some limitations in terms of the ability of the Fair Trade initiative to alter trade relations.

During the period of this study, the Finca 6 growers were only just starting to recognize their role as Fair Trade partners. For instance, one of the most surprising findings from initial interviews was how very limited the growers’ understanding of the Fair Trade initiative was. Only half of the growers interviewed from Finca 6 expressed knowledge of what Fair Trade was, and few seemed to understand how it worked, or that there were criteria to which they were supposed to comply. In addition, those who spoke of Fair Trade described it as a form of aid, rather than something in which they were actively participating. While this may not prevent other positive impacts of Fair Trade from reaching the community, until a more comprehensive understanding of their role is developed, equitable partnership may remain elusive.

Finally receiving direct payments of the social premium was a significant event and it now provides the Association with visible economic benefits from the Fair Trade market. The promise of a future Fair Trade premium is what encouraged the group’s exporter to pre-finance recovery efforts on the farm after Hurricane George, thereby permitting producers to begin exporting sooner. This use of the premium provided critical support needed by the growers and enabled them to recover from the effects of the hurricane far more easily than did other producers in the valley. Whereas the Fair Trade market was boosting

the optimism of those in Finca 6, growers in other communities were starting to convert land to other crops, explaining that with bananas, “*estamos comiendo la tierra*” (we are eating the soil).

Meanwhile, in Finca 6, the premium had repaid a large debt and was being earmarked for projects targeting the production process and for strengthening the Association. The urgency of responding to importers’ costly quality complaints and threats to cancel orders from the small farmers prompted both FLO and the Association to prioritize such projects.

Again, the size of the Fair Trade social premium is substantial. However, it is intended to be distributed in such a way that its benefits reach the community as a whole. To offer a viable alternative to conventional practices and provide long-term support, Fair Trade organizations may not wish to rely on the ‘trickle down’ of benefits from the *junta directiva* to the rest of the community, or from the male producer to the rest of the household. During the period of fieldwork, there were no overt attempts to increase the larger community’s participation in discussions about how to allocate the premium. A lack of the women’s input in the Association and in other decision-making processes was particularly noticeable. Unless the benefits are better distributed to a broader range of households (a challenge that has thus far been impossible to meet given the demands of the market), Fair Trade has the potential to increase inequality at the local level, a phenomenon not uncommon to other non-traditional export agriculture schemes targeting small-scale producers (Glover and Kusterer 1990; Conroy et al. 1996).

Determining how to best support capacity building in producer associations and organizing communities may be the greatest challenges facing Fair Trade organizations. As a community, Finca 6 at times seems to accept its ties to the exporter as it allows them to blame their problems on a common enemy, “*la compañía*.” However, autonomy and independence demand an organization capable of taking on responsibilities which would otherwise be performed by some other body. In a relatively short time, the Finca 6 Association was able to marginally reduce its close ties with the exporter, but even this limited move seemed to depend on the full-time residence of a FLO representative in the community. This person provides invaluable support, yet there is a concern that the growers might have simply shifted their dependence on the company to FLO. The presence of this representative however, also underscores FLO’s commitment to working with the weaker organizations which are in greatest need of the support and guidance, rather than limiting Fair Trade partnership to more capable groups.

Despite the growers’ increasing level of knowledge about Fair Trade, their sense of entitlement to its benefits was limited to an expectation that high-quality bananas can provide access to higher-paying export markets which favor fruit coming from small-scale producers. This limited understanding of the Fair Trade program is not unique to this case (see for instance Renard 1999b; Fisher 1997), but as elsewhere, it may inhibit the growers’ role as partners in an alternative trade relationship. It also prevents the realization of the broader potential of Fair Trade participation promised to growers. More attention could be given to educating participants about Fair Trade (for which a range of efforts are currently underway), so that they might eventually fill their role as equal partners, rather than as beneficiaries of an aid package and suppliers of a specialty market.

As suggested above, access to the alternative banana market is one of the most immediate benefits of Fair Trade. The downside of this form of support is found in impact of the quality requirements described above. Conforming to the dictates of the market means that growers with the highest quality benefit most, even in the Fair Trade market, and even if these growers are not the most vulnerable. To put this into perspective, consider that during the summer of 2000, an average of two containers (about 2,000 boxes) of Fair Trade bananas were purchased each week from the Association of Finca 6, whose membership totals around 275 members. Of these, only the best fifty or so were selling their bananas, since they were the only ones producing bananas that would meet the quality standards. When Fair Trade criteria concerning the social and environmental relations of production and the goal of providing an alternative to the conventional system are subordinated to quality, it seems that working “in the market” takes precedence over “against the market.”

Thus, the case study highlights some of the specific ways in which the constraints of working within the present agro-food system remains an important barrier to alternative forms of production and trade, which could transform international trade relations and provide a significantly different option to producers. The banana industry is structured in a way that precludes a real shortening of the commodity chain by circumventing conventional intermediaries, as is done with other Fair Trade products. The chain along which a Fair Trade banana travels may not vary radically from the journey taken by conventional bananas, thereby posing a challenge to a strategy that calls for trading directly with the certified producer groups. Further, it means that the locus of differentiation between conventional and alternative bananas should occur at the level of production if there is to be a real distinction between the products. Yet, the amount of attention placed on “quality” in Finca 6 suggests that, in some respects, production for the Fair Trade market mirrors production for the conventional market. That is, quality requirements placed on exporters by distributors farther along the chain have become an unofficial gatekeeper, permitting only the “best” of the small-scale producers to access the lucrative, specialty market. It can also have the effect of subordinating the autonomy of individual producers to the demands of the market, as in the example of the Quality Control Plan described above.

CONCLUSION

From the perspective of these producers, Fair Trade hardly resembles a strategy that confronts the “injustices inherent in the world economy and tries to transform North/South trade” (Raynolds 2000:301), much less one that “alleviate[s] poverty in the

South” (EFTA 2001b:5) or helps producers “get back on their feet and trade their way out of poverty with a renewed sense of pride” (FLO 2000a). By contrast, many banana producers who are certified by FLO do not know what this certification implies, nor do they differentiate Fair Trade from other forms of international development aid. Furthermore, the top-down/Northern-driven approach taken by the Fair Trade organizations raises concerns about why the monitoring is focused on the relations of production in the South while Northerners’ over-consumption is not challenged. It would be irresponsible, however, to draw from this a conclusion that Fair Trade initiatives have nothing significant to offer its registered producers. Disadvantaged, small-scale farmers who are marginalized in the global agro-food system do not suddenly become primary beneficiaries of the international banana industry when they become Fair Trade producers. Nonetheless, the experiences of Finca 6 provide evidence that participation in Fair Trade initiatives provides a number of different forms of support to producers.

A few final cautionary lessons can also be taken from this case. Compared with non-Fair Trade producers, those certified by FLO devote, on average, about 20 percent more of their total land into bananas and are 25 percent more likely to have converted all of their land to banana production. In Finca 6 this translates into a dangerously high level of dependence on a single export commodity, making the livelihood of the community vulnerable to the whims of consumption trends in the North. From the point of view of the growers, increasing production of the crop that brings most benefits is not unreasonable. However, paradoxically, this pattern also increases the growers’ exposure to the instabilities they face in the global economy and raises concern about whether Fair Trade participation could be displacing efforts to diversify production or compromising production for household consumption.⁶

The study also highlights FLO’s commitment to supporting small-scale producers and developing a viable alternative to conventional forms of production and trade. Even though the strategy chosen by FLO – to attach a high priority to marketing – clearly reflects the difficulties that accompany working “in and against” the conventional agro-food system, nevertheless the organization maintains an interest in identifying and strengthening less effective aspects of its initiatives.

Finally, Finca 6 represents only about one third of the small-scale banana production in Azua and their experiences cannot be generalized to all banana producers there, or even to all the Fair Trade banana producers in the region. The story of Finca 6 was chosen because it helps to demonstrate how, in spite of limitations, Fair Trade efforts represent a controversial alternative to what typically characterizes small-scale export agriculture in the South. The Fair Trade initiative in the Dominican Republic is dynamic and should not be ignored as an alternative mode of production or form of trade. Instead, a better understanding of the implications of Fair Trade at the level of production can be used to strengthen the model to ensure it will be more than a superficial scheme that permits Northerners to feel good about consuming commodities grown in the tropics.

ENDNOTES

¹ Alternative trade is a more general term than Fair Trade and typically refers to initiatives trying to link socially and environmentally conscious consumers in the North with producers in the South who engage in more socially and/or environmentally sound practices of agricultural or artisanal craft production. Here, “Fair Trade” refers to a formalized system of alternative trade that involves monitoring, certification, and labeling.

² These include organic production, ISO 14001, Social Accountability International’s SA 8000 standard, Rainforest Alliance’s Better Banana Program in addition to Fair Trade labeling. The UK’s Ethical Trade Initiative is also conducting one of its pilot programs on banana production in Costa Rica.

³ This paper concentrates on the implications of Fair Trade production. There are some differences between the organic banana industry and the Fair Trade banana market. Most significantly, the criteria required for organic and Fair Trade certification differ; currently, organic criteria are more environmentally rigorous, while the Fair Trade criteria are more rigorous in terms of social, labor, and trade criteria. In some cases, such as in the Dominican Republic, production meets both sets of criteria. This means the Finca 6 bananas are organically grown and can also be sold on the Fair Trade market, giving the fruit a chance to be sold in multiple specialty markets.

⁴ A significant caveat of this system is that the premium is based on the number of boxes accepted at the port (which depends on the quality of the fruit once it arrives), not the number of boxes sold at the farmgate.

⁵ It is important to note that FLO recently revised how it defines minimum prices for bananas. Today, the Fair Trade price is usually set as a farmgate price when producers export via an exporter and as an FOB price when they export directly.

⁶ Like many small-scale commodity producers in the South, those in Azua have historically been made dependent on export agriculture. I recognize that a critique of export dependency in this region can appear as naïve. However, most Finca 6 growers were actually not incorporated into export agriculture schemes prior to their initiation into banana production. Moreover, we should also realize that stimulating reliance on a single cash crop whose sales depend upon wealthy consumers with often rapidly changing consumption habits might be seen by some as irresponsible. Perhaps alternatively, increased income and security provided by the bananas could be invested in other crops so that any future (and not unlikely) disadvantageous changes in the banana sector would not be totally devastating for these growers.

REFERENCES

- Andreatta, Susan L. 1998. "Agrochemical Exposure and Farmworker Health in the Caribbean: A Local/Global Perspective." *Human Organization* 57:350-58.
- Banana Link. 1997. "Fair Trade Breakthrough Rattles Big Boys." *Banana Trade News Bulletin*, p. 1.
- , 2000. "¿2001: Hacia Un Nuevo Siglo Bananero?" [http://www.bananalink.org.uk/2001_doc/2001_doc.htm].
- , 2001. *Best of the Bunch! Fairtrade bananas: From producer to consumer*. Norwich: Banana Link.
- Barrientos, Stephanie. 2000. "Globalization and Ethical Trade: Assessing the Implications for Development." *Journal of International Development* 12:559-570.
- Bourgois, Phillipe. 1989. *Ethnicity at Work: Divided Labor on a Central American Banana Plantation*. Baltimore: Johns Hopkins University Press.
- Brown, Michael Barratt. 1993. *Fair Trade*. London: Zed Books.
- Chambron, Anne-Claire. 2000. *Straightening the Bent World of Bananas*. Maastricht: EFTA.
- Cone, Cynthia Abbott and Andrea Myhre. 2001. "Community-Supported Agriculture: A Sustainable Alternative to Industrial Agriculture?" *Human Organization* 59:187-97.
- Conroy, Michael E., Douglas L. Murray, and Peter M. Rosset. 1996. *A Cautionary Tale: Failed U.S. Development Policy in Central America*. Boulder: Lynne Rienner Press.
- EFTA (European Fair Trade Association). 2001a. "Finally the European Commission has adopted Fair Trade." *EFTA Advocacy Newsletter* 1:15.
- , 2001b. *Fair Trade in Europe 2001*. Maastricht: EFTA.
- Evans, Peter. 2000. "Fighting Marginalization with Transnational Networks: Counter-Hegemonic Globalization." *Contemporary Sociology* 29:230-41.
- Fair Trade Federation. 2000. "Fair Trade Facts." [<http://www.fairtradefederation.com>].
- FAO. 1999. "The Market for 'Organic' and 'Fair Trade' Bananas." CCP:BA/TF 99/7. Rome: FAO.
- , 2000. *Ad-hoc Expert Meeting on Socially and Environmentally Responsible Banana Production and Trade*. Rome: FAO.
- Fisher, Eleanor. 1997. "Beekeepers In the Global 'Fair Trade' Market: A Case From Tabora Region, Tanzania." *International Journal of Sociology of Agriculture and Food* 6:109-159.
- FLO (Fairtrade Labelling Organizations International). 2000a. "Fairtrade: A better deal." [<http://www.fairtrade.net>].
- , 2000b. "Fairtrade Banana Criteria." [<http://www.fairtrade.net/banana.html>].
- , 2002. "Sales in 2001." *FLO Fairtrade Fruits Newsletter* :1.
- Friedmann, Harriet. 1993. "The Political Economy of Food: A Global Crisis." *New Left Review* 197:29-57.
- Glover, David and Ken Kusterer. 1990. *Small Farmers, Big Business: Contract Farming and Rural Development*. New York: St. Martin's Press.
- Goodman, David and Michael Goodman. 2001. "Sustaining Foods: Organic Consumption and the Socio-Ecological Imaginary." Pp. 97-119 in *Sustainable Consumption: Conceptual Issues and Policy Problems*, edited by M. Cohen and J. Murphy. Amsterdam: Elsevier Science.
- Henriques, William, Russel D. Jeffers, Thomas E. Jr. Lacher, and Ronald J. Kendall. 1997. "Agrochemical Use on Banana Plantations in Latin America: Perspectives on Ecological Risk." *Environmental Toxicology and Chemistry* 16:91-99.
- Hinrichs, Clare, Gil Gillespie, and Gail Feenstra. 2001. "Entrepreneurial Development at Retail Farmers' Markets: A Regional Social Economy Perspective." Paper presented at the 64th Annual Meeting of the Rural Sociological Society, Albuquerque, NM.
- Imhoff, Daniel. 1996. "Community Supported Agriculture: Farming with a Face on It." Pp. 425-433 in *The Case Against the Global Economy*, edited by Jerry Mander and Edward Goldsmith. San Francisco: Sierra Club Books.
- Klonsky, Karen. 2000. "Forces Impacting the Production of Organic Foods." *Agriculture and Human Values* 17:233-43.
- Liddell, Ian. 2000. *Unpeeling the Banana Trade*. London: Fairtrade Foundation.
- Magdoff, Fred, John Bellamy Foster, and Frederick H. Buttel, Eds. 2000. *Hungry for Profit: The Agribusiness Threat to Farmers, Food, and the Environment*. New York: Monthly Review Press.
- Marsden, Terry. 2000. "Food Matters and the Matter of Food: Towards a New Food Governance?" *Sociologia Ruralis* 40:20-29.
- McMichael, Philip. 2000. "The Power of Food." *Agriculture and Human Values* 17:21-33.
- Moberg, Mark. 1997. *Myths of Ethnicity and Nation : Immigration, Work, and Identity in the Belize Banana Industry*. Knoxville: University of Tennessee Press.
- Murray, Douglas L. and Laura T. Reynolds. 2000. "Alternative Trade in Bananas: Obstacles and Opportunities for Progressive Social Change in the Global Economy." *Agriculture and Human Values* 17:65-74.
- Nash, June. 2000. "Postscript: To Market To Market." Pp. 175-179 in *Artisans and Cooperatives: Developing Alternate Trade for the Global Economy*, edited by Kimberly Grimes and B. Lynne Milgram. Tucson: University of Arizona Press.
- Oxfam. 2001. *Bitter Coffee: How the Poor are Paying for the Slump in Coffee Prices*. Oxfam Policy Paper. Oxford: Oxfam.
- Ransom, David. 1999. "Fruit of the Future." *New Internationalist* 317:20-23.

- Raynolds, Laura T. 2000. "Re-embedding Global Agriculture: The International Organic and Fair Trade Movements." *Agriculture and Human Values* 17:297-309.
- Raynolds, Laura T. and Douglas L. Murray. 1998. "Yes, We Have No Bananas: Re-Regulating Global and Regional Trade." *International Journal of Sociology of Agriculture and Food* 7:7-44.
- Renard, Marie-Christine. 1999a. "The Interstices of Globalization: The Example of Fair Coffee." *Sociologia Ruralis* 39:484-500.
- , 1999b. *Los Intersticios de la Globalización: Un label (Max Havelaar) para los pequeños productores de café*. Mexico, DF: CEMCA
- Tabb, William K. 1999. "Progressive Globalism: Challenging the Audacity of Capital." *Monthly Review* 50:1-10.
- Tallontire, Anne. 2000. "Partnerships in Fair Trade: Reflections From a Case Study of Cafédirect." *Development in Practice* 10:166-177.
- TransFair USA. 2000. "Starbucks Coffee Company Brings Fair Trade Certified Coffee to Retail Stores Through TransFair USA Alliance." Press Release, Sept. 25, 2000.
- Watts, Michael and David Goodman. 1997. "Agrarian Questions: Global Appetite, Local Metabolism: nature, culture, and industry in *fin-de-siecle* agro-food systems." Pp. 1-32 in *Globalising Food: Agrarian Questions and Global Restructuring*, edited by David Goodman and Michael Watts. London: Routledge.
- Whatmore, Sarah and Lorraine Thorne. 1997. "Nourishing Networks: Alternative Geographies of Food." Pp. 287-304 in *Globalising Food: Agrarian Questions and Global Restructuring*, edited by David Goodman and Michael Watts. London: Routledge.
- Personal Communication:
- Jetta van den Berg. President, Savid Dominicana C por A. Interview, 4/26/02.

GLOBALIZATION AND PORK RAISING IN MEXICO: THE CHALLENGES OF INTEGRATION TO THE WORLD MARKET*

María del Carmen Hernández M.
Centro de Investigación en Alimentación y Desarrollo

Carlos J. Maya A.
Universidad Autónoma de Sinaloa

INTRODUCTION

Mexico has experienced globalization a long time before this word became a cliché. Globalization deepened during the 1980s, when Mexico's import substitution model was replaced by the secondary exports model. Nowadays, there is no doubt that the Mexican economy is fully oriented towards exports, which account for one-third of its GDP. At the same time, the transition from one model to the other had major consequences. Among the most important of these were the disarticulation (Cypher 2001) and the polarization (Dussel 2000) of the Mexican economy, which means that export activities have not usually developed linkages with other economic sectors, but have functioned as a kind of modern enclave. This represents the exact opposite of other well-known and successful clusters, such as Silicon Valley in California. Polarization has occurred at several levels, among regions, economic sectors and producers, even within the same industry. That is also the case with agriculture *vis-a-vis* the rest of the economy, in sharp contrast to the manufacturing and finance sectors. Within particular economic sectors there are also deep and growing inequalities. This is the case within agriculture, between producers oriented towards the international markets and those oriented to the domestic markets; and between producers who are able to reach the level of investment dictated by the international competition and those who are crowded out of the market because of their lack of resources.

