The food production revolution:

The search for a consumption efficiency policy

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Executive summary

Agricultural production continues to expand rapidly, yet this higher production increasingly demands the use of human-made capital and inputs. This has a significant impact on natural resources, environmental quality and social well-being in rural regions. Agriculture is a major source of non-point pollution and is closely associated with deteriorating trends in soil erosion, land degradation, and loss of wetlands and biodiversity. These effects have led to concern about the appropriateness of ongoing intensification of food production management practices and the institutional response to these.

The continued expansion of food commoditisation as a result of institutional arrangements defines the incentive for commodity producers to increase productivity, leading to environmental and social impacts that society increasingly questions. This paper explains why these forces drive productivity gains under both high and low commodity price scenarios – an outcome that may seem to be illogical but which turns out to be a rational producer response.

The paper discusses how current institutional arrangements may constrain the development of sustainable food production systems and strongly recommends policy reform to re-balance the incentives for 'productivity' with those required for greater 'consumption efficiency'[1] in order to support the public good expectations and future requirements of a more sustainable agricultural system for New Zealand.

The question addressed in the paper is:

> **To what extent do the current policy and institutional arrangements adopted in New Zealand since the 1980s (to ensure agricultural production is able to compete in the free trade global markets) contribute to increasingly significant social and environmental impacts in New Zealand?**

While a 'market-based' approach to agricultural policy provided significant benefits to New Zealand in the mid-1980s, we believe that, combined with the increasing commoditisation of agricultural production systems and food market channels, such policy may provide significant support for private gains but at an increasing cost to the loss of public goods. These public goods are often related to environment and social systems that are demanded by an increasingly urban-based population.

Currently, public policy in the agriculture sector faces a dilemma. The production models and supporting institutional structures are affecting the natural and social capital on which they depend. Producers have increased production through the importation of human-made capital, such as energy, fertiliser and chemicals, into their businesses and placed excessive demands on ecological capacity and services of the environment. Nowhere is this better represented than in the recent reports of nitrate contamination of water in Mid-Canterbury. New Zealand society, as reflected in the concerns they raise about agricultural production systems, is becoming less tolerant and accepting of these effects and seeks redress. As resource degradation and non-point pollution problems grow and associated social systems are disrupted, the ability to make a transition to newer systems is potentially reduced – or the required changes are more costly. We argue that the goal of agricultural policy should increasingly reflect the needs of consumption-based efficiency by recognising the limitations of commoditised systems and to ensure that they reflect not only market-based institutions but also the non-market institutions within which long-run ecological integrity and social well-being are manifest. To do so, non-market goals must be components of the public policy, now more so than ever.

We believe that the current institutional structure has provided significant gains to the well-being of producers and New Zealand society. However, we ask if this is being manifest in an institutional and policy framework that has become too pathway dependent. The dependence on market-based production efficiency gains as opposed to innovation for social and environmental well-being is considered inappropriate in the context of New Zealand's sustainability policy statements and goals. The real benefit of the 'free market' policy settings has been to have producers linked more directly to commodity prices, to get producers and processors to search for innovation with the goal of promoting production efficiency as represented by increasing output. We believe that there has been too little effort to explore the potential for using market forces

to drive innovation toward a consumption efficiency goal as opposed to a production efficiency goal. This is a significant loss of opportunity and represents ongoing market and government failures.

As a result of the underlying production efficiency pressures within commodity-based systems, producers have limited choices to protect their well-being. To compete on price they are faced with the imperative to reduce costs to become more efficient. At the strategic level, producers face a binary choice – seek greater production efficiency or externalise costs. Commodity systems incentivise increased production for both of these strategic choices. Irrespective of whether there are increasing or decreasing returns, producers will seek to increase production of commodities. Under a scenario of increasing profits, a producer can choose to reinvest larger amounts to increase their production capacity through efficiency gains or expand to provide increased personal profits.[2] In a scenario of increased total production, commodity prices fall, reducing the producer's returns and threatening their well-being. In this situation, due to the limited choices of substitution the producer also seeks greater output through efficiency gains or expansion. A less desirable strategy is to externalise costs either spatially, or temporally. Opportunity exists for farmers to mine the natural capital or ecological function to save costs and increase their margin on each unit of production, while passing the costs of these decisions onto the public.

Producers' strategies are incentivised in commodity systems through three feedback loops. There are incentives for increased production arising from:

1. *Growth expansion feedback*, where producing more from reinvestment of profits will increase producer returns further

2. *Efficiency feedback*, where producers face price declines and they need to compete for their market through seeking greater efficiency – either through the use of technology, economies of size, or cost savings

3. *Demand response feedback*, where as prices fall, new markets open up and new uses of products are adopted, increasing demand and putting pressure on price increases reinforcing the expansion and efficiency feedback incentives.

Growth expansion occurs as total production rises as producers seek to increase their profits, providing capital for reinvestment. Reinvestment of this capital into productive capacity through new technology, application of increasing levels of human-made capital, or simply increasing size, continues to boost total production, reinforcing the cycle. The cycle therefore becomes self reinforcing as the more profit a producer receives the more opportunity there is to invest to increase future outputs and profits.

The efficiency incentive loop recognises that as total production rises average prices will usually decline and profits per producer fall, creating more pressure to boost production per unit costs. The producer response options include increases to the size and technology level of the production unit for the purpose of restoring producer profits. However, increasing the size and technology level per producer also boosts the total production via a feedback loop which puts downward pressure on prices and profits and creates a vicious cycle of rising production and falling prices and the need to continually seek efficiency gains.

The demand response feedback is created when total production rises, the commodity supply on the market rises. More supply causes average prices to fall, increasing the demand and supporting and boosting total production. More supply also increases the pressure to expand markets, increasing demand for the commodity as in global expansion.

The overarching effect of balancing the above incentives is to further increase production and reduce prices creating the ‘running to standstill’ or ‘treadmill effect’ producers continually refer to. These feedback systems mean, irrespective of high or low profits, producers will seek production increases. With high profits, reinvestment is made to increase production and lower the risk to future security of the family and business, whilst under falling profits efficiency measures and cost externalising along with expansion lead to increased production levels.

An important effect of the commoditisation of food production systems is that it contributes to the ability of producers to externalise costs by increasing the separation of the consumer from producer and the product from producer. In a commodity-based system, the source of product is rarely if ever known and if it is, there is little or no connection between the consumer, the effected, and the producer. The insulation of consumers from producers is referred to as distancing. Distancing can arise for various reasons, including geographic, socio-economic, and industry structure.

The loss of feedback breaks the direct link of traditional farmer markets which supported the producer-consumer linkages and created accountability for effects. In a local market a farmer may shade their transactions or costs but there is a high probability of having to face the recipient of the costs. Traditionally this was supported by social norms and processes that created a rights-responsibility relationship in the use of property, a relationship that incorporated both market and non-market institutions. The move away from face-to-face transactions created a decoupling or weakening of this relationship, which in conjunction with pressure to convert land to high value uses to intensify production with increased human-made inputs, has led to

many of the negative effects now being experienced. The long-term costs are often diffuse in time and space, while the owners of land and marketing channels have been able to accumulate significant wealth gains. It is also insightful to recognise that these changes have occurred over a long period of time. However, we suggest that the changes have gathered momentum and intensity as recent policy and institutional arrangements have continued to evolve the commoditisation of agricultural production.

The production growth drivers create incentives for higher levels of production and ensure that the cost of output is minimised. These are the same drivers that encourage production to the extent that they contribute to commodity systems traps, including:

- *resource depletion*: where the rate of use exceeds the rate of regeneration resulting in a declining resource level. As the cost of natural resources or human-made substitutes (e.g. fertiliser) are expected to limit total production, often the signal to producers is extremely weak or unseen
- *pollution*: where production drivers push the rate of waste generation upwards. Over time and space if the rate of waste assimilation exceeds the rate of purification the waste level will increase.[3] The link between waste level and total productive capacity is often missing or unseen
- *community decline*: where production drivers increase production that reduces price which is magnified by greater producer-buyer power differentials. The decline in producers' income increases the consolidation rate of producers, lowering the number of producers and the community well-being indicators. Feedback that may solve the problems is missing, as neither community well-being nor falling producer income affects productive capacity.

The paper confirms New Zealand agriculture sector data which highlights the notion of running to standstill, leading to the increased demand for human-made capital and the potential effects on environmental and social systems and the loss of overall well-being.