On the other hand, and as part of this transformation and restructuring process, there has occurred a redefinition of the roles of the countries that participate in the agricultural world market. Developed countries have come to focus on the production of strategic goods, like corn, eggs, meats, milk (Rubio 1995: 34), whereas underdeveloped countries produce for niche markets, and have come to specialize in the production of luxury or supplementary agricultural goods. Given these trends, there is considerable interest in the analysis of the pork industry in Sonora, in northwest Mexico. Ever since they first entered the international market, producers in this region have experienced a very dynamic and contradictory process of development and a concentration of output. In order to be competitive, pork producers in Sonora have had to seek market niches that were of no interest to the biggest producers of the industry, located in the USA, Canada and Denmark. Therefore, producers in Sonora focused on the specialties market, which in this case means portioned pork meat, which is cut exactly as the customer specifies. Such products include pork meat cuts portioned to a specified weight and individually frozen; for example, sliced loin; belly chunk; diced pork ham meat; pork shoulder slices; pork shoulder sticks, and many other products. Although this market is very small, it includes customers with high incomes, who willingly pay a premium price for a product which satisfies their contractual requirements.

This kind of insertion into the world market has allowed Sonora's pork raisers to revitalize their activity, in spite of a cyclical crisis which has affected all the economic sectors, and in spite of the drastic reduction of government support to the agricultural sector. In focusing on international markets, the pork raisers adopted a strategy of organizing themselves into trading companies, which proved to be very successful. However, this kind of embedding into the world market involved some other problems, such as polarization and the crowding out of some producers from the market, as well as the disarticulation of the sector from the local economy.

Understanding the positive and negative aspects of this experience could help us to analyze the most effective ways for Mexican producers to position themselves in international markets, and to consider also what action might be necessary in order to counteract some of the negative effects of the secondary exports model. In particular, it should be stressed that at the macroeconomic level, the promotion of regional activities like the pork industry in Sonora could help to reduce the strong concentration of Mexican exports, which are currently strongly concentrated on a few regions, a few industries and even fewer

* María del Carmen Hernández M. is a Researcher at the Centro de Investigación en Alimentación y Desarrollo. Carlos J. Maya A. is Research Professor at the Universidad Autónoma Sinaloa, México. The authors gratefully acknowledge financial support from the Sistema de Investigación del Mar de Cortés (SIMAC), which made this research possible. A part of this project was included in the FAO Strategists Alliance for Rural Development Program (AC/00163 FAO). The authors would also like to thank Ing. Antonio Ulloa Méndez, and the managers of the firms who agreed to be interviewed.

big companies. Similarly, it is desirable to promote activities which could develop productive linkages which have positive spillover effects at the regional and the local level.

THE STRUCTURE AND ORGANIZATION OF THE INDUSTRY

Sonora's pork industry was established at the end of the 1950s. It expanded rapidly during the 1960s as a consequence of the 'green revolution' in wheat, which made possible a 100 percent increase in the wheat harvest. This, together with financial support from the government, allowed farmers in the region to expand their activities into poultry and then into the pork industry. During the 1980s, these pork producers were already the main suppliers of pork meat and live hogs to the Mexican markets located in the centre of the country. They were independent growers, whose inventories of live hogs ranged from 50 to 400 sows. In order to buy inputs and sell outputs collectively, growers were organized in four marketing companies, an organizational form which was initially very attractive to the small and medium producers.

The growth of Sonora's pork industry was interrupted in the 1980s as a consequence of the stabilization program implemented by the Mexican government and by a severe contraction of the domestic market (Dussel 2000). Other adverse factors included increasing production costs and competition from other regions of the country. As a result, local production of pork fell from 156,285 tons in 1984 to 110,191 tons in 1990. Under these circumstances the pork producers began to search for alternative markets and to adopt new competitive strategies (which are discussed later). Of particular significance in this context were the opportunities made possible by the liberalization of trade between Mexico and the United States even before the North American Free Trade Agreement (NAFTA) was introduced in 1994. Such developments also contributed to further structural changes within the industry, in particular increased concentration of ownership. In 1982, the Unión Ganadera Regional de Porcicultores del Estado de Sonora (Sonora Pork Producers Association) had 169 members. Seventeen years later this number had fallen by 29.5 percent. The average swine farm in Sonora had 470 sows in 1997, but just two years later, some pork producers had more than 15,000 sows (Fideicomisos Instituidos en Relación con la Agricultura (FIRA) 1997; Unión Ganadera Regional de Sonora 1999). As will be seen shortly, this concentration of ownership at the farm level was matched by an increasing degree of corporate control as large companies invested in these facilities or entered into joint ventures. All of these developments help us understand why the pork industry is currently the most successful activity within Sonora's livestock sector.

The Embedding Context

Clearly, the Mexican pork industry has experienced major changes over the last twenty years, promoted by internal as well as by external factors. In terms of the internal factors, the most relevant has been Mexico's recurring economic crises, which have forced a reduction in the consumption of red meat, as a consequence of successive reductions in the minimum wage.¹ These crises have also raised the costs of production, through inflation and higher interest rates,² while other adverse elements include the reductions in subsidies, and higher prices for electricity and other inputs.

Although the 1980s were critical years for the pork industry everywhere, there is evidence which supports the contention that the crisis in the Mexican industry was particularly severe (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA) 2000).³ Although the industry slowly recovered over the 1990s, output has still not been restored to the production levels of 1982-1983. This is probably a consequence of the opening up of the domestic market to imports in 1988, when pork meat products began freely to enter Mexico.⁴ Consequently, the relative share of the imports in the total pork meat supply doubled in the following year (Pérez 1996: 399). This trend continued until 1994, when imports accounted for 30.4 per cent of the total national supply (Secretaría de Agricultura, Ganadería y Desarrollo Rural (SAGAR) 1998). The Mexican financial crisis of 1994-1995⁵ resulted in a slight decrease in imports over the next two years, but these recovered during the

¹ Chicken meat has been substituted for red meats. This happened for two reasons, the first economic and the second cultural. In 1994, chicken prices fluctuated between \$7.37 and \$12.88 per kilogram (in Mexican pesos), whereas red meat cost \$16.87 per kilogram and pork meat \$17.94 per kilogram. At the same time, consumers began to express a preference for foods with lower cholesterol levels.

² Between 1975 and 1988, the average inflation annual rate was 55.2 percent. In some years of course, it was even higher (e.g. it was 159.2 per cent in 1987). To the increase in prices must be added the negative impact of higher costs of government services and products associated with the strategy of economic adjustment (www.banxico.org, 2000).

³ Open carcass production fell by 41.9 percent in the period 1980-1989, while live hog production fell by 36.9 percent. The decline in output for Sonora was 12.5 percent and 8.01 percent respectively.

⁴ As noted earlier, although NAFTA came into effect in 1994, some of Mexico's sectors, like agriculture, experienced the opening-up of trade some years earlier.

⁵ The Mexican crisis of 1994-1995 was in fact a structural crisis, although it manifested itself as a financial crisis (Dussel 1996; Ros 1995; Guillén 1997; Guillén 2000). It should be remembered that in December 1994, the Mexican peso collapsed and within a few months, had been devalued by more than 100 percent. The macro indicators for 1995 were very poor, and indicated a negative growth rate of -6.9 percent; inflation was running at 52 percent and the current account deficit amounted to 8 percent of the GDP. The overvaluation of the currency (of between 25 and 40 percent), a very large current account deficit financed by massive (portfolio) foreign investments, low productivity, declining private savings, questionable credit policies and mismanagement of debt, and the enormous issuing of dollar-linked short-term debt (*tesobonos*), were important factors underpinning the crisis. But in essence, the crisis expressed the failure of the anti-inflationary program

Asian crisis of 1997, when declining sales to Asia resulted in American companies raising their sales of pork meat to Mexico by 700 per cent. Between 1995 and 2000, Mexico became the second most important market for US pork, with 20 per cent of American exports going to Mexico (www.fas.usda.gov). At the same time, the share of pork in total Mexican meat production decreased from 28.2 to 24.8 per cent (SAGAR 1998: 27).

Mexican pork raisers faced not just the contraction of the domestic market, but also massive imports of foreign pork meat, which was usually produced under more favourable conditions. These imports were cheaper than the Mexican product, which depressed the domestic price and also reduced profit margins. All these factors gave added pressure to the competition among pork companies, and forced them to adopt development strategies to survive in a situation in which there were no more government supports.

Under these circumstances, the location of the Sonora pork industry - so close to the US, one of the main producers of pork meat, yet so far from the most important domestic markets for this commodity - has given rise to a very critical situation for this industry. Nevertheless, the pork industry is currently experiencing considerable success, despite the pressures which followed the freeing up of trade. The following data confirm this:

1. Between 1990 and 1998 the rate of growth of production volumes in Sonora's pork industry was 5.3 percent, higher than the national average (2.68 percent), and the highest of all meat-industries located in Sonora.⁶
2. The local industry increased its share in the value added to industry end-products from 35 to 49 per cent (Gobierno del Estado de Sonora (GES) 1999).
3. Sonora's pork companies raised their share in the domestic supply from 10 to 18 per cent between 1990-98⁷ (SAGAR 1998; SAGARPA 2000) and in 1996 supplied 90 percent of Mexican pork meat exports (Díaz n.d.).
4. Sonora's pork industry has not only restored output to the levels prevailing before the crisis of the mid-1980s, but could surpass these levels in the future. Exports have grown continuously, in spite of high corn prices in 1996, a financial crisis in 1994 (involving higher rates of interest and more expensive US dollar credits), and the oversupply of pork meat in the world market in 1998, which derived from a contraction of the Asian market and overproduction in the USA.⁸

The success of the pork industry in Sonora is the result of a number of initiatives, which were designed to provide a competitive edge in export markets. These initiatives are discussed in the next section of this paper.

COMPETITIVE STRATEGIES TOWARDS GLOBALIZATION

Given the handicaps they face with regard to geographical location and weather conditions,⁹ the strategy of Sonora's pork companies had traditionally been to keep pace with current technological innovations and to be at the forefront in terms of the integration of production.¹⁰ Such innovations are necessary in the face of the advances of their main competitors in Mexico, namely pork farmers from the Bajío.¹¹ Moreover, the opening of the Mexican-American border forced Sonora's pork companies to adopt new initiatives in the face of the threat from the American pork industry. Thus, they implemented the following strategies.

that had the nominal exchange rate as the fundamental anchor (Edwards and Naím 1997), and most importantly, the subordination of the productive economy to the speculative economy during the preceding six years.

⁶ For the same period, cattle production nationally grew by 2.4 percent, while in Sonora it declined by 0.23 percent; for poultry, production increased nationally by 8.77 percent but declined by 15.6 percent in Sonora (SAGAR 1998; SAGARPA 2000).

⁷ The cause of this trend was that the local pork industry grew at a very high rate, whereas the production of the national pork industry plummeted.

⁸ After the elimination in 1984 of subsidies to corn used by cattle breeders, the organized producers from Sonora began to buy corn on the international market, taking advantage of the financial facilities offered by the American and Canadian governments, and involving interest rates that were considerably lower than domestic rates. However, the peso devaluation in 1994 caused such debts to increase by 124 percent when expressed in Mexican currency.

⁹ The weather in Sonora confers both costs and benefits; the extreme temperatures make necessary the use of air conditioning equipment, which increases fixed costs. However, at the same time, the dry environment helps the producer in dealing with sanitary problems, thereby reducing costs.

¹⁰ The local producers process the feed they use and also buy corn through their producer associations. In addition, 70 percent of them are associated with some authorized slaughterhouses and many participate in companies like seedstock producers, and laboratories and firms which analyze feed rations.

¹¹ The Bajío region enjoys significant advantages, such as local grain production (sorghum), closeness to the consumer markets and the highest incomes per unit, which are \$1,952 yearly per swine, 32 percent higher than in Sonora. Its disadvantages are related to sanitary issues (FIRA 1997:28).

1. *Seeking new foreign markets.* Even though Sonora's producers had some earlier experience of exporting through companies like Mezquital del Oro and Grupo PISA, which in the 1970s periodically marketed their products in Japan,¹² it was the opening-up of agricultural trade before the NAFTA that triggered new export activity. The first applications for export licenses occurred in 1988 and two years later Sonora's companies began to sell in Japan. The entry into the Japanese market was made possible by the fact that these companies operated at high levels of sanitary quality, acceptable technological development, and very efficient marketing. Thus, in 1992, they exported 5,400 tons of portioned pork meat to Japan, with a value of US\$25.1 million. Four years later, export volumes reached 16,253 tons valued at US\$76.1 million. This achievement, involving a growth rate of 338 percent in 1995, was without precedent, and placed this sector the third highest in terms of Mexican exports to Japan (Díaz n.d.:11). Ninety per cent of these sales were attributable to companies from Sonora, which in the year 2000, exported 31,000 tons of pork meat valued at US\$120 million (GES 2000).

In view of the fluctuations in demand in the international market, and their vulnerable position within this market, Sonora's pork companies decided, as a part of their marketing strategy, to pay greater attention to their presence in the domestic market.¹³ In 1998, 70 percent of pork meat production was sent to Mexico City, and the States of Mexico, Chihuahua, Nuevo León, Sinaloa, Puebla, Coahuila, Jalisco, Baja California and Colima, while only 18 percent of production, consisting mainly of special cuts, was sold in the world market, mostly Japan, Greece and the USA.

2. *Identifying the market segments where they could be competitive.* Given the huge inequalities between the pork industries of Mexico and the USA, this strategy meant avoiding competition with the big American producers.¹⁴ As a consequence, Sonora's pork producers did not enter into the fresh meat or the commodities market, but focused instead on a range of high value added products, namely special cuts - portioned, sliced, dressed or frozen products - specified by the buyer. All of this required the use of more advanced technology and a good deal of highly qualified labor.

3. *Transforming the productive process on the farms and the organization of the marketing companies.* In order to compete in the international market, Sonora's pork producers needed to modify their internal organization and structure. Before the recent move into new export markets, the marketing companies had limited their activities to selling pigs, but subsequently the aim was to meet international standards for production and productivity. At the same time, as a result of increasing fuel prices, transport costs for live hogs increased significantly, competition from other Mexican pork producers intensified and Sonora producers decided to set up their own slaughter plants. Initially, these were used to supply open carcasses to the Mexican sausage industries, although very soon foreign suppliers of open carcasses appeared, causing an oversupply and price reductions of up to 30 percent (Anonymous 2001a). Under these circumstances Sonora's pork producers recognized the need to differentiate their supply and also look for more attractive markets. Product diversification is the most important strategy for the leading firms, which undertake a steady process of enlarging their lines of production. Currently, these companies offer 58 products classified in three groups: fresh and frozen pork cuts; portioned pork cuts, produced in measured weights and separately frozen; and processed 'ready to eat' products. Of less relevance is the trading of sausage and secondary meat cuts. In order to continue with this overall strategy of product diversification, some companies have established a specialist department focussing on new products, the function of which is to identify buyer preferences and the possibilities of developing products with more added value, suitable for the demands of this select market segment. The internal organization of the processing plant is very flexible, so that it can quickly be adapted to meet the product specifications defined by the clients.

Accordingly, with this strategy, Sonora's pork producers have necessarily intensified the industrialization of their products, in order to add more value through special cuts, packing and freezing. This has also required the employment of a large and highly qualified labour force. In order to meet international standards of production, productivity, health and biosecurity measures, the producers have organized their activities according to the development cycles and the gender of the livestock. In this way, they have been able to increase productivity, optimize their use of inputs (e.g. feed), and prevent diseases, through the use of improved pig breeds, the automation of processes such as feeding and cleaning, and the introduction of artificial insemination. These measures have made possible reduced production times, increases in the weight of animals, and a reduction in the average loin fat of live hogs, from 26.23 percent in 1994 to 20.33 percent in 2000 (Anonymous 2000). Special attention has been given to biosecurity measures, which comprise several processes (e. g. isolation of the farms, the handling of residues, controlled human and animal access, etc). Overall, such developments have transformed the marketing companies into industrial plants, and have significantly increased the efficiency of Sonora's pork producers, who in 1997 had just 8 percent of the national inventory of live hogs, but supplied 18 percent of the Mexican pork meat production (SAGAR 2000: 16).

¹² These activities were sporadic because producers needed an export licence, which depended upon supply conditions and prices in the Japanese domestic market. Under these circumstances, producers could not always arrive at an accommodation on supply with Japanese companies.

¹³ The vulnerability of the Sonora's pork producers also stemmed from their marginal participation in the Japanese market. In 1997, Japan imported 700,000 tons of pork meat, of which Sonora's pork producers supplied just 25,000 tons (Trueba 1998:4-14 and SAGAR 1999).

¹⁴ In the USA there are companies with plants which slaughter 70,000 hogs a day. In Mexico, the biggest producers cannot slaughter more than 2,000 hogs a day (Anonymous, 2001a).

4. *Deepening the process of the integration of production and relocating some companies.* The strategy of the integration of the plant seeks to ensure a timely supply of meat of the high quality demanded. Hence, the leading companies supervise the whole production process, including the production of the balanced feed used by their associates and suppliers; the management of breeding farms and trading ('full cycle') farms; the operation of slaughtering plants and the processing of meat; and, of course, the marketing of the products. These companies pay special attention to the proportion of dorsal fat of the animals and also to their muscular symmetry, in order to facilitate more homogeneous cuts.

The point of this strategy is not just to reduce the costs of production, but to guarantee the timely supply of inputs while simultaneously satisfying the sanitary requirements demanded by consumers. Certainly in the 1980s, the integration of production was squarely aimed at cost reductions, which explains the emergence of associations for selling, slaughtering, and the production of feeds. Ten years later however, Sonora's pork producers, already fully integrated into the world markets, largely pursue quality improvements in their products, linking several phases of the value chain of meat production; genetics, nutrition, sanitary control, processes of adding value, and marketing.¹⁵ All of this requires huge investments in several fields (e.g. R&D, specialized equipment, personnel training, etc.), with the aim of ensuring the production of pigs which completely satisfy the Japanese demand for high and consistent quality.

5. *No expansion of exports, but increases in the added value of the special cuts.* This requires a level of technology and training that is not available to all companies; hence entry to this market segment is still very difficult for most export companies. At the same time, such commitments are unavoidable. A very precise knowledge of the market, and the establishment of very close relations with the customers, are necessary in order to satisfy the quality levels and the specific features demanded by buyers willing to pay high prices. This strategy is closely related to the production capacity of the Sonora pork industry, and its focus on two segments of the market; minimally-processed commodities and special cuts. The first segment includes ordinary pork meat, which does not require further processing or specific features. The second segment, in contrast, comprises very sophisticated cuts which require extensive processing. Profits in the first of these segments depend on high levels of turnover, and in the second segment on a firms' capacity to diversify its production in order to satisfy the needs of buyers. In addition, the availability of a highly qualified labour force is crucial, because it plays a key role in adding value, since many activities require craft-like skills. These specialized workers must be trained under tight sanitary conditions, in different departments and sections of the production plants, over a period of several months. Each new product requires new and specific learning processes, usually carried out under the direct supervision of the Japanese client, who sends an expert from Japan for this purpose. This expert remains in Sonora for weeks and even months, until the product requirements demanded by the client are fully met.¹⁶ At that point, the Japanese buyer certifies the new product, which precludes the selling of this product to another client.¹⁷

All these measures are necessary if the Mexican firms wish to preserve their position in the international market. Besides, exports represent high profits for the studied companies. For instance, the third biggest Sonora's firm exports just 18 percent of its output, but these sellings account for 50 percent of its total income.¹⁸ This market is also attractive, because these kind of products have hardly any substitutes. Thus, their demand is not affected when powerful global players, like Denmark, channel massive supplies of pork meat products to Japan. Nevertheless, in spite of all these advantages, it is not easy for the Sonora's pork producers to position themselves in these niche markets, for two reasons. First, on the production side, huge investments in equipment and labour are unavoidable. Second, on the demand side, the Japanese client - clearly the dominant partner in the relationship - requests special cuts as well as minimally-processed commodities. Therefore, the Japanese clients are demanding two different sets of products, each of them of different quality and therefore corresponding to two markets segments. Both of them must be supplied together and their combination constitutes what is called a *blend*. It is worth noting that the whole negotiations between the companies and their Japanese clients turn on the exact composition of the *blend*. Negotiations are unavoidable, since special cuts are very labour intensive products and therefore are more expensive than minimally-processed commodities, and blend prices must reflect this fact.