The paper discusses a range of options to address some of the pitfalls of commodity systems that are market-based. These options seek to emulate the ability of markets to drive the innovation that will be necessary for environmental well-being and sustainability – innovation that rewards consumption efficiency rather than production efficiency. In doing so, the paper concludes that current free market policies and commodity production systems serve an important function in society's goals. The primary goal has been to provide plentiful raw materials at the lowest possible cost; however, these policies have served this goal through stripping away information (and the

associated costs) of how commodities are produced and instead focused on volume and price relationships. As a consequence, producers are increasingly distanced from feedback or signals about pollution, degradation and the decline of rural community. Even with signals, it is unlikely that most producers would respond, as altruistic goals linked to 'sustainability' and 'stewardship' are generally addressed only once producers face a neutral incentive scenario and when higher level personal goals are secure.[4]

Acting as individuals the only option is to step outside commodity production and to market a product outside the structure of the commodity system. Producing highly-differentiated products and marketing these directly to well-defined consumers effectively minimises the distancing created by commodity systems. The value of closer linkages should not be downplayed as a worthy contribution to societal goals that individuals can make. The difficulty is the extent or scale to which such strategies can be adopted. With 10 percent of producers involved, it still leaves 90 percent facing the incentives of commodity production and the social cost and public harms that this entails. The policy management responses need to address this 90 percent more effectively. However, currently we simply do not know enough about what farmers can actually do.

Sustainability needs collaboration and collective approaches – the total opposite of current institutional incentives that favour low-cost transactions through representing the value of the individual. Current private property rights provide an excellent basis for minimising the cost of transactions, but suffer from high cost associated with coordination and collaboration. Collaboration costs increase as the number of decision-makers increases and the individuality of property rights. These factors create a need to negotiate agreements, including an agreement on how to reach an agreement. Cooperative and collaborative mechanisms are, therefore, under developed in market-based systems that have seen comparative advantages from individuality and the distancing of people.

The policy objective must be to decide what can be done. The challenges in addressing the effects of agriculture on natural resources, environmental quality and social systems are massive. They will require a portfolio of change strategies that may comprise a number of small steps before significant progress can be made. Each of the options provides some potential for improvement and should be exploited wherever possible.

Creating feedback, achieving influences on an appropriate scale, and having options for people to move into systems that do not threaten their need for security are the challenges that can start to be addressed. Ultimately, as asked by the Sustainability Institute (2003) report on building sustainability into natural resource economies: "What type of efficiency do we as a society want?"

This paper stresses the individual needs for balancing allocative and production efficiency goals with the societal needs for enhanced consumption efficiency. We realise that this is a strategic leap from current policy but we feel such a jump is imperative as New Zealand seeks to achieve its stated sustainability goals. We believe that the answers do lie with market-based approaches which embrace the ability of markets to provide continuous incentives for innovation and not simply lower-cost output. How to emulate the capacity of markets to innovate for natural resource, environment, and social systems are urgent challenges for current public policy in New Zealand agriculture.

Irrespective of price signals being favourable or unfavourable, the short-run incentive for producers is to increase their production further. These increases may be driven from increased use of technology resulting in higher productivity from the capital employed. To date the most significant productivity gains are related to the use of labour and capital. Land productivity data is harder to discern, however, research suggests smaller maybe more productive. The challenge for producers is how to respond when available technical efficiencies and productivity gains are fully utilised. At this stage options include increased cost externalisation and structural reforms. The system of commodification takes no account of scale of production and scale of effects, concentrating on lowering the cost of production to enable suppliers to compete for market share.

We suggest that there needs to be greater balance between the productivity gains from efficiency that current policy influences with increasing consumption efficiency. We do so by viewing production as a consumption activity – it consumes resources. As producers run to stand still, they consume more for the same level of gain or return. Given increased populations and consumption per capital, our production systems need to be more efficient not just in producing material goods and services but in terms of greater social satisfaction and well-being. This requires increased recognition of the non-market values which largely fall outside our current institutional arrangements. As a consequence, producers are distant from consumers and the institutions that bridge this gap are rewarded on the basis of their market transacting. Information and decision-making are bounded within the market-based institutions leaving the non-market institutions poorly represented in decision-making, enabling producers to consume resources that have no price or cost and therefore fall outside the realm of producers when they consider the cost of production.

It would be easy to caste this as doom and gloom. It is not. The dialogue and analysis that is started in this project has already highlighted significant potential gains for producers and New Zealand in terms of economic value and for environmental protection and social well-being. The challenge is how to make the necessary changes to incentivise the very markets that continue to

drive food productivity gains to ones that increasingly support environmental innovation. While many (including ourselves) ask what efficiency should society strive to achieve, we also ask who will or should lead this search?