Therefore, Sonora's pork producers aim at acquiring a higher level of expertise, better knowledge of the Japanese market, and adequate technology for special cuts production, thereby adding more value to their products; in this context, the aim of

¹⁵ Some firms, like Newsham, a member of the Norson group, are associated with US firms which employ Mexican workers to produce semen in the USA for farms located in Sonora. The same activity is being carried out by another firm, Kowi, which is associated with the Canadian firm Genetipork, which owns the company Geneti-Kowi, located in Canada. It supplies semen and other inputs to the Geni-Kowi company located in Sonora.

¹⁶ An example of such specifications can be found in the Internet site of Alpro-Norson: 'Pork loin eye is prepared from main cut of loin. Side muscle on, 2.5 cm. belly side on from side muscle. Uniform 5 mm. fat covering over back area. Completely free of sinew and soft bone. One piece per bag, four bags per box' (source: <http://www.norson.net/index2.html>, March, 2002).

¹⁷ The price difference between ordinary pork meat (called full set) and special cuts makes profitable all these efforts. A kilogram of full set meat costs between US\$2.50 and US\$4.50, whilst the price of the special cuts fluctuates between US\$5.00 and US\$10.00 (Anonymous 2001a).

¹⁸ Interview with the general director of the third most important processing firm in Sonora, August 2, 2001.

increasing export volumes is a secondary consideration. Several companies also indicated an interest in further extending their presence to other phases of the pork meat chain; this is certainly the position of the pioneers of the industry, such as Alpro-Norson, Kowi, SASA and Lancer, as well as the new companies such as Genpro, Cortes y Procesos de Carnes de Sonora Grupo Soles and Grupo Parada.¹⁹

6. *Joint Venture Agreements with foreign companies.* Such joint ventures make easier the capitalization of Mexican companies and allows them to enter into new lines of production, the products of which will have more added value. Joint ventures also help to open new markets using a well-known trade mark and to reinforce the strength of key production areas of the company.

In the mid-1990s, international competition forced Sonora's pork companies to look for strategic alliances with foreign firms. Alpro-Norson became associated with Smithfield Foods Inc. in order to increase meat production, the processing of special cuts and to promote the marketing of pre-cook and ready-to-eat products.²⁰ Although Smithfield currently owns 50 percent of the shares of Alpro-Norson, the president and the vice-president of the company are Mexican nationals, and they remain in control of the marketing of special cuts exported to Japan.

For its part, Grupo Kowi has two agreements with American firms; the first is with Farmland to produce feed, involving an investment of US\$3.4 million (<http://www.sonora.gob.mx/csocioal/mes/1098/109801.htm>); the second is with Geneti Pork International, a Canadian firm, for semen production in Canada (Anonymous 2000b). Many other companies in Sonora are also looking for such agreements with foreign partners as a way of improving their growth and consolidation.

CONCLUSION

Sonora's pork industry has successfully faced the challenges of the international market, as well as the crisis of the Mexican economy. Furthermore, the rising level of imports of pork meat products into the Mexican domestic market have had no effect on the industry in Sonora. The integration of the industry into the world market required deep transformations, such that pork production can no longer be seen simply as an activity within Mexico's primary sector, but as part of a global agri-industrial chain. In this context, a major role was played by the four former marketing companies, which were established in the 1970's and 1980s by small and medium growers in order to transport and sell their products collectively. These firms eventually were transformed into processing plants, which came to organize and integrate the whole of local production in order to satisfy the requirements of overseas, and particularly Japanese, demand. Thanks to the strategies adopted by these firms, Sonora's pork industry is the most important of all local livestock activities, and contributes 50 percent of the value produced in this sector (*El Imparcial*, March 17, 2002).

However, this trend is not free from contradictions or negative consequences. Small and medium producers with insufficient financial resources have been removed from the market. Furthermore, in their effort to add value to their products, the companies in Sonora can source their main input, pork meat, from wherever the market conditions (relating to quality and price) are most favourable. In fact, between 1998 and 2001 the rate of growth of pork meat imports to Sonora was 39 percent, whilst for the same period the growth rate of exports was 8 percent (Secretaría de Fomento Ganadero 2002). Clearly, such behaviour could damage those local farms dedicated only to swine-raising.

In sum, the last ten years have seen Sonora's pork companies undergo a very intensive learning process, involving not just undertaking innovations in their production methods in order to meet the demands of the international market, but also learning to negotiate with all the economic agents who participate in their market niche; investors, customers, government officials, etc. The most important lesson is that while these companies are defined as pork processing and marketing companies, the origin of their raw materials inputs becomes irrelevant, provided they fulfill the sanitary and quality requirements. Certainly this principle makes more dynamic the way these companies function, but at the same time it jeopardizes the productive linkages of the whole of Sonora's pork industry.

REFERENCES

- Agriculture and Agri-Food Canada. 1995. "Opportunities in Mexico: Pork Products. Market profile-Mexico". <http://www.atnriac.agri.ca/public/htmdocs/e077.htm>
- Anonymous 2000. Confidential data supplied by a Sonora government official, 3 July.
- Anonymous 2001a. Confidential data supplied by managers of processing plants owned by Alpro-Norson, Kowi and SASA, 31 January.
- Anonymous 2001b. Confidential data supplied by a director of Geneti Pork International, 24 November.
- Cypher, James M. 2001. "Developing Disarticulation Within the Mexican Economy". *Latin American Perspectives* 28(3): 11-37.
- Díaz, Ricardo. n.d. *Sector Porcino*, México: UNAM.

¹⁹ This trend is confirmed by the official data. See SAGAR 2000 and the Sonora newspaper, *El Imparcial*, March 17, 2001.

²⁰ This joint venture has led to the establishment of 34 new swine farms, and an increase in processing capacity for special cuts from 1,000 to 2,000 pigs a day. This project will require an investment of US\$61.1 million. See *El Imparcial*, September 17, 2002.

- Dussel, Enrique. 1996. "La crisis mexicana: ¿Últimas diez lecciones?". *NEXOS* 220, April 1996. CD version
- , 2000. *Polarizing Mexico: The Impact of Liberalization Strategy*. Boulder: Lynne Rienner.
- Edwards, Sebastian and Moisés Naím (editors). 1997. *Mexico 1994. Anatomy of an Emerging-Market Crash*. Washington, D.C.: Carnegie Endowment for International Peace.
- El Imparcial*, Sonora, various issues.
- FIRA Fideicomisos Instituidos en Relación con la Agricultura (FIRA 1997. "Oportunidades de Desarrollo de la Porcicultura en México". *Boletín Informativo*. XXIX (296), July, 31.
- Gobierno del Estado de Sonora (GES). 1998. *Agenda Estadística*. Hermosillo, Sonora: Secretaría de Planeación del Desarrollo y Gasto Público. Subsecretaría de Planeación. Dirección General de Planeación y Estadística.
- GES 1999. 2º Informe de Gobierno Alfonso López Nogales, Anexo Estadístico Gráfico, Hermosillo, Sonora.
- GES 2000. Estadísticas de la Porcicultura Sonorense 1990-2000. Internal Document.
- Guillén, Héctor. 1997. *La contrarrevolución neoliberal en México*. México: Ediciones Era.
- Guillén, Arturo. 2000. *México hacia el siglo XXI: Crisis y modelo económico alternativo*. México: UAM, Plaza y Valdés editores.
- Hernández, María del Carmen. 2001. *Crisis avícola en Sonora. El fin de un paradigma*. México: Plaza y Valdés editores, CIAD, UAS, UNISON.
- Maya, Carlos and María del Carmen Hernández. 1999. "Competencia global y competitividad local: dilemas y desafíos a partir de experiencias de productores mexicanos", *5º Encuentro Nacional sobre Desarrollo Regional en México*. Hermosillo, Sonora: Universidad de Sonora, CIAD, AMECIDER, IIE, El Colegio de Sonora.
- Pérez, Rosario. 1996. "La Porcicultura en el Tratado de Libre Comercio de América del Norte". Pp.377-408 in S. Lara and M. Chauvet (eds). *La Sociedad Rural Mexicana Frente al Nuevo Milenio*, Vol. 1: La Inserción de la Agricultura Mexicana en la Economía Mundial, México: INAH, UAM, UNAM, Plaza y Valdés..
- Revista *Desarrollo Porcícola*. 1999. No. 52 May-June. Órgano de difusión del Consejo Mexicano de Porcicultura, A.C.
- Ros, Jaime. 1995. "La crisis mexicana: causas perspectivas, lecciones." *NEXOS* 220, April 1996. CD version.
- Rubio, Blanca. 1995. "Agricultura mundial, estructura productiva y nueva vía de Desarrollo para América Latina (1970-1992)." Pp.19-58 in H. Cartón de Grammont (ed) *Globalización, deterioro ambiental y reorganización social en el campo*. México: UNAM, Juan Pablos Editor.
- Secretaría de Agricultura, Ganadería y Desarrollo Rural (SAGAR). 1996. *Sistema de Información Agropecuaria de Consulta 1980-96*, Mexico.
- SAGAR. 1998. *Situación y Perspectivas del Mercado Porcícola en México*, México, <http://www.sagar.org.mx>).
- SAGAR. 1999. *Anuario Estadístico de la Producción Agrícola de los Estados Unidos Mexicanos*, 1998. México.
- SAGAR. 2000. *Situación Actual y Perspectivas de la Producción de Carne de Porcino en México 2000*, México.
- Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA). 2000. Sistema de Información Agropecuaria de Consulta (SIACON) 1980-1999. México, CD version.
- Secretaría de Fomento Ganadero 2000. Government of Sonora.
- Trueba, Sergio. 1998. "Situación Actual y Proyecciones de la porcicultura." *Revista Desarrollo Porcícola*, 48:4-13.
- Union Ganadera Regional de Sonora. 1999. *Porcicultura Sonorense. Censode Granjas Porcícolas*. Hermosillo (internal document).

CREATING MARKETS FOR BIOTECHNOLOGY

Vivien Walsh*
UMIST, Manchester

INTRODUCTION

Much recent literature on biotechnology has focused on the supply side. Discussions have concentrated either on technological opportunities and applications, which include genetically engineered crops and drugs, diagnostic kits, new search methods in R&D or new approaches to waste treatment; or on organisational change in the firms commercialising biotechnology - merger, demerger, acquisition, divestment, collaborative alliances and the appearance of new firms (Walsh, Ramirez and Tampubolon 2000; Walsh and Lodorfos 2002).

In the face of the new technology and increased globalisation, the chemical and related products industry¹ might be said to have reinvented itself in two stages. First it changed its boundaries and formed two industries: one based on traditional chemicals and synthetic materials and the other based on life sciences, including agrofood and pharmaceutical products. The demerger and divestment of life sciences activities from traditional chemical activities was been followed by a new wave of merger and acquisition within each of the two new groupings, to consolidate market share and move into new markets. The second stage, still underway, has been a further separation of the life sciences sector into pharmaceuticals and agro-food, via a further round of demerger, divestment, merger and acquisition.

Rather less has been written in the social sciences about the demand side of biotechnology innovation, although the mass media has given considerable attention recently to the opposition of consumers in Europe (though far less so in North America) to genetically modified food (Gee 2000), and the opposition of farmers in poorer countries to genetically modified and especially sterile seeds (Vidal 1999), which this paper discusses later. I have accordingly focused more on the demand side of biotechnology, and in particular on the creation of markets and of demand for agro-biotechnology in the late 1990s.

In neo-classical or standard economics, markets and market signals play a primary role in the allocation of resources and in decisions made about technological change. Neo-Schumpeterian or evolutionary economics, in contrast, places more emphasis on supply-side factors such as entrepreneurship and firm capabilities. It stresses the role of the firm, as an actor which will take risks, which goes through a learning process, and which develops strategies based not solely on 'objective' knowledge, but also influenced by its own culture, ethos and guiding philosophy, rather than one which is able to take profit-maximising decisions based on knowledge of (future) prices of inputs and outputs.

This paper is certainly in agreement with the latter approach rather than the former, but takes the view, firstly, that evolutionary economics tends to neglect the demand side, and in particular the environment in which products succeed or fail. The neo-Schumpeterian tradition (Nelson & Winter 1982) has a name for this - the Selection Environment - but research within its framework has tended to focus more on the study of supply side factors. In re-focusing on the demand side this paper does not in any way embrace a neo-classical perspective, but seeks to develop a better understanding of the concept of the selection environment.

Secondly, the analysis presented here explores a *rapprochement* between economics and other social science disciplines, notably sociology and anthropology. In a sense the concept of the selection environment does this already, since a selection environment includes not only markets but also non-market factors (e.g. government regulation, government and industry standards, and professional recommendation), which may determine the nature and extent of a market, or indeed whether or not a market will exist; factors which have been particularly important in biotechnology. Such an expanded concept of the demand side may be said to incorporate into economics ideas about behaviour and culture (the province of sociology and anthropology) and motivation (the province of psychology).

My purpose in this paper is to explore the evolutionary economics concept of the selection environment, from a perspective informed by ideas from the disciplines of sociology and anthropology, as a framework within which to analyse and understand markets, users and the demand side, and their influence on innovations in biotechnology as they continue to

* Direct all correspondence to Vivien Walsh, Manchester School of Management, UMIST, Manchester M60 1QD, UK. Tel (44) 161 200 3434. Fax (44) 161 200 3505. E-mail vivien.walsh@umist.ac.uk.

Acknowledgements: I am grateful to the UK Economic and Social Research Council for funding some of the research reported in this paper (Award number H52427500796). I would like to acknowledge the contribution to my thinking on biotechnology, demand and other issues discussed in this paper, by a number of colleagues, students and friends - notably François Chesnais, Sally Gee, Jordan Goodman, Ken Green, Deborah Greenlaw Nicholls, George Lodorfos, Andy McMeekin, Richard Nelson, Victor Pelaez, Paulina Ramirez, Marilyn Strathern, Gindo Tampubolon, Mark Tomlinson and John Wilkinson.

An earlier version of this paper was presented at the Tenth World Congress of Rural Sociology, 30 July - 5 August, Rio de Janeiro, Brazil. I am grateful to the participants in the Agricultural Technology, Society and the Life Sciences Symposium of this conference for their useful comments, and to John Wilkinson and Pascal Byé for organising it.

unfold and diffuse. I have drawn in what follows on interviews conducted at various times with specialist biotechnology firms and chemical and agro-food multinationals and discussed at greater length elsewhere²

THE TAKE-OFF OF BIOTECHNOLOGY

The commercialisation of biotechnology by a wave of new firms created to exploit advances in (mainly) public sector research has been widely reported. So, indeed, has the fact that, despite its revolutionary scientific foundation, biotechnology has been gradually assimilated by the dominant firms rather than leading to one or several waves of significant numbers of new entrants growing to large firms as in information technology (Chesnais & Walsh 1998), while new firms continue to be created to commercialise new waves of discovery in biotechnology.

The established chemical firms might, in principle, have been pushed aside by these new entrants commercialising an entirely new technology in the established firms' traditional markets and destroying their competencies. But many of the chemical firms have been around a very long time³ and have survived successive waves of innovation as they did in this case, and indeed have been responsible for some of them. This time, when innovation came from elsewhere, the chemical firms established alliances with the independent firms, providing the complementary assets and skills needed by the small firms to exploit their technological knowledge commercially. At the same time the established chemical firms used the collaborative work as a means to develop their own competencies in the new technology.

For their part, the small firms were willing to enter these alliances for two reasons: (1) they lacked skills and experience in manufacturing, clinical trials, regulatory compliance, promotion and distribution, and (2) many of the expected commercial opportunities were a long time in coming to fruition as demand remained only a potential for much longer than anticipated, *and markets had to be created*, the main theme of this paper.

The established firms' investments in the life sciences increased in the 1970s and 1980s. By the late 1980s the firms which had developed biotechnology competencies in pharmaceuticals, health diagnostics and enzymes, consolidated their positions with major investments in those areas and began to gain regulatory approval for, and market, the resulting products. Diagnostics were the first biotechnology products to reach the market, requiring less stringent regulatory approval, followed by genetically engineered human hormones (such as insulin and human growth hormone) used for medical purposes. Meanwhile the firms which had pursued agricultural opportunities came to the conclusion that commercialisation in this area was longer term and more risky. Many of them (e.g. Bayer & Hoechst) reduced their biotechnology investments to maintaining 'windows on opportunity' by alliances with specialist firms, and reinforced their positions in traditional agrochemicals.

A few agrochemicals firms, however, had diversified downstream into seeds and had acquired a position in the seeds market, and skills in traditional plant breeding as well as in genetic engineering. The 1980 decision by the US Supreme Court in *Diamond v Chakrabarty* that "a live, human made microorganism is patentable subject matter" as long as it meets the criteria of novelty, utility and non-obviousness, and as long as it is a product not of nature but of human manufacture (Kloppenburger 1988: 261-2) paved the way for the patenting of genetically engineered plants. This decision was the result of General Electric's appeal against the US Patent and Trademark Office's rejection of an application for a patent on an oil-degrading micro-organism developed by GE scientist Ananda Chakrabarty.

Ciba, Sandoz (since merged to form Novartis) and ICI (subsequently Zeneca Agrochemicals and then Syngenta⁴) are the major firms which strongly invested in this area, although in the early 1990s they were still expressing caution, for example saying in interviews that they were not planning the commercial launch of any genetically modified crops for the time being. However, in practice, the first field trials of a GM crop (virus resistant tobacco) had started to be held in 1986, in the USA and France (Tampubolon 2000). Monsanto is arguably the best known producer of GM crops as a result of its advertising campaign of the late 1990s and subsequent media coverage (discussed below); however, despite its investment in a research programme in agrobiotechnology in the 1980s, Monsanto did not follow the path taken by ICI, Sandoz and Ciba by moving into seeds and plant breeding, either in terms of organic growth of research or acquisition of firms with the desired competences and markets, until the 1990s. Its patents in agrobiotechnology did not begin to take off until the early-mid 1990s, and indeed its move out of traditional chemicals into higher value-added products took place initially via a move into pharmaceuticals, like that of the majority of chemical firms (Walsh & Lodoros 2002: 279, 281 & 295).

From the late 1980s, events began to move fast, so that all the leading agrochemicals producers, Bayer, Novartis, Du Pont, Hoechst (now Aventis)⁵, Monsanto, Rhône-Poulenc (now Aventis) and Zeneca (with 60% of the world market between them) were producing genetically engineered crops by the mid-1990s (Nottingham 1998), and in three years, the amount of acreage planted with them went from negligible to an area the size of Britain (*New Scientist* 1998). The inflection point in the graph (see Fig 1), or takeoff year, of the number of field trials world-wide occurred in 1992 (Tampubolon 2002). In the same year China planted more than 2 million acres of virus resistant tobacco. In 1994 Calgene (since bought owned by Monsanto) launched the Flav^rSav^r™ tomato. By 1998 more than 5000 field trials were being held involving 60 GM crops, more than 60 countries and about 75 million acres (*Ibid.*). The introduction in the USA in 1993 (and elsewhere soon after) of a fast track system for granting release permits for planting GM crops, considerably speeded up the process of takeoff of innovation in GM crops.

The main features genetically engineered into crops include resistance to herbicides (often but not always the firms' own), resistance to insect pests, and enhanced nutritional properties (e.g. high polyunsaturated oil content) or properties which increase shelf life, automatic handling and value to weight ratio (e.g. low water content). Table 1 lists these in more detail. Another new market has been created for nutraceuticals: these are foods with beneficial health effects, such as grapes which help to reduce heart disease, tomatoes that help control prostate problems, broccoli which helps protect against cancer, and alfalfa to resist tooth decay (Radford 1997).

Table 1 Examples of Properties Genetically Engineered into Crops
to 1998 inclusive

Agronomic properties 49 categories including	Product Quality 79 categories including
Altered maturing	Altered amino acid composition
Cold tolerant	Bruising reduced
Drought tolerant	Antioxidant enzyme increased
Fiber quality altered	Delayed softening
Growth rate altered	Dry matter content increased
Modified growth characteristics	Fiber quality altered
Nicotine levels reduced	Fruit firmness increased
Yield increased	Fruit ripening altered
Stress tolerant	Fruit sweetness increased
Bacterial resistance 12 categories	Fruit solids increased
Fungal resistance 42 categories	Nutritional quality altered
Herbicide tolerance 11 categories	Oil quality altered
Insect resistance 21 categories	Prolonged shelf life
Marker gene 12 categories	Protein quality altered
Nematode resistant 5 categories	Seed size increased
	Rust resistant
	Yield increased
	Other 29 categories including
	Altered plant hormone levels
	Antibiotic produced
	Industrial enzyme produced
	Novel antigen produced
	Novel protein produced
	Polymer produced

Source: Gindo Tampubolon, (2002)

A convergence of biotechnology and information technology has produced a raft of new techniques, including combinatorial chemistry, rapid throughput screening, and computer-aided molecular design, which have automated parts of the R&D process and enabled the design of molecules for specific end-uses. Initially applied in the pharmaceutical industry, often as a result of the collaboration between small specialist firms (e.g. Affymax in the USA⁶ and Cambridge Combinatorial in the UK⁷) and large drug companies, the new search processes have since been applied to the discovery of new agrochemicals (see for example AstraZeneca 2000) designed to kill specified pests and new catalysts designed to generate polymers with specific properties. Genetic engineering for the production of chemicals, building materials, plastics, fibres and new sources of energy from renewable resources has been forecast for years (e.g. OECD 1989; Rifkin 1998); but since the mid 1990s firms have actively developed, for example, a genetically engineered cotton plant that can produce polycotton fibres while Monsanto's Blue Jeans project obtained blue lint from cotton plants (Nottingham 1998).

THE SELECTION ENVIRONMENT FOR BIOTECHNOLOGY DEMAND

In turning now to the selection environment for GM crops, which determines whether or not they will succeed commercially, I start by considering the nature of demand for this area of innovative activity. In everyday English innovation is taken to mean a novelty or a new way of doing something. In the social studies of science and technology it is usually used in the sense given to it by economists Joseph Schumpeter (1912) and Christopher Freeman and Luc Soete (1997: 6), that is an invention⁸ which has been launched on the market and has been the object of a commercial transaction, or has been adopted into the social fabric in some other way (e.g. a new medical technique which has been adopted without a commercial transaction necessarily having taken place). In other words, the idea of an innovation captures two notions, technological novelty, and commercial transaction (or other adoption into practice) - contributions of both the supply and

demand sides⁹. It also allows for the possibility that innovations may be failures as well as successes. (This paper uses the term 'innovation' to mean 'technological innovation'; other kinds of innovation are qualified, as in 'organisational innovation'.)

Early debate in the innovation literature about the relative importance of demand-pull and discovery-push forces in stimulating innovation (e.g. Walsh 1984) resolved itself around a consensus that innovation is in fact a coupling process between technical possibilities or opportunities and market demands or opportunities¹⁰, though at different times in the life-cycle of a technology or industry one or other might be the prime mover. Radical innovation, in particular, is more likely to be initiated by the supply rather than demand side. But if any innovation is to be a success, radical or otherwise, there must be customers who are willing and able to do so.

A potential innovator might be expected to find out who are likely to be customers of their innovation, and how the innovation might best be adapted to meet their needs. Some social science research suggests, however, that managers and innovators often believe they intuitively know what their customers want (e.g. Akrich (1995). In any case, radical innovations may be so different from potential customers' experiences that they do not necessarily realise that they have needs which the innovation might meet (Miles 1993; Miles, Cawson & Haddon 1992).

At the same time innovators may not have a very clear idea about which the most promising markets will turn out to be. Traditional market research is not very helpful where a new product or process departs substantially from what is reasonably familiar to potential customers. Marketing becomes 'existential' (Littler and Leverick) and innovators take what anthropologist Lucy Suchman (1987) and others call 'situated actions', that is, actions which have to be adapted to the unforeseeable contingencies of particular situations. The innovator is unable to shape or adapt the product or process to the needs of a target customer. Where innovations are radical, a market in the usual sense may not exist, but may have to be *created*. Michel Callon (1987), a sociologist with an engineering background, writes about 'engineer-sociologists', that is engineers acting as sociologists (or economists), who not only make inventions but invent social and economic environments in which they can be successful, and then continuously seek to mould their (real) environment accordingly, rather than just introduce new artefacts into a pre-existing environment on which they then have some impact.

In the early days, there was no market for the various applications of biotechnology, though *potential* demand existed in the form of a variety of problems in need of solutions that the developers of biotechnology believed they could provide. The existence of various illnesses and medical conditions, for example, may represent a potential demand for drugs to treat them - although in practice the solution may not be a drug at all, but the reduction of pollution or provision of clean water. In any case such a potential demand is not the same as a market signal, though it may be a motivation for key actors.

The gap between the belief that the existence of a medical condition was an indication of a potential demand for treatment, and the actual demand that materialised when a product or service becomes available, was illustrated by Ken Green (1992) in the creation of markets for diagnostics by the active intervention of the innovators. World hunger could be said to represent even less a demand for genetically modified foods, even though Monsanto was quoted in the late 1990s as saying 'ask how you're going to feed the world' in reply to public opposition to GM foods (Vidal & Milner 1997). It certainly is not a market signal for them, since poverty is a major factor in lack of adequate food. The entrepreneurs and investors who first tried to commercialise biotechnology discovered that they had grossly misjudged the time scale within which returns could be realised and the conditions under which demand would be sufficient for commercial viability.

USERS AND CONSUMERS

Having discussed the concept of 'demand', let us now turn to the users and consumers of innovations, and especially of innovations in agro-biotechnology. Von Hippel and colleagues (e.g. von Hippel 1988; von Hippel and Tyre 1995) have written about users as prime movers in the innovation process, and Lundvall (1988; 1995) has argued the key role of user-supplier interaction in the success of innovation. Collaboration in the development stage between a producer of an innovation and its lead users can be very important. Indeed, users may be as innovative as producers of innovations since they may have to adapt a new product, or adapt their own procedures. Some innovators create markets, customer loyalty and 'lock-in' by providing technical services and training to customers of radically new products¹¹. In biotechnology, collaboration between suppliers and users of the technological knowledge, or of innovative, biotechnology-based tools and diagnostics, has been important in commercial success of innovations and the survival of new firms. So has interaction between innovators and experts who test biotechnology-based products and subsequently recommend them to end-users.

Any technology which has or is seen to have moral or ethical implications can generate public concern, and aspects of the demand side of biotechnology can be highly politicised. Consumer reaction against genetically modified foods, the lobbying of government bodies by multinationals, and concern about the ethics of aspects of human reproductive technology, are all examples. Campaigning and pressure groups (such as Greenpeace, Friends of the Earth, consumer organisations, 'right to life' and 'right to choice' groups) are in a position to play a significant role, while the media not only reflect but also influence public opinion, and hence play their part in market shaping.

Monsanto adopted a strategy of first commercially launching GM crops which were bulk commodities and would blend seamlessly with traditional varieties as they entered the processing and export pipeline (Morse 1996). Multinationals in general expected that the application of genetic engineering to food would be welcomed by the public for their beneficial effects for crop production and the environment. US consumers accepted the new technology fairly readily, but firms were

surprised to learn that many consumers in Europe regarded GM food as contaminated. Firms thought that all that would be necessary would be to provide the public with facts and logic to convince them otherwise (Nottingham 1998) and Monsanto, in particular, launched an advertising campaign in the summer of 1998. Advertising is a traditional method of creating markets, but this particular promotional activity proved to have the opposite effect: it increased resistance to the new technology as it increased awareness of it.

Promotional material claimed that the new technologies were environmentally friendly, and would lead to health benefits, an end to world hunger and reduced use of pesticides. Monsanto's advertising campaign, for example, said that GM foods meant higher yields and lower chemical treatments. They found, however, that 'people's concerns are not based on science or economics. They're based on a gut feeling that there's something dodgy about these foods.' (Greenberg 1998a)¹².

Monsanto commissioned a survey of public opinion in Britain and Germany before and after their advertising campaign, focusing on several different groups: the general public, social classes A and B, the press, retailers, and MPs and Civil Servants. In Britain, the public were found to be skeptical of science (*ibid*). They were generally without confidence in the food chain, in scientists, in government, and in British or European regulatory authorities, primarily as a result of 'mad cow disease' ('stating that seed had been approved by British food safety agencies *reduced* support for our products' [*ibid*, emphasis added]). The media were sceptical or even hostile. And the name Monsanto was well known to the public and explicitly associated with the unwanted products ('those dreadful people with that f---ing long name, whatever it's called, Monsanto' and 'they used bullying tactics, really. Used their might to bulldoze it through.') (*ibid*).

Customers for innovative foods are not only the end consumers who eat it, but also the retailers who decide what to stock and what to promote to the public, and consequently make a crucial contribution to market demand. The retail sector's stance was not so much about safety as about consumer demand (Wrong 1999a). They were particularly critical of Monsanto whom they saw as having 'foisted [GM foods] upon us', having left retailers to reassure the public, and having removed the possibility of giving consumers a choice. 'They didn't care, didn't want to help' (*ibid*). In 1986, both European food retailers and Greenpeace began to campaign against non-labelled imports, and consumer organisations were advising caution towards GM foods, fearing that scientific, ethical and social concerns were being swept aside. They were all critical of the fact that decisions were being made on behalf of consumers with minimal public debate. EuroCommerce, which represents the wholesalers and retailers, urged US grain companies to segregate GM from non-GM products. At that time Monsanto claimed this to be physically and economically impossible (Maitland 1996), and in general it continued to shrug off protests at this time.

Whereas in the USA the more highly educated and upper socio-economic groups 'helped forge the way for biotechnology', in the UK they were found to be even more hostile than the general public. Seventy percent of Members of Parliament and civil servants, while themselves reacting positively to GM foods, showed a strong negative reaction to the way in which Monsanto introduced them ('absolutely appalling' and 'arrogant' were among the comments quoted by Stan Greenberg [1998a]). In summary, the Monsanto advertising campaign, which had cost the firm £1 million, 'was overwhelmed by the society-wide collapse of support for genetic engineering in foods' in 1998 (*ibid*). That year saw a major upsurge of hostile public opinion in Europe to genetically modified products in food.

Firms we interviewed in the USA in the same year were not yet faced with similar concerns from the American public, and commented that Europe's move towards requiring the labelling of genetically modified foods 'could really disrupt trade' or indeed that firms in European biotechnology markets could be facing 'a major trading disaster'. The reports to Monsanto discussed above were leaked onto the internet by Greenpeace in November 1998, revealing the 'extreme hostility' and 'collapse of public support for biotechnology and genetically modified foods' (Greenberg 1998 a & b), in both Britain and Germany. The hostility towards GM foods was even greater in Germany than in Britain.

Meanwhile other firms in the business, such as Zeneca and Novartis, were busy distancing themselves from Monsanto's strategies, both in GM food promotion (to which they attributed the consumer backlash (Coughlan 1998)) and in limiting the sales of Roundup Ready™ crops to users of their herbicide Roundup™, although these crops are also resistant to other herbicides. There was also opposition to Ciba's corn-borer resistant maize, but tomato paste using Zeneca GM tomatoes had been sold for a few years in UK supermarkets, clearly labelled and apparently without opposition (Maitland 1996)¹³. UK supermarkets Sainsbury and Safeway labelled tomato pastes made with Zeneca tomatoes, so shoppers knew what they were buying and could choose something else (though tomato paste containing GM tomatoes appears to have since been withdrawn). Monsanto's advertising campaign, however, *alerted* the public to the fact that they in fact had no choice - and possibly no knowledge - about the inclusion of GM soya and other products in all manner of unlabelled foods, and to add insult to injury the firm was telling them it was a good thing.

Europe's early opposition - compared with the USA - to GM foods has been attributed to the public's inability to trust what politicians, scientists or representatives of the food industry said about food safety, in the light of misleading statements during a succession of food safety scares, such as those about salmonella in eggs and chickens, listeria in cook-chill meals, and above all BSE in beef (Nottingham 1998; Gee 2000). Environmental concern, for example about 'gene hopping' has also been expressed and this, too, seems to be more an issue in Europe than the USA. Smaller farms, smaller fields, closer to each other, and high population density in Europe may have contributed to this. Opposition to 'meddling with the processes of life' has also been present, though no more so in Europe than in the USA. The latter concern seems to

have been overcome in relation to the development of drugs for saving life or alleviating serious chronic medical conditions (Maitland 1996), although other medical treatments where ethical issues are more to the fore, such as those concerning human reproductive technology, are still the subject of widespread public unease, and this is at least as much the case in the USA as in Europe.

This section has considered the role of consumers and users as actors in the demand for agro-biotechnology products and services, arguing that there are a number of different actors along the value chain, and that these actors not only send (or do not send) market signals in the conventionally accepted way, but also contribute to the creation and shaping of markets in various ways. As discussed earlier, evolutionary economics has expanded the concept of the market into that of the selection environment, which includes the system which regulates what may or may not be marketed, and intermediaries who prescribe and recommend products on the market. These will now be explored in the next section.

THE REGULATORY ENVIRONMENT AND INTERMEDIARIES

The non-market parts of the selection environment are particularly relevant in understanding the success and failure of biotechnology-based products and services. Regulations covering drug and food safety and environmental protection affect the market for biotechnology, while professional experts in the field of medicine, nutrition, agriculture and ecology carry out trials and prescribe or recommend products. Firms consider it necessary - and worthwhile - to lobby law and policy-makers and to direct promotional material at the professionals and experts.

In the early 1990s, for example, the Council of the Chemical Industries in Europe (CEFIC¹⁴) had a Senior Advisory Group on Biotechnology (SAGB), made up of representatives of all the large firms in the industry with biotechnology interests. This group had the task of producing information and lobbying the European Parliament and other decision makers to encourage them to take decisions that were as close to the interests of the industry as possible, especially concerning environmental, product safety, intellectual property and other regulations governing biotechnology based products, processes and services (e.g. SAGB 1990). The 'fast track' for notification of releases of GMOs in field trials and commercial planting, a consequence of public policy in this area, has also affected the rate of growth of the market for the products.

We have reported elsewhere (Walsh, Ramirez & Tampubolon 2000) that the building of international inter-firm / inter-organisational alliances, in relation to pharmaceuticals, has been motivated by firms' need to tap into and embed themselves in the different national systems of innovation, not only for supply-side reasons (e.g. best utilisation of the science and technology infrastructure, tax breaks and other favourable government policies), but also for demand-side reasons. By becoming recognised as an established part (and 'good citizens') of the countries in which they sell their products, firms may shape and influence their selection environment, notably by influencing the policies of governments that affect markets, prices and regulatory régimes, as well as carrying out the more traditional activities of establishing links with lead users and complying with regulatory requirements that necessitated local trials. The drive to commercialise genetically engineered foodstuffs, in particular, has involved heavy lobbying of trade organisations, regulatory bodies, law makers, the media and consumers (Vidal & Milner 1997).

The intense lobbying and advertising by the agrofood industry has, however, rebounded on it, as discussed above, and although governments in Europe have generally been more willing than their citizens to accept GM foods - the EU approved US imports of soyabeans containing GM varieties in April 1996, for example - public pressure has had its effect. EU policy in the late 1990s was influenced by two main concerns - lack of consumer choice, generating calls for labelling and the separation of GM from non-GM foods; and environmental safety as expressed in the danger of creating weeds resistant to pests and herbicides, or the harm to beneficial predators of crop pests.

Even the US government began to feel the pressure. The British press had been critical, as noted in the previous section, but until the spring of 1999, food biotechnology still had broad support in the USA. A special report by *The Guardian*, serialised over several days at the end of 1997, had reported a 'revolving door between the US government and the biotechnology industry'; 'heavy lobbying', and 'use of the world's leading PR firms' to 'massage debate' and 'rewrite world food safety standards' in favour of biotechnology; 'legal contracts locking farmers into corporate control of production'; 'consumers being given no effective choice of foods'; and 'use of world organisations to challenge governments opposing GM crops'. Both 'Wall Street and the White House' were said to favour Monsanto (Vidal 1999), whose income had grown 28% since the previous year, and whose CEO was saying that the launch of GM crops was the most successful of any technology, ever. This was the year *after* the very negative report on public acceptability discussed above - clearly Monsanto were hoping to ride the storm, having dismissed social and ethical criticisms from environment, church and consumer groups (*ibid*).

But less than two years after *The Guardian's* special report, *The Wall Street Journal* wrote in April 1999 that the GM controversy was beginning to be felt in the USA. By May 1999, even the US Secretary of Agriculture warned 'of profound consequences' and suggested voluntary labelling. The US grain industry reported that it had nearly stopped shipping to Europe: by the summer corn exports had gone down by 96% and the first GM crops in the USA were being destroyed by environmental activists.

INTERACTION WITH THE SUPPLY SIDE

Economic analysis does not really allow for an interaction between the supply and demand sides, other than in the market place. However, some degree of selection may be made by managers and R&D staff in the innovating firm (normally considered to be part of the 'supply side'), on the basis of what is likely to work, or to be accepted by customers. Thus a degree of interaction or even blurring of boundaries exists between the supply and demand side (Chesnais and Walsh 1994). This is an area more within the scope of sociology of innovation, and some sociologists working in the framework of actor-network theory (e.g. Akrich 1995, Mangematin & Callon 1995) have suggested that there is a simultaneous construction of a product or a technology and the market for it. For example, a prototype is tried out with lead users, who adapt it to better meet their own needs and provide feedback to the innovator who makes the necessary adjustments. At the same time the lead users may also adapt their own practices, relationships and related products to make better use of the prototype, while enlisting new potential users by a demonstration effect. In this way they create and shape the market at the same time as modifying the technology, and there is a blurring of the distinction between 'early adopters' and 'late designers'.