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CHAPTER 1

Introduction

1.1 Purpose

It is widely recognised that agriculture is one of the most environmentally-damaging sectors. The environmental effects of agriculture production have been highlighted in New Zealand through reviews undertaken by the Office of the Parliamentary Commissioner for the Environment and are well documented in international literature. Agricultural production continues to expand rapidly, however, this higher production increasingly demands the use of human-made capital and inputs. Associated with the increasing production levels are significant effects and impacts on the natural resources, environmental quality and social well-being in rural regions. Agricultural is the major source of non-point pollution[5] and is associated with deteriorating trends in soil erosion, land degradation, loss of wetlands and biodiversity. These effects have resulted in social concern about the contribution and, therefore, the appropriateness of current intensive food production management practices and the institutional responses to these effects.

This paper discusses how current institutional arrangements define influences and pressures that create incentives on commodity producers to increase productivity, which in turn leads to environmental and social impacts that society increasingly questions. The paper explains why these forces drive productivity gains under both high and low commodity price scenarios, an outcome that may seem to be illogical but which turns out to be a rational response by producers. We discuss the strategies that producers adopt in

response to these incentives and the consequences of these on natural resources, environmental quality and social well-being. Finally, the paper discusses means for addressing these through policy reforms, the current state of information and knowledge for New Zealand policy makers, and outlines some policy options that recast producers' incentives so that they align more with the policy goal of more sustainable production systems.

Ultimately, we challenge the reader to think about how current institutional arrangements constrain and in many cases are opposed to the development of sustainable food production systems. We also strongly recommend that policy is needed to re-balance the incentives for 'productivity' with those required for greater 'consumption efficiency' in order to support the public good expectations and future requirements of a more sustainable agricultural system for New Zealand.

1.2 Context

Public concerns about environmental sustainability have resulted in society questioning the ability of current food production systems to deliver an acceptable balance between private goods and services and public 'goods' as opposed to what is increasingly perceived to be a raft of public 'bads'. These concerns suggest the presence of significant market and government failure associated with current agricultural and environmental policy. Concern about the appropriateness of policy and the effects of policy outcomes is not new. What is new is that this concern is now caste in the context of intensive agriculture and New Zealand's policy goals for sustainability. Previous public concern focused on the inability of New Zealand producers to maintain output while competing and participating in world trade without significant levels of public support previously provided as input and output subsidies. This concern arose due to the cost of historically high levels of protection offered to agricultural producers that distorted the price and market signals received by farmers. Ultimately, the concerns about public subsidisation of agriculture led to the deregulation of agriculture. As a result of deregulation, New Zealand producers faced new incentives and signals and responded through dramatic productivity increases. The increased output also creates a number of associated side-effects, largely on environmental and social systems. In response to these effects, the public is again expressing it's anxiety over the environmental and social effects of ever-increasing intensification of production systems and the potential for producers to personally gain by externalising their costs in the form of environmental damage. The growing concern about current trends coincides with the introduction and slow operationalisation of the Resource Management Act (RMA) as well as the growing influence of urban values (as opposed to rural production values) within the New Zealand socio-political landscape.

The question we ask is: "To what extent do the current policy and institutional arrangements adopted in New Zealand since the 1980s to ensure agricultural production is able to compete in the free trade global markets contribute to increasingly unacceptable social and environmental impacts in New Zealand?"

Producers of goods and services are predicted (and proven) to respond to the incentives and opportunities created by the economic, social, and institutional context within which they operate. This is a core characteristic of a capitalist system. As expressed by Metcalfe *et al*. (2003), producers are continuously "restless and adaptive" and will change their behaviour in accordance with the set of incentives they face. Within the capitalist model, growth depends on microeconomic behaviours – on investment and innovation and the coordination of these behaviours by market processes. Driving this process is competition which has been described as an evolutionary process "taking all forms of increasing returns in its stride, simply speeding up and influencing the direction of change."

In this paper we do not advocate the removal of market-based capitalism and the incentives it provides for producers to seek economic growth. Rather we consider the total reliance on market-based policies as being increasingly outdated in the global context of food production and sustainable resource management in New Zealand. It is outdated in the sense that the very incentives created by the current policies lead producers toward negative outcomes for the communities in which they operate and the environment that supports their own well-being. Ultimately, these negative outcomes constitute a risk to the future growth in value of New Zealand's food production systems, particularly in a sustainable development context.