Table 2

Elements of the Selection Environment for Biotechnology	The role they play
Pharmaceuticals & diagnostics	
Health care providers (organisations)	Recommend drugs, use diagnostics
State or private health insurance	Pay for drugs, diagnostics; may influence which products are sold by determining which will be paid for
Pharmacists	Sell over the counter drugs & diagnostics; stock others for supplying to a prescription
Medical profession	Conduct clinical trials; write prescriptions; use diagnostics; advise regulatory bodies
Government regulatory system	Determines whether a new medicine is safe, efficacious and represents an advance in treatment over existing products
Patients	Consume products
New methods for design and discovery of new molecules	
Researchers, laboratories	May buy in, develop themselves or acquire via collaborative alliance with firm developing the techniques
Genetically modified crops	
Farmers	Buy seeds, grow crops
Food processing firms	Buy foods and additives as raw materials for canning, freeze drying, freezing and preparing ready-to-heat meals; preparation of 'processed' foods and products such as TVP, Quorn. Buy diagnostics and testing devices for unwanted micro-organisms.
Supermarkets	Buy from food processing firms, farmers and markets; decide what to stock and hence what consumers may buy; what to permit in 'own brands'; important pressure group for lobbying e.g. over labelling
Greenpeace, consumer organisations and other public interest groups	Campaign on consumer choice, public health and safety, environmental protection, labelling, openness in decision-making and government regulations; provide information; may carry out independent tests of products & services
People who buy and eat food	The end user – consumes the products; may or may not have made an informed choice
Citizens	Vote for representatives who support particular policies; campaign on all manner of issues; may demand more openness in decision-making
Government regulatory bodies	Examine evidence that new products meet product and environmental safety standards; may carry out tests themselves; negotiate with firms to establish the tests that they need to carry out or other actions required for regulatory compliance
Agricultural research establishments	Carry out research; recommend products and techniques
Nutritionists	May carry out research; recommend products
Research Foundations	Fund research; inform the public; influence many of the main actors
IPR regime	Allows market to exist; allows monopoly profits to be made (possibly for a temporary period); encourages innovators to innovate

This kind of adjustment between the demand side and the supply side, however, works better with an innovative product or system where lead users can actually work with, and adjust, a prototype - for example, a road guidance system

(the case study used by Mangematin & Callon), or a telecommunications system (Akrich's example). Users of biotechnology tend to have a different relationship to the innovation and to the innovator than is the case with such mechanical and electronic examples, and do not modify the product to suit their needs in the same way. Various users and stakeholders along the supply chain (such as supermarkets, farmers, agricultural research institutes, health care services, food processing firms, doctors, regulatory bodies, pharmacists, waste treatment organisations, final consumers and public interest campaign groups, see Table 2) have a role in shaping the products and services that biotechnology supplies, typically by making demands on the supplier, rather than playing the part of 'lead users' in the way that users of IT products and services, for example, might do. They also shape markets by their own acceptance, recommendation, opposition, reassurance, raising concerns or campaigning, as the case may be.

Meanwhile, as we have seen in the case of GM foods, suppliers have also been rather more active in trying to create a market for the new products than is often the case, and have resorted to lobbying and propaganda as well as advertising and market research. Innovators, even established firms with a great deal of experience, can sometimes wildly misjudge potential markets. In an area where ethical issues are important it is even easier to misjudge public opinion, and the agrofood industry, especially Monsanto, seems to have succeeded in the late 1990s in what would normally be a nearly-impossible task: it unified (in opposition) the various stakeholders or elements of the selection environment. End users, farmers, retailers, wholesalers, government bodies, consumer organisations, environmental organisations and the press were all drawn, to a greater or lesser extent and some only temporarily, into the network of opposition to the new technology.

DEVELOPING COUNTRIES

The case of GM crops in economically less advanced countries further develops some of the points already made about demand, the creation of markets, and the politicisation of the whole process. Genetic engineering is a highly competitive business and the focus of biotechnology companies has been on developed country markets where potential sales are large, patents are well protected and the risks are lower. However, agrofood firms frequently legitimate genetic engineering of food by asserting that they provide the means to overcome world hunger and malnutrition, through provision of the technology for breeding pest-resistant crops. This social need, however, is not likely to translate itself into market demand, since vast numbers of poor farmers are in no position to buy the new patented seeds, unless United Nations or charitable organisations are able to subsidise them or the biotechnology firms reduce their prices. Otherwise GM crops could add to, not solve, world hunger as millions of small farmers who are without access either to the technologies or to global markets, would be unable to compete.

GM crops are produced more widely throughout the world than other biotechnology products (drugs, for example). Table 3 shows that Argentina and China are among the top 10 growers of transgenic seeds. In the USA transgenic soya and maize represent 40% of total plantings; in Argentina 70% of soya is transgenic. But this is not necessarily going to eradicate hunger. Brazil is the world's second largest producer of soya, but resisted GM crops for a long time. Monsanto invested \$550 million in 1998 to build a factory in Brazil to make their herbicide Roundup, and Roundup Ready soyabeans became the first genetically engineered crop to be approved by the Brazilian government. But the vast numbers of rural Brazilians who are subsistence farmers do not grow soya: that is grown by the big landowners, and is used to feed beef cattle for export (Mack 1998). The growth in demand for non-GM soya in the wake of public opposition to the transgenic version might have offered a market opportunity to Brazil, as a large producer which had not gone very far towards embracing the new technology. But this would not necessarily help the poor either, if it is the large landowners who grow soya.

Table 3

Country	Cumulative No of Field Trials 1986-1995
USA	1,952
Canada	486
France	253
UK	133
The Netherlands	113
Belgium	97
Argentina	78
Italy	69
China	60
Germany	49

Source: Gindo Tampubolon, 2002

The claim that biotechnology will enable the third world to feed itself has to take into account the complex social and economic factors that contribute to hunger. Is it due to not enough food being produced, or to the exclusion of some of the hungry from access to the food that is produced? Feeding the world is a complex question that is largely outside the scope of this paper or the competencies of this author. I shall therefore limit myself to asking some questions. For example, exactly which properties are in practice being bred into crops using the new technology, directed at which markets and in

whose interests? How many staple foods are being bred to withstand adverse soil, climate and other conditions in poor countries, compared to the breeding of 'exotic' foods that may be grown in industrial countries? Or compared to the breeding of crops for automated farming practices, increased value to weight ratio or otherwise to satisfy farmers or food processors in the richer countries? Is biotechnology, in the form of cell culture or tissue culture, currently being used to propagate crops native to developing countries outside those countries, rather than to enable those countries to grow food for themselves?

The experience of the terminator gene and Monsanto does rather suggest that feeding the third world was not that firm's primary goal in developing biotechnology. The company invited Gordon Conway, president of the Rockefeller Foundation and an agricultural ecologist, to address a meeting with Monsanto board of directors on July 14th 1999. This was part of a commitment they had made to consult more widely, following the GM furore in Europe the previous year. Conway is a supporter of the view that biotechnological techniques are necessary to feed the world, especially in 20 or more years' time, and believes that health concerns may be overstated¹⁵, although he is concerned that the agrobiotechnology multinationals will monopolise patents so that the poor cannot afford them. (He proposes public-private partnerships, if developing countries are to benefit [Conway 1997]). However, the Rockefeller Foundation had invested more than \$100million in GM crop research & Monsanto expected Conway to be more of an ally than otherwise. But in his speech he deplored the company's style and global strategy. He said that they had alienated millions and threatened trade war and long term damage to the prospects of the poor. That the firm had a reputation for arrogance and secrecy, and was seen as responsible for meltdown in confidence in science and big business, and for a backlash against US agriculture (Vidal 1999).

He referred in particular to the terminator gene, which makes crops produce sterile seeds. It was heralded as the solution to environmental fears since crops with the terminator gene could not reproduce. But poor farmers would be in no position to keep buying seed every year - typically they save some from the harvest each year for re-planting. The significance of this speech, and especially the fact that the Rockefeller Foundation had issued a press release containing its main points, so that it became public very quickly, was that a monolithic corporation was being held up to public accountability by someone with far more authority with Monsanto or the industry than Greenpeace or the Consumers' Association, and who could not be accused of opposition to biotechnology or to big business in general. However, the various campaigns and actions of Greenpeace, the Consumers' Association and other such groups, not to mention consumers themselves and poor farmers in some of the developing countries where GM crops were being planted or planned, laid the basis on which the Rockefeller Foundation's criticism could have meaning and impact. Within three months, Monsanto finally admitted (in a speech by satellite link by CEO Robert Schapiro to the Greenpeace conference in London) that it had lost the public relations war by appearing arrogant and condescending (Wrong 1999b). US executives of the company held talks with Greenpeace and other environmental groups, and finally made the formal pledge not to commercialise terminator technology. The following year, in a further move towards improved public relations, Monsanto placed in the public domain the data it had assembled on the rice genome (Monsanto 2000).

INTELLECTUAL PROPERTY RIGHTS

Intellectual property rights are an important part of the infrastructure for innovation, but would normally be associated with the supply rather than the demand side, as they are designed to encourage inventors by ensuring that they can benefit from their discoveries and their investments. This paper argues, however, that the intellectual property rights (IPR) régime also affects the demand side in an important way. Patent protection, in allowing a firm to have a monopoly and therefore charge monopoly prices (if only temporarily) encourages the establishment of a market for the invention. It may also encourage a market in the patents themselves, in the form of licensing and various cross-licensing arrangements. And freely available technology may not be implemented at all, if a firm cannot protect its ability to generate a revenue from its discoveries, e.g. by patenting them.

There has been an ever-increasing expansion of the definition of what could be considered to be intellectual property, and therefore subject to protection via patents, trademarks and copyrights, especially since the Second World War (discussed for example by Coombe 1998, Hayden 1998 and Cassier 2002). In the last 30 or so years in particular, rapid changes have taken place in what the public expects and accepts in IPRs, and in IPRs covering biotechnology in particular. Patent law has been extended to cover life forms such as novel plants (e.g. US Plant Variety Protection Act 1970), genetically modified organisms (following *Chakrabarty v Diamond* 1980, mentioned earlier), and subsequently genetic sequences, despite opposition especially to the latter. (Callon (1994), for example refers to the controversy over patenting genetic code, particularly in Europe, quoting *Le Monde's* view that the 'hereditary patrimony of the human race' should be offered to the international community and not retained as private property.)

The distinction between what is classified as 'natural' and what is the product of human ingenuity has been continuously renegotiated (Hayden 1998) so that the US Patent and Trademark Office, for example, now treats a gene as equivalent to a chemical formula for a product (Cassier 2002). New methods of appropriation of resources or knowledge outside the formal IPR system have also been identified by Cassier (*ibid*), including exclusive-use contracts and private databases covered by the terms of commercial confidentiality. These have been used to appropriate collections of genealogical and medical data, then used to add value to gene sequence information in the development of diagnostics and therapies. Trademark law has similarly evolved from a primary emphasis on protecting consumers from 'fakes' to the protection of manufacturers from competition (Coombe 1998: 53 & 64-66). 'Establishing intellectual property is one way

of securing control over the potential life of creative ideas with reference to both their production and their future use,' comments Strathern (1996: 17).

Most IPR systems are based on the assumption that property rights have to be granted to an identifiable inventor or a limited number of inventors, although (as discussed above) invention and innovation are increasingly carried out in networks. Sometimes a vast array of firms, other organisations and individuals each makes a contribution, but cannot all be named on a patent, trademark or copyright. Some economists have addressed the issue of IPR in networks by expressing concern with the optimum IPR system to encourage collaboration, and to promote the commercialisation of public sector research either by collaboration with existing firms or by the researchers concerned establishing new start-up firms (e.g. Mazzonleni & Nelson 1998; Merges & Nelson 1994). On the whole, however, the issue of IPR in networks is not typically problematised in the economics literature. This is more the domain of anthropologists and sociologists. Indeed, Rosemary Coombe (1998) criticises economists for their focus on the incentive structures of IPRs, aimed at producing a socially optimal supply of intellectual creations, and their neglect of the question of what is owned, how rights of possession may be exercised, who else has made a contribution, and others whose lives are affected in some way. Penny Harvey (1998) makes the point that indigenous knowledge about plants, for example, belongs to a whole community rather than to identifiable individuals, and is based on tacit knowledge of complex local ecologies and on subtle skills in selection and breeding. The success of a plant that is then genetically modified relies as much on such knowledge as on the ingenuity and novelty imparted to it by Western science: but it is not recognised when the GM plant is designating as 'property' according to the laws and conventions of patenting.

A related issue is to consider innovation as a cumulative activity, in which new products are made by applying existing knowledge in new ways, in building on, extending and improving existing innovations, and in 'reverse engineering'. Dominique Foray (1995) argued that conventional IPR régimes were experiencing a crisis (especially in biotechnology), because they discouraged this type of innovative activity, especially in the USA and Europe (where the IPR system favours radical innovators), although he suggested that the Japanese IPR system was more favourable to incremental innovation. This, too is an area more discussed by sociologists and anthropologists. While economists' work on Biotechnology and IPR has generally concentrated on ownership by industry or at least ownership within industrial society, anthropologists' work may focus on non-industrial societies and indigenous knowledge. Penny Harvey (1998) argues that a community may use knowledge in a way that is quite different from earlier uses, and that this recontextualisation - as opposed to simple abstraction - is part of the creative process. This point might apply equally to the copyrighting of music as to the patenting of plant products. Michel Callon (1994) takes the view that even 'pure' or 'basic' science is always appropriable to some extent, because it cannot be separated from its context, the specific matter on which it is inscribed (e.g. equipment, papers, the minds of scientists), and from the complementary assets and skills needed to make use of it.

The distributed and cumulative processes by which innovation takes place have particular implications for IPR in the context of GM foods and feeding the world, where it is particularly relevant to the question of the appropriation of indigenous and traditional knowledge and the ownership, possibly collective, of rare species and areas rich in biodiversity, to be found in many poorer countries¹⁶, or indeed poorer regions of richer countries. There is not much evidence that this concern, strongly expressed by some of the poorer countries, has had an impact on multinational firms' practices. Indeed, the World Trade Organisation's agreement on trade-related aspects of IPR in 2000 has led to pressure on some of the poorer countries to introduce legislation that protects outside investment, although it has also given rise to attempts to protect local resources through intellectual and cultural property legislation, such as the model law drafted for the Pacific Region by the World Intellectual Property Organisation and UNESCO¹⁷. These concerns do, however, seem to have affected the freedom of Western biologists carry out botanical expeditions in developing countries, and has led to demands for the compensation of traditional communities (as well as their governments) for use of their intellectual and material property (Daly 1996).

This section has argued that establishing intellectual property rights, and extending their scope (geographically and in terms of what constitutes 'property'), is one way of privatising what was once in the public domain, or the property of a community, and of creating markets in those areas.

CONCLUSIONS

At the beginning of the 21st century, especially in English-speaking countries, markets are often emphasised as the best, or even the only efficient way of organising and governing an economic system. However, market organisation may often be far more complex, and with more varied forms, than is suggested by conventional economic theory. At the same time an increasing number of situations exist in which the market is not a very satisfactory way of governing and coordinating behaviour or allocating resources. Regulations and other non-market elements may be necessary to make market governance work, while for many activities it is, or would be, socially more desirable or economically more efficient to use other modes of organisation and governance.

This paper has taken the case of biotechnology, focusing on GM foods in particular, and examined the creation of the selection environment within which the innovation could diffuse. The selection environment is a wider and much more complex and subtle concept than that of the market, which is useful in understanding the many factors at work in

determining the success or otherwise of an innovation. It is not enough to have market demand: there are also many other institutional factors that may decisively determine whether or not a market can exist, while demand itself may be created by the actions of those individuals and organisations with an interest in the success of the innovation.

Some of these factors, and their interaction with each other and with demand, are also particularly susceptible to analysis from a sociological or anthropological perspective, or - as I have tried here - a multidisciplinary approach using concepts from several social science disciplines, which provides a richer picture than would be the case using the tools available from only one discipline. Creating a market, for example, may therefore be shown to be not only an economic, but also a social shaping activity. The behaviour and expectations of key actors are as important in the success of an innovation as factors susceptible to purely economic analysis. Intellectual property may be understood from an economic perspective as an incentive system that ensures an optimal supply of inventions, whereas anthropological and other approaches question from whose point of view the supply might be considered 'optimal', and identify social groups (within industrial society, as well as indigenous people) who make important contributions to the generation of intellectual property but are unable to reap the benefits.

The many elements of the selection environment in the case of agro-biotechnology included the market of consumers and potential consumers - a complex supply (or demand) chain illustrated by Table 2. But it also included the regulatory system; retailers; policy makers; environmentalists; consumer organisations; the intellectual property régime; intermediaries which promoted the new products, which informed consumers, and which raised areas of concern; the politicisation of the whole process; and the market creation activities of the main players (one in particular). These latter - normally within the realm of traditional market creating behaviour - in the context of other elements of the selection environment, had a counter effect and generated a learning process in which the companies concerned discovered the merits of opening up a dialogue with these and other elements of the selection environment. They may well have to alter what they offer customers if they are to create a market successfully.

REFERENCES

- Akrich, Madeleine. 1995. User representations, practices, methods and sociology. Pp 167-184 in *Managing Technology in Society: the approach of constructive technology assessment*, edited by Arie Rip, Thomas Misa and Johan Schot. London: Pinter Publishers.
- AstraZeneca. 2000. Zeneca Agrochemicals and Cambridge Discovery Chemistry announce collaboration. <http://www.astrazeneca.com/news/archive>, last accessed April 30th, 2000.
- Callon, Michel. 1987. Society in the making: the study of technology as a tool for sociological analysis. Pp 83-103 in *The Social Construction of Technological Systems*, edited by W. Bijker, T. Hughes and T. Pinch. Cambridge, MA: MIT Press.
- Callon, Michel. 1994. "Is science a public good?" *Science, Technology and Human Values* 19: 395-424, quoting *Le Monde* 29 October 1992.
- Cassier, Maurice. 2002. "Private Property, collective property and public property in the age of genomics." *International Social Science Journal* 171: 83-98.
- Chesnais, François & Vivien Walsh. 1994. Biotechnology and the chemical industry: the relevance of some evolutionary concepts. *Evolutionary Economics of Technological Change Conference*, organised by the European Network on the Economics of Technological and Institutional Change (EUNETIC), Strasbourg, October.
- Chesnais, François. 1997. *La Mondialisation du Capital*. Paris: Syros.
- Conway, Gordon. 1997. *The Doubly Green Revolution*. London: Penguin Books.
- , 2000. Crop biotechnology: benefits, risks and ownership. OECD conference on GM Food Safety: Facts, Uncertainties and Assessment. Edinburgh, UK 28th March. <http://www.rockfound.org>
- , 2001. Grain of Hope. *The Guardian*, 21 March 2001.
- Coombe, Rosemary. 1998. *The Cultural Life of Intellectual Properties: Authorship, Appropriation and the Law*. Durham, NC: Duke University Press.
- Coughlan, A. 1998. Mutiny against Monsanto. *New Scientist*, 31st October.
- Daly, Douglas. 1996. Interview 29th August. Daly is a botanist at New York Botanical Gardens, and was talking about his botanical expeditions to the tropical rainforest of the Amazon while being interviewed in the context of a study of an anti-cancer drug found (in contrast) in the temperate rainforest of North America.
- E. Merck AG. 1968. *From Engel's Angel Pharmacy to the World Wide Merck Group*. Darmstadt: Merck Public Relations Group.
- Faulkner, Wendy and Jacqueline Senker. 1995. *Knowledge Frontiers: Public Sector Research and Industrial Innovation in Biotechnology, Engineering Ceramics and Parallel Computing*. Oxford: Clarendon Press.
- Foray, Dominique. 1995. The economics of intellectual property rights and systems of innovation: the persistence of national practices versus the new global model of innovation. Pp 109-133 in *Technical Change and the World Economy: Convergence and Divergence in Technology Strategies*, edited by J. Hagedoorn. Cheltenham, UK: Edward Elgar.
- Freeman, Christopher, and Luc Soete. 1997. *The Economics of Industrial Innovation* (3rd edition). London: Frances Pinter.

- Gee, Sally. 2000. *The Media and Public Opinion in the GM Foods Controversy: The USA and UK Compared*. Final Year Dissertation, Manchester School of Management, UMIST, Manchester, UK.
- Green, Kenneth. 1992. Creating Demand for Biotechnology: Shaping Technologies and Markets. Pp 164-184 in *Technological Change and Company Strategies*, edited by Rod Coombs, Paolo Saviotti & Vivien Walsh. London: Academic Press.
- Green, Kenneth, Hull, Richard, McMeekin, Andrew, & Walsh, Vivien. 1999. "The Construction of the Techno-Economic: Networks vs Paradigms." *Research Policy*, 28: 777-792.
- Greenberg, Stan. 1998a. Report to The British Working Group, Monsanto, 5th October, <http://www.greenpeace.org.uk/monsanto>, accessed November 1998.
- Greenberg, Stan. 1998b. Report to The German Working Group, Monsanto, 5th October. <http://www.greenpeace.org.uk/monsanto>, accessed November 1998.
- Harvey, Penelope. 1998. "Exploitable Knowledge Belongs to the Creators of it: A Debate." *Social Anthropology*, 6: 109-126.
- Hennion, Antoine. 1989. "An Intermediary Between Production and Consumption: the Producer of Popular Music." *Science, Technology and Human Values*, 14: 400-424.
- Kloppenburger, Jack. 1988. *First the Seed: The Political Economy of Plant Biotechnology 1492-2000*. Cambridge, UK: Cambridge University Press.
- Littler, Dale and Leverick, Fiona. 1990. "Strategic Marketing in New Technology Sectors: the Case of Mobile Communications." 19th Annual Conference of the European Marketing Academy, Innsbruck, Austria, May.
- Lundvall, Bengt-Åke. 1988. Innovation as an interactive process: from user-supplier interaction to national systems of innovation. Pp 349-369 in *Technical Change and Economic Theory*, edited by G. Dosi, C. Freeman, R. Nelson, G. Silverberg & L. Soete. London: Pinter Publishers.
- , 1995. "The Social Dimension of the Learning Economy." Inaugural Lecture, Department of Business Studies, Ålborg University, November 10th.
- Mack, Debbie. 1998. Food for all. *New Scientist*, 31st October.
- Maitland, Alison. 1996. Against the Grain: Controversy Around GM Crops May Have Caught Biotech Cos by Surprise. *The Financial Times*, 15th October.
- Mangematin, Vincent & Callon, Michel. 1995. Technological Competition, Strategies of Firms and the Choice of the First Users: the Case of Road Guidance Technologies. *Research Policy*, 24: 441-458.
- Mazzoleni, Roberto & Richard Nelson, 1998: The Benefits and Costs of Strong Patent Protection: a Contribution to the Current Debate. *Research Policy*, 27: 273-284.
- Méadel, Cécile. 1992. Entre corporatisme et représentation: genèse du service public de l'audiovisuel. *Culture Technique*, 77-88.
- Merges Robert and Nelson, Richard. 1994. On Limiting or Encouraging Rivalry in Technical Progress: the Effect of Patent Scope Decisions. *Journal of Economic Behaviour and Organisation*, 25: 1-24.
- Miles, Ian. 1993. Bringing Computer Power to the Consumer Market. *Technology Analysis and Strategic Management*, 5: 151-171.
- Miles, Ian, Cawson, Alan & Haddon, Leslie. 1992. The Shape of Things to Consume. Pp 67-81 in *Consuming Technologies*, edited by R. Silverstone & E. Hirsch. Harlow: Longmans.
- Monsanto. 2000. Scientists achieve major breakthrough in rice; data to be shared with worldwide research community. <http://www.monsanto.com/monsanto/layout/media/00/o4-04-00.asp>; <http://www.monsanto.com/monsanto/layout/careers/timeline/timeline6.asp>. Last accessed 10.10.02.
- Morse, Laurie. 1996. From Petri Dish to Supper Plate. *The Financial Times*, 15th October.
- Nelson, Richard & Winter, Sidney. 1982. *An Evolutionary Theory of Economic Change*. Cambridge, MA: The Belknap Press of Harvard University Press.
- New Scientist*, 31st October 1998, Editorial.
- Nottingham, Stephen. 1998. *Eat Your Genes*. London: Zed books.
- OECD. 1989. *Biotechnology: Economic and Wider Impacts*. Paris: Organisation for Economic Cooperation and Development.
- Radford, Tim. 1997. Geneticists Bring Speed and Accuracy to an Age-Old Craft. *The Guardian*, 15th December.
- Rifkin, Jeremy. 1998. Apocalypse when? *New Scientist*, 31st October.
- SAGB. 1990. *Economic Benefits and European Competitiveness*. Brussels: CEFIC (European Chemical Industry Council).
- Schumpeter, Joseph. 1912. *Theorie der wirtschaftlichen Entwicklung*. Leipzig: Duncker & Humboldt. English translation: *The Theory of Economic Development*. Cambridge, MA: Harvard University Press 1934.
- Strathern, Marilyn. 1996. Potential Property: Intellectual Rights and Property in Persons. *Social Anthropology*, 4: 17-32.
- , 1999. *Property, Substance and Effect*. London: The Athlone Press.
- Suchman, Lucy. 1987. *Plans and Situated Actions: the Problem of Human Machine Communication*. Cambridge: Cambridge University Press.
- Tampubolon, Gindo. 2002. "Globalisation, Technological and Organisational Change in the Agro-Food Industry." Unpublished PhD thesis, Manchester School of Management, University of Manchester Institute of Science and Technology, UK.
- The Guardian*, 15th December 1997 and subsequent days.

- Vidal, John & Mark Milner. 1997. Food: the £250 billion gamble: big firms rush for profits and power despite warnings. *The Guardian*, 15th December.
- Vidal, John. 1999. How Monsanto's mind was changed. *The Guardian* 9th October.
- von Hippel, Eric. 1988. *The Sources of Innovation*, New York: Oxford University Press.
- von Hippel, Eric & M.J.Tyre. 1995. How Learning by Doing is Done: Problem Identification in Novel Process Equipment. *Research Policy*, 24: 1-12.
- Walsh, Vivien. 1984. Invention and Innovation in the Chemical Industry: Demand Pull or Discovery Push? *Research Policy*, 13: 211-234.
- , 1996. Design, Innovation and the Boundaries of the Firm. *Research Policy*, 25: 509-529.
- , 1997. "Globalisation of Innovative Capacity in the Chemical and Related Products Industry." Pp 89-125 in *Technology, Innovation and Competitiveness*, edited by J. Howells & J. Michie. Cheltenham, UK: Edward Elgar.
- , 1998. "Managing Technology and Organisational Change in the Globalised Chemical Industry." Final Report to ESRC, H52427500796, December.
- Walsh, Vivien, Jorge Niosi and Philippe Mustar. 1995. Small Biotechnology Firms in France, Canada and the UK. *Technovation*, 15: 303-327.
- Walsh, Vivien, Paulina Ramirez and Gindo Tampubolon. 2000. "La mondialisation de l'activité innovatrice dans l'industrie pharmaceutique." Pp 147-158 in *Connaissance et Mondialisation*, edited by M.Delapierre, P. Moati & E. M. Mouhoud. Paris: Economica.
- Walsh, Vivien & Lodorfos, George. 2002. Technological and Organisational Innovation in Chemicals and Related Products. *Technology Analysis and Strategic Management*. 14: 273-298.
- Wrong, Michela. 1999a. Fodder for the GM debate. *The Financial Times*, 18th November.
- , 1999b: Monsanto Chief Admits Public Relations Disaster. *The Financial Times*, 7th October.

ENDNOTES

¹ Defined as the complex of industries related to the exploitation of chemical knowledge, or which have grown around a chemical base (Walsh 1997). Thus new materials, food processing, glass, paper processing and waste treatment, which are based substantially on flow processes and chemical reactions, and seeds and confectionary, with ownership as well as technological links with chemicals, were all for a time within the boundaries of the industry according to the above definition.

² The biotechnology firms were interviewed for a study reported in Walsh, Niosi and Mustar (1995), the chemical and agrofood firms for a study reported in Walsh (1997 & 1998), and the pharmaceutical firms for a study reported in Walsh, Ramirez and Tampubolon (2000).

³ Du Pont, the oldest US firm I visited in a recent survey, was established in 1802, while many of the European firms are much older. Merck, for example, took over the Engel Apotheke in Darmstadt in 1668 (E. Merck AG, 1968).

⁴ ICI's pharmaceuticals, crop protection and specialities businesses demerged to become Zeneca in 1993; Zeneca merged with Astra in 1999 to form AstraZeneca, the agrofood business keeping the name Zeneca Agrochemicals; the latter then merged with Novartis crop protection business to form Syngenta in 2000.

⁵ Hoechst merged with Rhône-Poulenc to form Aventis in 1999

⁶ Acquired by Glaxo Wellcome in 1995 and spun off again by GlaxoSmithKline in 2001.

⁷ Now called Cambridge Discovery Chemistry & owned by Oxford Molecular Group plc.

⁸ An invention in turn is the embodiment of a new idea or concept (or a new application of an old idea or concept) in the form of a sketch, prototype, model or blueprint.

⁹ There are one or two exceptions to this. Some sociologists of innovation also study non-technological innovations: for example, Antoine Hennion (1989) has written about innovation in music while Cécile Méadel (1992) has written about radio programmes. *Organisational* innovations are important both to sociologists and evolutionary economists in analysing the take-off of *technological* innovations (e.g. Green *et al* 1999). Design can both be part of the technological innovation process (the embodiment of a new technology in a product) or innovative in the non-technological sense (as in packaging and advertising design) (Walsh 1996).

¹⁰ Faulkner and Senker (1995: 206-211), for example, review recent models of innovation.

¹¹ Particularly important in the early computer industry and the early diffusion of synthetic materials.

¹² Stan Greenberg was CEO of Greenberg Research, and polling advisor to Tony Blair, Bill Clinton and others.

¹³ There seem to have been two factors at work here: one a concern to preserve consumer choice (in this case farmers' choice of herbicide) in the face of monopoly power; the other a concern about openness.

¹⁴ Conseil Européen des Fédérations de l'Industrie Chimique, based in Brussels.

¹⁵ Gordon Conway's views on GM food, the need for careful testing for unwanted effects, the role of the food industry and also its profits, but also the potential of modified crops to save lives, are presented in more detail in his book (Conway 1997), in a speech made at an OECD conference (Conway 2000) and in an article in *The Guardian* (Conway 2001).

¹⁶ For example a seminar, on intellectual property rights in the context of policy discussions over biodiversity protection, took place in 1997 in Port Moresby, Papua New Guinea (Strathern 1999: 179 & 201). A conference on these issues was held at Cambridge University 13-15 December 2001: Property, Transactions and Creations: New Economic Relations in the Pacific, although the context was wider than the Pacific Region.

¹⁷ Discussed at the Cambridge conference mentioned in the previous note.

**IT'S NOT EASY BEING GREEN:
THE DEVELOPMENT OF 'FOOD SAFETY' PRACTICES IN NEW ZEALAND'S APPLE INDUSTRY**

Megan McKenna*

Hugh Campbell

University of Otago

INTRODUCTION

This paper provides an introduction to New Zealand's apple industry through a review of different approaches to producing 'fresh' and 'environmentally safe' fruit. Two broad objectives are identified. First, to explore different production systems used to enhance New Zealand's environmental or 'food safety profile'. While the New Zealand apple industry has long been recognised for its high quality fruit, the last five years have witnessed increased pressure from consumers, buyers and trade regulators to formalise 'safe' production practices that guarantee minimum consumer risk through unacceptable chemical residues. Integrated Fruit Production (IFP) and Organic Fruit Production (OFP) represent philosophically related, but technologically different methods of 'greening' New Zealand's apple industry. Second, the paper examines some political and ideological agendas by various industry participants to promote and capture, 'green marketing' advantages. The analysis points to the fact that the 'politics of green' are complex and that ideological struggles over production practices reflect wider questions about the nature of New Zealand's national co-operative industry structure and single channel marketing.

Exploring the dynamics and interpretations of 'safe' food production introduces questions about who governs and directs actions concerning land use, production practices and the terms of 'sustainable' industry participation. This paper uses the case of the New Zealand apple industry to highlight the difficulties inherent in attempting to strike a balance between globalisation critique and locality-driven analysis. We argue that 'greening' dynamics within the New Zealand apple industry strongly highlight the multiple scales and processes that influence the restructuring of, in this case, the New Zealand Fresh Fruit and Vegetable (FFV) sector, but more broadly also speaks to wider methodological challenges in agri-food theory. This paper will argue that for apple growers in New Zealand, the question of how to be green brought into play a range of political, regulatory, geographical and biophysical constraints which suggest that agri-food theory needs to re-theorise 'scale' and industry regulation as process-based, socially (re)produced and contested.

CONCEPTUAL PLATFORM

This paper builds on previous research evaluating FFV in the context of food regimes, food networks and agri-commodity chains (Le Heron and Roche 1995, 1996; Roche et al. 1999; McKenna, Roche and Le Heron 1998, 1999; McKenna and Murray forthcoming; McKenna 1999b; Grosvenor, Le Heron and Roche 1995; Moran, Blunden and Bradley 1996a, 1996b *inter alia*). One related arena of interest to the agri-food analysis of FFV has been debates about food safety, 'green' production practices and 'fresh' produce and how these tie into other agri-food discussions concerning the 'agrarian question' - particularly the dynamics of organic production as it represents a shifting, and at times misrepresented, mix of simple commodity production and capitalist modes of production (Campbell and Coombes 1999; Coombes and Campbell 1998; Buck, Getz and Guthman 1997; Tovey 1997; Whatmore 1995; Peck and Tickell 1994a, 1994b). Representing a diverse literature and multi-disciplinary interests, research on the global FFV complex has identified numerous contemporary trends, including:

- (1) increased consumer concern with food safety;
- (2) the 'greening' of corporate food producers' images and production practices;
- (3) formalised and wide ranging guidelines prescribing food qualities at various organisational scales;
- (4) the movement of large-scale capital-intensive food producers into 'low intervention' and 'organic' production systems, and;
- (5) the continued use of 'sustainable' discourses to define production and consumption trends.

This evaluation of 'globalised' and 'safe' production practices in the FFV complex has also opened up important debates about how local (subnational, regional) farming practices, industry organisation and social relations are being restructured and rescaled. Therefore, it is possible to argue that the analysis of FFV incorporates some of the key dynamics in the contemporary restructuring of agri-food systems. It is, therefore, not surprising that so many key theoretical debates in agri-food analysis have been applied to FFV analysis.

* Direct all correspondence to Dr Hugh Campbell, Centre for the Study of Agriculture, Food and Environment, University of Otago, PO Box 56, Dunedin, New Zealand or hugh.campbell@otago.ac.nz The authors would like to acknowledge the assistance of Carmen Polson in preparing this manuscript. We would also like to thank the anonymous referees and Editor of the IJSAF who provided useful comments on an earlier version of this paper. The research reported in this paper was funded by the Foundation for Research Science and Technology in New Zealand.

The concept of 'food regimes' (Friedman and McMichael 1989; Friedman 1993) has been a dominant theme in much of this discussion of FFV, linking macro-scale, systemic changes in world food economies with restructuring processes among nation states (McMichael 1994, 1996, 1999; Roche 1999; Le Heron and Roche 1995; McKenna et al. 1998). Where food regimes theory has encountered criticism is in the way the concept offers only passive clues about regional and local specificities in the value construction of food, farm practices and regulatory mechanisms (Goodman and Watts 1994; Moran et al. 1996a, 1996b; McKenna and Murray forthcoming). Further, 'global' and 'macro-scale' discourses can obscure attempts to theoretically engage nature with bio-politics and regulation in exploring the highly contested politics of agri-food networks and 'green' production practices (Goodman 1999; McKenna and Murray forthcoming; Campbell and Coombes 1999; Coombes and Campbell 1998).

The recent criticism of food regimes theory, and the unresolved debate over a transition to a third food regime based on 'fresh' concepts (Le Heron and Roche 1995), has left agri-food research with something of a theoretical lacunae. While agri-food research needs to operate within frameworks like commodity systems or food networks that transcend isolated spatial and temporal sites, Campbell and Fitzgerald (2001) argue that there is no clear consensus as to how this might be achieved. At least three responses within agri-food theory have been made. The first is from those who have abandoned structural analysis in favour of collapsing analysis to the post-structuralist level of discourse (Whatmore, 1995; Marsden, Murdoch, Lowe, Munton and Flynn 1993; Cloke and Little, 1997; Murdoch and Marsden, 1994). Second, the challenge of overcoming the nature/culture binary has been attempted through re-embedding bio-physicality into agri-food systems. This has prompted a strong engagement with the Latourian-inspired notion of food networks (Goodman and Watts 1997; Lockie and Kitto 2000), although, as Lockie and Kitto (2000) argue, proposing that food networks analysis can overcome binaries of nature/culture and actually achieving it are two different things.

Third, and finally, this paper takes up a question that has been less often posed in response to the recent disruptions within agri-food theory. Namely, where did the demise of food regimes theory leave us in relation to issues of scale? We suggest that while some aspects of food regimes theory are now considered to be less relevant, the idea of the food regime can still play an important role in prompting some interesting geographical debates in agri-food research through explicit inclusion of geopolitical concerns and time-space comparisons in theorising analytical 'scale' (McKenna and Murray forthcoming; Roche, McKenna and Le Heron 1999; Roche 1999).

Clearly, recent attempts by agri-food theory to supersede the food regimes approach have struggled to situate analysis firmly within any particular *scale* of activity. Both the food networks approach and the persistent tradition of commodity systems analysis raise questions about scale that are not explicitly addressed. We argue that contemporary world-scale trends in food production, valorisation and consumption have no prescribed pattern, uniformity or inevitable trajectories. Consequently, this paper contends that scale is best understood as something that is process-based, socially produced and contested. Far from being an ontological 'given' with neutral discursive meaning, scale is both the arena and moment where power relations are contested, negotiated and regulated (Swyngedouw 1997; McKenna and Murray forthcoming). Swyngedouw (1997) uses the term 'glocalisation' to encompass simultaneous and contested processes of political-economic transformation that reflect 'global' trends in food economies and contextually bound regional/local discourses shaping power and productive relations within FFV commodity chains. Further, this paper will demonstrate how issues of scale are often bound into bio-physical relations within production.

We contend therefore, that a key component in understanding the 'global-local' relationships shaping FFV dynamics and the notion of 'greening' food industries, can be uncovered in the politics structuring scale which are simultaneously constituted through material production and metaphorical meaning.

Already, research into the apple - and wider organic - industries has revealed these kinds of tendencies. International evidence suggests that 'safe' food and 'fresh' discourses have, to a large extent, been incorporated by capitalist interests and converted into systematic efforts to create economic advantage for specific producers in lucrative markets (Buck et al. 1997; McKenna et al. 1998; Tovey 1997). Such explanations are insufficiently sensitive to the politics of scale. In the New Zealand apple industry orchardists often find themselves reacting to 'sustainable' discourses that emphasize economic goals to the virtual exclusion of more integrated socio-environmental and economic ideologies about alternative food production systems (McKenna et al. 1998). Given that the New Zealand apple industry has developed from a 53 year history of a national grower co-operative, orchardists have significant and direct input into the economic, political and social operation of their industry. In other words, there is active and significant 'local' involvement in managing and interpreting the impact of 'global' market forces shaping industry change, marketing and production practices.

Following Coombes and Campbell (1998), it is evident that making universalistic assumptions about the relationship between capital and industry greening tends to occur at the expense of recognising national and regional diversity in orchard practices and industry regulatory mechanisms. 'Large-scale' capital interests do not necessarily marginalise or 'subsume' smaller organic producers as is often assumed in prioritising the 'global' in global-local dialectics relating to agri-food networks (see Buck et al. 1997). Similarly, New Zealand's apple industry, encompassing 1,600 growers is dominated by small family based orchards of 10-12 ha (McKenna et al. 1998, forthcoming). Less than 5 percent of growers currently produce organic export fruit, with the remainder of the national export crop grown in through 'environmentally safe' integrated fruit production (IFP) systems. Indeed, local input and the embedded social characteristics of alternative or

'green' agriculture movements are increasingly important in maintaining its present legitimacy with growing numbers of consumers (Campbell and Liepins 2001).