The business environment in which producers operate is stimulated by both market and non-market institutions. Non-market institutions are those components of society well-being that are currently not priced within the prevailing market environment. We suggest that policy makers need to pay attention not only to the market institutions (e.g. capital, labour, and commodities), but equally to the non-market institutions (including environment and natural resources and social systems) that shape the growth and application of new knowledge at the level of industry and the firm. These same incentives threaten rural communities, natural capital and environmental quality on which the production systems themselves depend. Continued failure to pay greater attention to the non-market institutions will knowingly enable the policy and government failures to persist and will increasingly see costs pass from the private sector to the future public purse for remedial and mitigation expenditures. This is currently demonstrated by the proposed public expenditure to address severe agricultural derived risks to the lakes of the Taupo and Rotorua districts and New Zealand waterways and water resources.

CHAPTER 2

Influences on food production

This chapter examines several of the underlying influences that shape the behaviours of producers which in turn determine the level of growth in food production.

2.1 Capitalism

To consider how incentives influence producer decision-making processes, it is important to first consider the nature and basis of the market economy. Capitalism is based on the notion of individuals and enterprises searching to accumulate assets or wealth.[6] Capitalism in this context is the relationship between the owner of capital (money and goods) and the users of this capital. The users of capital need the goods and money to support their own livelihood. The legal basis of the relationship between the owner and user of capital is the notion of property and the right to exclude others from any benefits that may flow from the use or control over specified property. As such, property is more than simple ownership as it creates entitlements that are legally enforceable.[7] Property creates power for the holder of that property by enabling them to exclude others from accessing the benefits available from the use of property through the creation of a right to the property. De Soto lists the underlying features of property that support the notion of capitalism:

- fixes the economic value of potential assets
- integrates dispersed information into one place and system

- has the effect of making people accountable
- makes assets fungible
- networks people; and protects transactions.[8]

These features are important in developing an effective transaction system that underpins the accumulation of wealth and capital. These property characteristics are essential components for achieving the transactional efficiency that a commodity-based system requires and rewards.

Property entitlements give the holder of the property the right to exclude others. However, it does not implicitly provide the right to use the property in a manner that creates 'harms' for other individuals or the overall good of society. By creating rights or privilege, the holder of property entitlements can exert their power in a number of unintended ways. Society creates these property entitlements to enjoy the benefits of capitalism at an affordable cost, primarily low cost of transaction, lower prices for products and as means of capitalising assets. In this manner it is both the stock of assets (e.g. land) and the associated flows (e.g. dairy production) that derive from these stocks that can be transacted and capitalised.

At the same time, other flows result from the production system relating to environmental waste, social costs and loss of future resource stocks through depletion or degradation. However, as these attributes are not defined within property entitlements they can be kept external to the property holder's decisions at little or no direct cost. Property holders can withhold their property entitlement from the market choosing to relinquish either the flows or stocks at a time and place that maximises their personal gain. It is this reward, the value of the flow of goods or the underlying value of the capital stock, that creates the wealth on which capitalism depends and for which capitalism provides incentives to accumulate. Socially, wealth is therefore inseparable from power, as power is required to assert control over others. The power to accumulate wealth from property is an inextricable form of power over others who are precluded from doing so.

Capitalism like most social systems has its positive and negative attributes. Socially sensitive capitalism has the best record in producing the necessary conditions for empowerment and freedom of a society, both of which are required for development and social well-being.[9] The institutional challenge is how to create socially sensitive capitalism that is adaptive and responsive to the changing nature of social preferences both domestically and in the country of destination for New Zealand exports.

Social concerns about agriculture and its ongoing cost externalising through either subsidisation or through negative environmental effects, reflects the

changing preferences of New Zealand society to which institutional arrangements must also adapt. These concerns mirror the reality of a changing socio-political power base in New Zealand and the changing values that a more affluent urban-based society demands. As discussed in the section on commodification below, food production systems and globalisation of capital through trade add new dimensions to social sensitivity to the capitalism model. This is the dimension of social responsibility that consumers are increasingly able to apply to consumption decisions. A number of trade and retail systems now demand proof of social responsibility in production as a prerequisite to gaining market access. An example of this is the need for Forest Stewardship Certification to gain access to specified European Union lumber retail outlets. This requirement is in response to consumers demanding sustainable production systems which are non-exploitative, especially in their harvesting of tropical hardwoods. In effect, consumers are demanding to know about the environmental and social effects of products they consume, even where production and harvesting is located at some distance from them and the effects of the production and harvesting has limited or no direct personal effect on them.