Combining discussion of scale, industry greening and agri-food research we contend that 'green' and 'fresh' food discourses are embedded in political-economic transformation characterised by parallel and simultaneous movements to smaller and larger scales. In fact, we suggest that building an understanding of these constant and contested transformations demands a conceptual framework that does not theoretically favour any particular geographical scale. There is a tendency within agri-food research to allow scale-related explanations to define particular sets of ideological and political positions related to 'global-local' dialectics. We demonstrate here that industry regulation and organisation actually represent moments in constantly fluctuating socio-spatial discourses. It may be useful therefore to view agri-food systems as non-hierarchical and encompassing a series of simultaneously 'nested' relationships which incorporate interconnectedness and overlap.

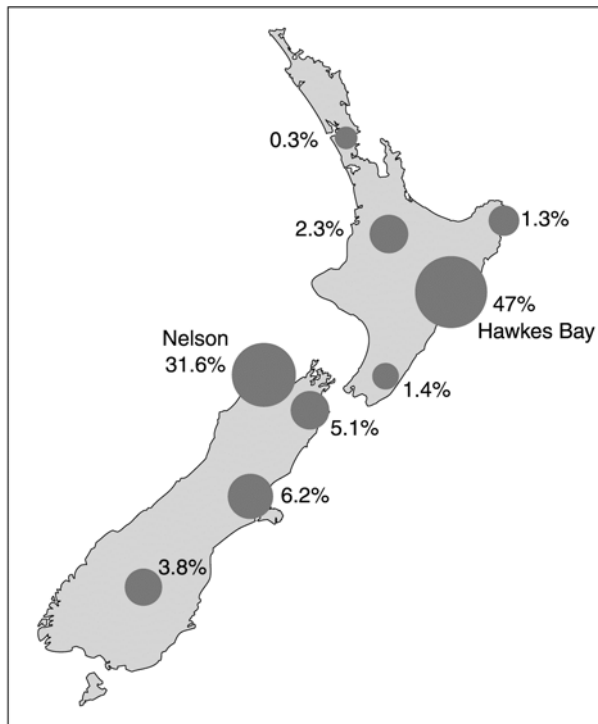
In this paper, we suggest that competing global-local processes structure the discursive terms of apple industry greening in New Zealand. 'Global' trade agreements and consumer preferences are structuring orchardists' production choices geared towards 'environmentally safe' foods. At the same time, 'local' growers are choosing between IFP and OFP practices which represent different (often contentious) approaches to industry greening and expose tensions among growers concerning the best way to regulate industry functions and marketing. Our research centres on how competing and complimentary practices reflect the complex politics of regulation and scale in shaping options for apple industry 'greening'. Before discussing industry 'greening', however, the next sections outline some key aspects of New Zealand's apple production and sector organisation.

THE NEW ZEALAND APPLE INDUSTRY - A BRIEF PROFILE

New Zealand produces about 1 percent of the world's apples, and captures about 3 percent of the global fresh export apple trade. Receiving the lowest producer subsidy equivalents in the OECD, New Zealand's apple industry has responded effectively to increased risk and 'globalisation pressures, and it has been named as the World's Most Competitive Apple Exporter from 1996-2001¹.

Almost half of the national export crop is produced in Hawkes Bay and over one third is produced in the Nelson region (Figure 1).

Figure 1 Apple Growing Regions in New Zealand



The Hawkes Bay horticultural sector is the largest and most concentrated of any in New Zealand. Within this sector, fruit growing accounts for 60 percent of the total activity and apple growing dominates the regional fruit industry. Similarly, Nelson has a high degree of dependence on horticultural activity, where two out of every three jobs in that sector relates to fruit (mainly apple) growing (Business and Economic Research Ltd. 1997, 1998). The area of land planted in

¹ The World Apple Report is produced by an independent research organisation in the United States. The report has only been produced since 1996, and New Zealand has won each year. The rankings are calculated on 21 criteria organised into three main categories: (1) production efficiency; (2) industry infrastructure and inputs, and; (3) financial and market factors.

apples for Hawkes Bay and Nelson varies considerably. Hawkes Bay has about 7,000 hectares of apple orchards, while Nelson has about 4,000 hectares (Statistics New Zealand 1999). The number of orchards varies year to year, with an overall trend towards larger orchards and fewer growers since the early 1990s. In 2000, there were approximately 750 growers in Hawkes Bay and 450 in Nelson.

In terms of regulatory and structural characteristics, the New Zealand Apple and Pear Marketing Board (NZAPMB) had statutory powers to control the sale of export apples as a 'single desk' seller from 1948 to 2000. During this time, the industry ran as a national grower co-operative and protected local grower control/ownership over, and input into, industry operations. More recently, the Board has traded under the name ENZA Ltd. (which also brands the apples). In 2000 the co-operative was corporatised and ownership shares in ENZA were issued that were tradeable among growers. Corporate growers have bought significant share interests from smaller growers which has changed the emphasis of the industry from smaller-scale grower control, to larger-scale fruit industry interests.

GREEN FACTIONS - MIXING POLITICS AND PRODUCTION PRACTICES

The contested shift from co-operative to company and from small-scale grower to 'corporatisation' provides some insight into the complex politics surrounding interrelationships between different 'green' factions of the industry. Aspects of these political issues are captured in discourses about the shifting and multi-scaled nature of global-local processes, including: deregulation debates within the industry; the emergence of 'green protectionism' in destination markets for New Zealand apples; and the rise of consumer concerns and the resultant importance given to quality and audit systems by destination markets.

DEREGULATION PRESSURES

Since 1998, ENZA has been under intense pressure to deregulate from proponents of 'free market' ideology. It is feared by many smaller scale growers that removal of the 'single seller' legislation and the ENZA's exclusive control over export products will have widespread negative economic and social impacts on major producing regions (YAF 1998a, 1998b; Business and Economic Research Ltd. 1997, 1998; Kearney 1998; McKenna, 1999a, 1999b). Located far from its main markets, capitalising on an 'exclusive' New Zealand brand (ENZA), and producing a small fraction of the world's apples - the single seller system is widely considered in the industry to maximise grower returns. While overseas evidence suggests that it would be likely that some growers and post-harvest operators would make more money in a multi-exporter system, the impact on the majority of growers, related service industries, dependent communities and net foreign exchange earnings is thought to be negative (YAF 1998a; Business and Economic Research Ltd. 1999). Within the apple industry, opinions vary over the deregulation debate and whether or not ENZA functions as efficiently as possible and in the best interests of growers.

The *New Zealand Apple and Pear Act* (1948) has been amended to the *Apple and Pear Industry Restructuring Act* (1999). The implications of the Restructuring Act have been politically complex and damaging to 'single desk' interests. From 1 April 2000, a new body called the 'Exports Permits Committee' has had the power to decide on independent export consents - separate from ENZA's control. The principle for 'private' export consents remains one of 'complementarity' - not conflicting with ENZA Ltd.'s global marketing plan, but in practice this has not been the case (McKenna and Roebuck 2000). In 2001, approximately 25 percent of the total export crop was sold outside of ENZA's control which led to weak selling of New Zealand apples in world markets. For the first time in more than 50 years, New Zealand interests competed amongst themselves, largely on price, as a means to secure market share (McKenna and Roebuck 2000).

Other important changes to industry structure and function involve the removal of compulsory acquisition of fruit by ENZA Ltd.; the deregulation of onshore logistics and; the point of fruit acquisition moving from coolstore to 'free alongside ship' (FAS). While the Board would have preferred to have maintained its cooperative structure in 1999 (New Zealand Apple and Pear Marketing Board 1999) the Government insisted that ENZA Ltd. operating under the Companies Act would: improve transparency and accountability; provide better price signals; allow capital withdrawal, and; clearly separate commercial and regulatory functions.

GREEN PROTECTIONISM

The pressures to deregulate the apple industry within New Zealand - and their uneven outcomes as mediated by the participation of multiple interested parties - have occurred at a time when the global trade conditions for apple exporting have been changing. A major factor in industry restructuring is the emergence of 'green protectionism' in destination markets.

Even before the completion of the GATT Uruguay Round in 1995, international border controls on the sanitary and phytosanitary (SPS) qualities of food imports were becoming tighter. Such controls do not appear to be entirely divorced from politics. SPS barriers now involve much lower Maximum Residue Levels, an increasing range of banned inputs, and clauses enabling embargoes on goods that might cause environmental damage or compromise animal welfare. Campbell and Coombes (1999), argue that SPS and/or 'food safety' barriers have become a major mechanism for protecting EU and Japanese farmers against a tide of cheap, intensively produced, imports from the US (see also Saunders 1999).

However, the process for establishing legitimacy for environmental claims has proved highly problematic. Within the Uruguay Round Agricultural Agreement (URAA), the principle was established that 'scientific proof' was required for

overriding free trade in favour of environmental protection. While that principle was agreed upon, the practice of establishing scientific consensus has proved very difficult in highly politicised trade situations. Two examples of this in 1999 alone were the widespread agreement of the US science establishment that Bovine Growth Hormone (BGH) had no adverse effects, while EU scientists contended that there were potential health and animal welfare risks from using this particular input. A second debate, and one that is receiving considerable attention in New Zealand's FFV industries, is emerging over the potential environmental and health risks posed by genetically modified foods.

The result of these conflicts around perceived potential risks is that it is unlikely that markets will quickly move towards more permissive SPS regimes and, in fact, it is more likely that some First World markets will become more restrictive. New Zealand's FFV exporters have identified these trends as threatening to long-term market access for conventionally produced FFV from New Zealand (Campbell and Coombes 1999).

By the early 1990s, the New Zealand apple industry had spread its international market access risk by developing markets in over 60 countries - compared to about 40 countries in the 1970s (ENZA 1998). Despite reaching so many markets, ENZA could not avoid the emergence of green protectionist strategies in some key markets. Australia for instance, has banned New Zealand apple imports since 1935 claiming the domestic industry would be threatened by bacterial infection through fireblight (*Bacillus amylovorus* Trev.). Exhaustive scientific evidence has shown the risk of infection through New Zealand fruit to be very low, however Australia has maintained its 'biological' ban. One of the reasons for the utility of green protectionist strategies for some First World governments, is that such a strategy combines a desire for protection from imports expressed by agricultural producers with the emergence of concern over food safety and a shift in consumption patterns by mainly urban consumers.

CHANGING CONSUMER/RETAIL DEMANDS

While the 1990s have been characterised by complex trade negotiations and the emergence of new global trading realities, there have also been significant shifts *within* destination markets. Two such shifts have involved the continued move by First World consumers towards 'fresh', 'healthy' or 'green' foods (Le Heron and Roche 1995; Goodman and Watts 1995; Campbell and Coombes 1999; McKenna et al. 1998), and the subsequent shift by large distributors such as supermarket chains and consumer co-operatives to position themselves as the preferred suppliers to this growing (elite) market. New Zealand's reputation for quality since early in the century has become one of the apple industry's most important strategic assets in the contemporary market.

Given the dual pressures of legislated/governmental requirements and retailer demands to meet perceived consumer preferences that together created a green protectionist barrier, the NZAPMB moved in 1996 to develop an Integrated Fruit Production (IFP) system. Such systems were recognised by European consumers in particular as providing 'safe' and 'environmentally grown' fruit (see subsequent sections for discussions of IFP), and would also satisfy rising SPS barriers at the point of entry into these markets. For ENZA, this transition marked a shift from commodity trading of intensively produced fruit to a re-imaging strategy which preserved market access and tied ENZA more closely to large retail chains (ENZA 1999).

First World supermarket chains are growing in size and developing extensive international linkages, while at the same time becoming more prescriptive in their fresh fruit requirements. Concentration of the retail sector is particularly pronounced in ENZA's main markets in the UK and the US which respectively take 30 percent and 25 percent of New Zealand's total crop by volume. The power of retail chains to influence 'environmentally safe' production practices was clearly signaled by UK supermarket Tesco in 1997, which claimed to be the largest single customer for New Zealand pipfruit. Tesco informed growers that not only were they poised to demand that produce be grown under IFP or similar schemes, but that they would not pay a premium for it. In effect they were demanding IFP practices as the minimum entry standard to gain access to their consumer base. The implications for growers are significant, and have an impact on options for varietal mix, production techniques, labour processes, management practices and acceptable trade-offs between economic and environmental sustainability.

While such processes are unfolding at the level of a single distribution chain like Tesco's, there are also initiatives between EU distribution chains to standardise and audit their environmental demands. Currently, this operates under the rubric of the Integrated Crop Management (ICM) protocols which are adhered to by 20 EU supermarket and co-operative chains (Howley 1997). At an even higher level of scale, the ISO14000 system for auditing Environmental Management Systems is increasingly being utilised by distribution channels to guarantee food safety (Saunders 1999). Each of these initiatives - at the supermarket, intra-supermarket, or supra-supermarket level - are contested and produced by the changing politics of food distribution. They do, however, have one common factor; all are heading towards tighter food safety and environmental auditing criteria.

In summary, the New Zealand apple industry's restructuring and 'greening' pressures have clearly global-local dynamics. Apple production is strongly inserted into regional economies and local/regional institutional, political and biophysical environments while simultaneously having distinctly 'global' connections and dependence on overseas markets. Deregulation pressures and 'free market' ideology have had significant impacts on shifting regulatory structures within the industry. At the same time, the nature of industry restructuring has been profoundly influenced by a 53-year history of grower co-operation at the national level. Overseas consumers and large-scale buyers of New Zealand apples

have demanded 'safer' production practices resulting in at least two significant global-local trends. First, growers are experiencing risk and competition on an ever expanding scale. 'Local' production systems and areas are constantly (re)articulating and re-scaling through connections with national and 'global' processes. And second, industry greening reflects complex global politics over regulation, economic efficiency, national 'sustainable' development legislation and consumer choice. The re-scaling of industry regulation and production practices reflects the dynamic and contestable nature of socio-spatial relations underlying agrifood commodity systems.

IFP and OFP Approaches to 'Safe' Practices

Where do organics start and stop? You need dedicated plant and tools - picking buckets, ladders, hand tools, vehicles - to do it, but what about the other parts of the operation? Does organics represent *efficient* systems? Because right now you need a 30 metre buffer strip between conventional and organic production which is an inefficient use of land. ~ Grower Interview 1

ENZA cannot advance my interests as an organic pipfruit grower. ~ Grower Interview 3

While the market pressures over 'safe food' were clearly evident in the mid-1990s, the style and extent to which New Zealand's FFV exporters responded to these pressures varied. Here the politics of scale became an important feature of the resultant configuration of 'green' production of apples.

At the national regulatory level, New Zealand policy makers sought to reconcile the evident necessity to address concerns about 'sustainability' in general (both at home and in the overseas marketplace), with the more specific political commitment to engage in any such activities with the minimum of governmental intervention or guidance. The result was a pursuit of 'sustainability' that was often contradictorily defined and pursued in a token way by different government agencies.

With respect to 'safe' practices in the apple industry, initial attempts to establish organic production were bypassed in favour of establishing an Integrated Fruit Production programme (IFP). The decision to favour IFP over organic apple production as the industry response to greening pressures had broad ramifications for the sector. A key reason given for this decision were the perceived risks associated with growing organic apples. Scientists within the industry, orchardists, independent consultants and even the organic certification body Bio-Gro agreed that growing apples organically was one of the most challenging systems to place under organic production.² In particular, the high number of insect pests occurring in apple production was considered by the industry to create the potential for large-scale crop failures under organic production. Consequently, this was a significant reason why IFP was strategically favoured over organic production by ENZA.³ While these biophysical issues were germane to the development of ENZA's strategy towards industry greening, the following discussion will show how these biophysical issues in organic and IFP production became interwoven with the politics of scale and discourses about industry deregulation.

The industry decision to favour IFP was partly influenced by concerns over the biophysical viability of organic production, and partly because of clear opportunities for IFP in the market. Large-scale IFP growing systems were already established and recognised in European markets. The most definitive 'environmental' signal sent to ENZA by overseas buyers occurred in 1995-96 when a group of six UK retailers formed the Fresh Produce Consortium and specified that apples from New Zealand had to be produced using Integrated Pest Management systems (IPM). These retailers controlled more than 78 percent of all UK FFV sales. These 'global' market demands were, however, complicated by the contradictory regulatory trajectories of the EU and US, with the EU supporting a shift towards IFP-style production while US quarantine requirements increasingly targeted both low residues and a high level of guarantee that pests were not present on fruit (Batchelor, Walker, Manktelow, Park and Johnson 1997; Walker, Hodson, Wearing, Bradley, Shaw, Tomkins, Burnip, Stiefel and Batchelor 1997; Manktelow, Beresford, Hodson, Walker, Batchelor, Stiefel, and Horner 1997; Anon 1995).

Integrated Pest Management is the philosophical cornerstone of international IFP programmes and is defined as:

The control of pests by employing all methods consistent with economic, ecological and toxicological requirements while giving priority to natural limiting factors and economic thresholds⁴.

Developed in the 1960 and 1970s, IPM was extended in the 1980s to include disease control and other aspects of crop production. With support from the International Organisation for Biological Control (IOBC), IFP programmes for apple have been practiced in Europe since the late 1980s. By the early 1990s, apple producers in Italy, Austria, Germany, Switzerland and the US were involved in IFP practices (Solymar 1996). While each country's IFP programmes are

² One independent organic production consultant considered this to be an excellent reason why organic production should be attempted for apples: 'to demonstrate that organic production can be achieved for any crop in New Zealand'.

³ McKenna and Campbell (1998) list some other reasons including: difficulties achieving export fruit quality standards, and concerns over the long-term status of some organic applications like copper sprays being permitted in the organic standards.

⁴ From, *Present Status of Integrated Control of Pests*, in *Mededelingen Faculteit Landbouwwetenschappen*, 533: 245-265, 1974.

different (owing to specific pest and disease conditions) they all adhere to common principles and, particularly in Europe, reflect high levels of consumer concern over pesticide residues on fruit.

The balance between environmental and economic objectives inherent within IFP has important implications for ENZA's crop management strategies and international marketing objectives. ENZA's IFP greening strategy is predicated on the twin goals of ensuring economic benefit through establishing 'environmentally differentiated' fresh produce and guaranteeing maximum market performance by maintaining access to established and lucrative markets that were moving towards 'green protectionism' and more stringent food safety requirements. The adoption rates of IFP practices in New Zealand have been extremely rapid. From 88 test growers in 1997, all 1,500 New Zealand export growers produced fully IFP or IFP-Transitional fruit by 2000. These rates of adoption would not be possible without the comprehensive research and operational focus of the single desk structure governing the export apple industry in New Zealand.

However, implementing the IFP programme has been contested. The apple industry experienced an institutional split between IFP and OFP strategies linked to ENZA's initial decision to favour industry-wide IFP practices in the early-mid 1990s.⁵ While a small amount of organic R & D was taking place, a major institutional split emerged between ENZA and independent exporting of organic fruit.

Throughout the mid to late-90s, the market opportunities for organic apple production in New Zealand were generating significant interest from growers. Market data shows that in 1997-98, conventionally grown apples returned approximately \$10.00 tce⁶, while organic apples returned about \$30.00 tce (ENZA 1998; Stiefel and Lichtwark 1998). These figures should be interpreted with some caution, however, because they represent different sets of industry costs and charges associated with the NZAPMB's foreign exchange management in the 1998 - factors that prevent any direct comparison of market performance.

At the time of writing there was one 'large-scale' exporter of organic apples - Freshco - which is based in Auckland. Freshco shipped approximately 150,000 tce in 1997 and gained an export consent to ship 350,000 tce in 1998-99 (although there were difficulties in securing adequate supply). By 1999-2000, Freshco was exporting to 650,000 tce of organic or organic-transition apples overseas. However, considerable speculation exists over whether Freshco will be able to source and effectively market this many apples in the coming seasons. Given New Zealand's total export volume (in 1999-2000) of approximately 18 million tce, the 1999 export organic crop represents about 2 percent of the total exported apple crop. Freshco handles a range of FFV exports and has specifically targeted organic produce, with a third of its business in 1999 organically certified to some extent, and a declared aim of 100 percent certified as produced using environmentally sound growing practices within five years (*New Zealand Herald* 23.8.99).

Prior to 1996-97, there were few opportunities to pursue export marketing of organic pipfruit. The organic production that did occur was conducted by small-scale, organisationally-isolated growers with a strong commitment to the sustainable agriculture movement. Before Freshco's first organic apple export consent in 1996-97, organic apples were largely sold at the gate or distributed to New Zealand outlets specialising in organic produce, with a very little being entered into ENZA pools of conventionally grown fruit for export. At the time of writing, approximately 37 growers, mainly from Hawkes Bay, supply organic apples to Freshco.

Since claiming to have conducted a small, but successful, organics programme with fruit being targeted to key bio-outlets in Continental Europe and the UK in 1998, ENZA has recently developed a proposal to develop its own organic export programme (ENZA 1999a, 1999b). The principal challenge for ENZA's organic programme is identifying and securing a supply pool. However, in the 1999-2000 season, ENZA competed directly with Freshco for organic fruit having given a commitment to operate as a commission seller on behalf of organic growers and promising some technological production support to organic orchardists. ENZA's organic programme however, remains underdeveloped.

The different positioning of ENZA and Freshco over organics has led to some degree of political hostility between the organisations over a much wider terrain. Tensions focus on ENZA's statutory powers and issues surrounding 'industry greening'. As IFP practices become more 'mainstream', the position of Freshco's 'organic fruit' may be eroded in terms of market value. The fact that there has been only one exporter of organic apple in New Zealand to date, keeps the fruit prices and grower pay-outs higher than if competition ensued between two or more organic exporters in international markets - multiple exporters normally lead to weak selling practices and lower grower returns in the long term.

Interview data with organic growers in Hawkes Bay revealed complex and contradictory views about organic and IFP growing practices and related industry operations. In addition to the philosophical appeal of organic apple production, all of the growers cited disaffection with ENZA as a contributing factor to their decision to produce organic fruit. Most organic growers also advocated industry deregulation as they felt the export consent process under which Freshco markets their organic apples was prone to manipulation and inconsistency by the NZAPMB consents-granting committee before

⁵ This does not imply however, a complete absence of organic-related research and development within the apple industry. HortResearch, a Crown Research Institute, has conducted experiments and field trials with organic apple since the late 1980s. HortResearch's station in Central Otago (at Clyde) produced small volumes of organic fruit that were exported under the ENZA brand in 1998-99.

⁶ Tray Carton Equivalent, which equals 18.2 kg.

2000. In other words, combined sentiments of improved environmental stewardship and 'opting out' of ENZA's marketing control were key motivating factors for moving to organic production systems. Cast in terms of historical ideological resistance to the principle of co-operative fruit exporting, it could be argued that an important 'local' contributing factor to organic growers' participation in alternative exporting arrangements is based on contested regulatory politics as much as on environmental politics.⁷

Ironically, Freshco is attempting to maintain its 'monopoly' position in organic exporting - seeing the advantages of being a single seller - at the same time that it is challenging ENZA's overall political position as a statutory producer board. Should ENZA or any other exporter successfully start exporting organic pipfruit, initial returns to growers may rise due to competition for supply, but international evidence suggests that returns would decrease in the long term. Further, ENZA has made some steps - albeit slowly - towards 'capturing' a pool of organic growers. The new legislative structure, where export consents are given by a body independent of the Board has been proposed as a way to avoid such obvious conflicts of interest; however, only time will tell whether this is able to be achieved.

Given these overlapping tensions, co-operation between the various 'green' components of the industry is minimal or non-existent. Several scenarios might emerge from the current restructuring. First, organic production may continue to operate under export consents and represent (to some degree) a production and political space for growers who opt out of the conventional system based on some combination of environmental, economic and political choice. Second, the entire production and investment structure of organic apple production may fundamentally change as the existing suite of pest control strategies ceases to be permissible under organic certification. Third, ENZA may make some constructive and concerted steps to encourage and incorporate organic apple growing as an important (if small) component of its production and marketing operations. The advantages of this strategy for ENZA would be some potential economic gain (through developing and exploiting markets); and promoting industry innovation in research, production, investment and marketing. At the same time steps should be taken to include organic growers' viewpoints within the newly restructured apple industry.

CONCLUSIONS - IT'S NOT EASY BEING GREEN

The New Zealand apple industry has embarked on a greening strategy that highlights a number of broader theoretical issues about the way in which we conceptualise the restructuring of agri-food systems.

Owing to the unique conjuncture of both greening strategies and the politics of deregulation the apple industry is an excellent example of how biophysical conditions in production, shifting regulatory frameworks and political contestation shape industry development prospects with respect to producing 'safe' foods. The move towards organic apple production has become intimately tied to resistance to a single-desk selling structure for the industry. Furthermore, within the apple industry, 'green' and 'fresh' discourses are characterised by parallel and simultaneous movements to smaller and larger scales, contributing to complex transformative politics and power struggles within industry regulatory structures and production systems. This is most clearly demonstrated as the broad and unified structures of the industry endorse and develop the IFP-based version of greening, while a small-scale, isolated and sometimes forthrightly rebellious group of producers have collected under the organic cause to supply one independent export company.

To date, there has been a separation of activities between private export of organic fruit and producer board export of IFP fruit, and with similar separation for support systems. However, this separation is not particularly synergistic, and at the current point in time ENZA is initiating competition for organic supply. While ENZA's statutory powers allow some planning as to where export licenses are granted, there is an overall atmosphere of suspicion between the various parties involved in industry greening strategies. ENZA's future success in securing organic supply post-deregulation, remains a matter of speculation.

Our research has shown that growers' choice to engage in organic or IFP production stems from a complex mix of environmental and economic philosophy, personal financial position, views on industry politics and structure, biophysical constraints of land holdings and the willingness to pursue 'unconventional' socio-cultural production techniques. Contemporary industry greening practices and choices therefore, are constantly shifting and re-scaling according to different mixes of macro- and micro-scale risk factors and opportunities. In turn, the glocalised politics of scale are shaping the terms of industry participation, political contestation of regulatory structures and orcharding practices.

This research into New Zealand's apple industry has provided an opportunity to examine broader theoretical issues in our understanding of agri-food systems - primarily through a theoretical re-examination of 'scale'. Re-thinking what 'scale' represents in the material and metaphorical sense is a vital, and as yet relatively under-explored step, in negotiating a way through the oppositional 'global-local' dialect currently shaping theoretical debates in agri-food research. The theoretical focus on discrete 'scales of activity' - and the implicit assumption that scales have ontological meaning and content - has obstructed progress on thinking about the ways bio-politics, regulation and social processes of food production are (re)produced in different places and industries. Revisiting 'scale' as something that is socially-based,

⁷ This contrasts strongly with the neighbouring kiwifruit industry. Campbell et al. (1997) found no similar mixture of enthusiasm for industry deregulation and production under organic systems. Clearly, there are significant localised differences in the politics of industry deregulation between the apple industry in one region of New Zealand and the kiwifruit industry in another.

contested and produced allows us to think about food production, consumption and regulation as embodying spatial and temporal compromise between power relationships and existing forms of co-operation. This is particularly important as agri-food theory grapples with how to re-introduce the bio-physical into agri-food systems. This examination of the New Zealand apple industry has shown how the influence of biophysical aspects of organic and IFP systems became central to a re-scaling of political alliances within the industry. As growers made their choices about pest control strategies, the daily deployment of pheromone traps and other pest control strategies became deeply significant actions in the unfolding of both the politics of industry deregulation and the articulation of New Zealand apple exports with international trade pressures, green protectionism and health conscious consumers.

REFERENCES

- Anon. 1995. *Nature's Choice Code of Practice*. UK: Tesco PLC.
- Batchelor, T., J. Walker, D. Manktelow, N. Park and S. Johnson. 1997. "New Zealand Integrated Fruit Production for Pipfruit - Charting a New Course." *Proceedings 50th Plant Protection Conference*:14-19.
- Buck, Daniel, Christina Getz and Julie Guthman. 1997. "From Farm to Table: the organic vegetable commodity chain of Northern California." *Sociologia Ruralis* 37 (1): 3-19.
- Business and Economic Research Limited. 1999. *Deregulating the Apple and Pear Marketing Board - Impacts and Costs*. Draft analysis and report. Wellington, New Zealand.
- Business and Economic Research Limited. 1998. *Nelson Regional Economy Driver Clusters*. Wellington, New Zealand.
- Business and Economic Research Limited. 1997. *Economic Driver Clusters of Hawkes Bay: A Working Paper*. Wellington, New Zealand.
- Campbell, Hugh, and Brad Coombes. 1999. "Green Protectionism and the Exporting of Organic Fresh Fruit and Vegetables from New Zealand: Crisis Experiments in the Breakdown of Fordist Trade and Agricultural Policies." *Rural Sociology* 64(2): 302-319.
- Campbell, Hugh, John Fairweather, and David Steven. 1997. *Recent Developments in Organic Food Production in New Zealand: Part 2, Kiwifruit in the Bay of Plenty*. Studies in Rural Sustainability Research Report No. 2, Department of Anthropology, University of Otago.
- Campbell, Hugh and Ruth Fitzgerald. 2001. "Follow the Fear: A Multi-Sited Approach to GM." *Rural Society* 11(3): 211-224.
- Campbell, Hugh and Ruth Liepins. 2001. "Naming Organics: Understanding Organic Standards in New Zealand as a Discursive Field." *Sociologia Ruralis* 41(1): 21-39
- Cloke, Paul and Jo Little (eds). 1997. *Contested Countryside Cultures: otherness, marginalisation and rurality*. London: Routledge
- Coombes, Brad and Hugh Campbell. 1998. "Dependent Reproduction of Alternative Modes of Agriculture: Organic Farming in New Zealand." *Sociologia Ruralis* 38(2):127-145.
- ENZA 1999a. *Initial Market Forecasts*. Wellington: New Zealand.
- , 1999b. pers. comm. February 1999. Wellington, New Zealand.
- , 1998. *Annual Report 1997*. Wellington: New Zealand.
- Friedmann, Harriet. 1993. "The Political Economy of Food: A Global Crisis." *New Left Review* 197:29-57.
- Friedmann, Harriet and Philip McMichael. 1989. "Agriculture and the State System." *Sociologia Ruralis* 29:93-117.
- Goodman, David. 1999. "Agrofood Studies in the 'Age of Ecology': Nature, Corporeality, Biopolitics." *Sociologia Ruralis* 39:17-38.
- Goodman, David and Michael Watts. 1994. "Reconfiguring the Rural or Fording the Divide? Capitalist Restructuring and the Global Agro-Food System." *The Journal of Peasant Studies* 22 (1):1-49.
- Goodman, David and Michael Watts (eds). 1997. *Globalising Food: Agrarian Questions and Global Restructuring*. London: Routledge.
- Grosvenor, S., R. Le Heron and M. Roche. 1995. "Sustainability, Corporate Growers, Regionalisation and Pacific-Asia Links in the Tasmanian and Hawkes Bay Apple Industries." *Australian Geographer* 26(2):163-172.
- Howley, V. 1997. The Peak of Practices. *Fresh* September 1997.
- Kearney, Mike. 1998. "Downside to Deregulation of Producer Boards: Pipfruit Perspective". *Briefing notes prepared for Pipfruit Growers of New Zealand Inc. by New Zealand Horticultural Economic Services* 22 July 1998.
- Le Heron, Richard and Michael M. Roche. 1996. "Globalisation, Sustainability, and Apple Orchard, Hawkes Bay, New Zealand." *Economic Geography* 72(4): 416-432.
- Le Heron, Richard and Michael M. Roche. 1995. "A Fresh Place in Food's Space." *Area* 27: 22-32.
- Lockie, Stewart and Simon Kitto. 2000. "Beyond the Farm Gate: Production-Consumption Networks and Agri-Food Research." *Sociologia Ruralis* 40(1):3-19.
- Manktelow, D., R. Beresford, A. Hodson, J. Walker, T. Batchelor, H. Stiefel and I. Horner. 1997. "Integrated Fruit Production (IFP) for New Zealand Pipfruit: Evaluation of Disease Management in a Pilot Programme." *Proceedings 50th Plant Protection Conference*:14-19.
- Marsden, Terry, Jonathon Murdoch, Phillip Lowe, Richard Munton and Andrew Flynn. 1993. *Constituting the Countryside*. London: University College Press.
- McKenna, Megan. 1998. "Growing Apples and the 'Growing Pains' of Restructuring for New Zealand's Pipfruit Industry." *New Zealand Geographer* 54(2):37-45.

- , 1999a. "The Economic Viability of Deregulation in New Zealand's Pipfruit Industry." *Primary Industry Management* 2(1):4-9. Wellington, New Zealand: Publishing Solutions.
- , 1999b. "The Emperor Has No Clothes - Geographies of Deregulation." *New Zealand Geographer* 55(1):59-62.
- McKenna, Megan, Michael M. Roche and Richard Le Heron. 1998. "Sustaining the Fruits of Labour: a Comparative Localities Analysis of the Integrated Fruit Production Programme in New Zealand's Apple Industry." *Journal of Rural Studies* 14(4): 393-409.
- McKenna, Megan and Hugh Campbell. 1998. *Strategies for 'Greening' the New Zealand Pipfruit Export Industry: The Development of IFP and Organic Systems*. Studies in Rural Sustainability Research Report No. 6, Department of Anthropology, University of Otago.
- McKenna, Megan and J. Roebuck. 2000. *Global Market Research: New Zealand Pipfruit Industry Regulatory Issues*. YAF Consulting Limited, July 2000.
- McKenna, Megan, Michael M. Roche and Richard Le Heron. 1999. "An Apple a Day: Renegotiating Concepts, Revisiting Context in New Zealand's Pipfruit Industry." Pp. 41-59 in *Restructuring Global and Regional Agricultures*, edited by David Burch, Jasper Goss and Geoffrey Lawrence. Aldershot: Ashgate Publishing Ltd.
- McKenna, Megan and Warwick Murray. Forthcoming. "Jungle Law in the Orchard: Comparing Globalisation in the New Zealand and Chilean Apple Industries." *Economic Geography*.
- McKenna, Megan, Michael M. Roche, Juliana Mansvelt and Lawrence Berg. Forthcoming. "Core Issues in New Zealand's Apple Industry: Global-Local Challenges." *Geography*.
- McMichael, Philip. 1994. "Global Restructuring: Some Lines of Inquiry." Pp. 277-300 in *The Global Restructuring of Agro-Food Systems*, edited by Philip McMichael. Ithaca, NY: Cornell University Press.
- McMichael, Philip. 1996. "Globalisation: Myths and Realities." *Rural Sociology* 61(1):25-55.
- McMichael, Philip. 1999. "Virtual Capitalism and Agri-food Restructuring." Pp. 3-22 in *Restructuring Global and Regional Agricultures*, edited by David Burch, Jasper Goss and Geoffrey Lawrence. Aldershot: Ashgate Publishing Ltd.
- Moran, Warren, Greg Blunden and Adrian Bradley. 1996a. "Empowering Family Farms Through Cooperatives and Producer Marketing Boards." *Economic Geography* 72 (2):161-177.
- , 1996b. "Family Farmers, Real Regulation, and the Experience of Food Regimes." *Journal of Rural Studies* 12(3):245-258.
- Murdoch, Jonathon and Terry Marsden. 1994. *Reconstituting Rurality*. London: University College Press.
- New Zealand Apple and Pear Marketing Board. 1999. *Letter to Growers: Industry Reform*. New Zealand Apple and Pear Marketing Board, 13 July 1999.
- Peck, Jamie A. and Adam Tickell. 1994a. "Jungle Law Breaks Out: Neoliberalism and Global-Local Disorder." *Area* 26(4): 317-326.
- , 1994b. "Searching for a New Institutional Fix: the After-Fordist Crisis and the Global-local Disorder." Pp.280-315. in *Post-Fordism: a Reader*, edited by A. Amin. Oxford: Blackwell.
- Roche, Michael M. 1999. "International Food Regimes: New Zealand's Place in the International Frozen Meat Trade, 1870-1935." *Historical Geography* 27:129-151.
- Roche, Michael M., Megan McKenna and Richard Le Heron. 1999. "Making Fruitful Comparisons: Southern Hemisphere Producers and the Global Apple Industry." *Tijdschrift voor Economische en Sociale Geografie* 90(4): 410-426.
- Saunders, Caroline. 1999. "Agenda 2000 and the Next WTO Round: the Implications for NZ Trade into the Next Millennium". *Paper presented to the 3rd Wellington Conference on World Affairs, 'New Perspectives for a New Millennium'*. Hosted by European Studies Association and Political Studies Association, Victoria University of Wellington, Dec 1-3, 1999.
- Solymar, Bernie. 1996. "The European Perspective: Integrated Fruit Production." *Compact Fruit Tree* 29: 44-46.
- Statistics New Zealand. 1997. *New Zealand Official Yearbook 1997 – 100th Edition*. Wellington, New Zealand: Statistics New Zealand.
- Stiefel, H. and D. Lichtwark. 1998. "Techlink Feasibility Study for Organic Pipfruit Production." *Agriculture New Zealand Consultancy Report*. Hastings, New Zealand: Agriculture New Zealand.
- Swyngedouw, Erik. 1997. "Neither Global nor Local: 'Glocalisation' and the Politics of Scale." Pp. 137-166 in *Spaces of Globalisation: Reasserting the Power of the Local*, edited by K. Cox. Guilford Press: New York.
- Tovey, Hilary. 1997. "Food, Environmentalism and Rural Sociology: On the Organic Farming Movement in Ireland." *Sociologia Ruralis* 37(1): 21-37.
- Walker, J., A. Hodson, C. Wearing, S. Bradley, P. Shaw, A. Tomkins, G. Burnip, H. Stiefel and T. Batchelor. 1997. "Integrated Fruit Production for New Zealand Pipfruit: Evaluation of Pest Management in a Pilot Programme." *Proceedings 50th Plant Protection Conference*: 14-19.
- Whatmore, Sarah. 1995. "From Farming to Agribusiness: the Global Agro-food System." Pp. 36-49 in *Geographies of Global Change: Remapping the World in the Late Twentieth Century*, edited by R. J. Johnston, Peter J. Taylor and Michael J. Watts. Oxford: Blackwell.
- YAF Consulting Limited. 1998a. *Supporting the Single Desk: A Preliminary Review of Economic and Community Issues*. Discussion document prepared for United Fruit and submitted to Prime Minister Jenny Shipley, 25 September 1998.

- , 1998b. *A Review of the Deregulation Debate: Analysing Industry-Community Viability and Risks for the Kiwifruit Industry*. Discussion document prepared for United Kiwi and submitted to Prime Minister Jenny Shipley, 27 November 1998.