2.2 Efficiency

The concept of transacting is central to economic growth and involves those with property entitlements relinquishing their rights to the flows, stocks (or both) of assets in return for payment. Systems for coordinating transactions for the benefit of growth objectives have evolved as the notions of property and standardisation gained increasing acceptance. As technology, demand, socio-political values, consumer expectations and knowledge change, the allocation of resources to production is adjusted. This re-orientation of resources is signalled to the holders of property through the relative prices established within the ordering process (i.e. the market and expected ability to sell output or assets). As society seeks wealth, suppliers compete for the right to supply and capture the wealth that each transaction can generate. Market-based systems are rightly recognised as an efficient means of ordering transactions, valuing the goods and services to be transacted at a low cost of transaction. Markets are efficient means for ordering transactions between suppliers and consumers.[10]

New Zealand has adopted institutional arrangements that seek to maximise the benefits available from emulating free markets and recognises the advantages that market systems provide in the allocation of its resources to productive activities. Market-based transactions through pricing and competition create incentives for production efficiency through which farmers are able to compete with other food producers both locally and globally.

The 'free' market policies of New Zealand were embraced within public policy to move away from centralist decision-making involving the subsidisation of 'preferred production systems' to a market-based approach. The market approach was seen to create incentives based on international markets and consumer demand providing greater efficiency as outlined in neoclassical economic assumptions. Some key assumptions in neoclassical thought are:

- the environment (including natural capital) is assumed to be part of the human economy as a factor of production. As such the role of ecological systems in supplying materials, services and waste sinks is largely ignored[11]
- it is assumed to a large extent that human-made capital can be substituted for natural capital
- the infinite substitutability of human-made and natural capital rejects the concept of limits to growth
- the welfare of society is best served by people as individuals pursuing their own interests through the market; there is little to support the views of ecological integrity, interaction, interdependence, community, and the non-market institutions.

Neoclassic thinking originated during periods of low population, low consumerism, limited international transactions, with commensurately low levels of human artefacts and waste. Neoclassical economic thought developed in response to the need for society to provide material well-being, something which it has achieved with great effectiveness. The question we raise is whether this remains the dominant need in public policy and institutional arrangements for food production today, given the changed circumstances that society now faces. The adoption of sustainability policy in New Zealand suggests changing priorities within public policy as represented in statements on New Zealand's sustainable development strategy.

Market-based systems create incentives for innovation that encourage producers to decrease costs and/or increase outputs as a means of competing for the right to supply. Producers respond to these signals by searching for and investing in innovation to increase production or reduce the cost of existing production. In doing so they are not required to take account for 'inputs' that are not monetarised, that is, those that fall in non-market institutions. The net outcome is for producers to strive to maximise their productive efficiency in order to maximise their personal wealth.

Within a market the holder of property (or the flow of goods from property) can identify the value of goods to be produced and balance these with the cost of producing these goods to determine the expected profit or return for their

efforts, albeit with a degree of uncertainty.[12] The market also signals the incentive or disincentive for the producer who intends to supply a certain amount of goods relative to demand for that output. In this market when goods become scarce, consumers compete for the limited supply forcing the price up, resulting in the reallocation of resources within the production system to increase supply. When goods are plentiful relative to consumer demand prices fall signalling to producers to move resources out of production.

Market-based systems therefore represent a form of decentralisation where power over decision-making is moved from planners or bureaucrats to investors or entrepreneurs who seek to capture the benefit of production systems. As such, market-based systems provide substantial incentives to innovate in the production of more goods and the material well-being of 'society'. The use of free market policy shifts responsibility to the level of individual owners of capital (and therefore resources) and represents a strong form of decentralisation.

Any form of decentralisation increases the number of private decisions in the economy that may or may not have potentially degrading or damaging effects. If the number of private decisions for environmental protection innovation is significantly less than the number of damaging decisions, then long-run environmental degradation and damage is inevitable.[13] This is a real risk as few environmental attributes have been defined in formal property relationships and therefore environmental stocks and flows remain outside the market process and can be considered external to the ordering and signalling systems. Many natural capital attributes remain outside the incentive system created by markets and consequently are unaccounted for in production decision-making.

Systems that emulate free markets provide strong incentives to innovate for the goal of improved material well-being, but provide little or no incentive for environmental innovation. The lack of consideration of environmental effects arising from intensification of agriculture were (and continue to be) a predictable outcome of current market-based policy and institutional arrangements. Compounding the inability of markets to address these effects has been the restructuring of resource management responsibilities with the introduction of the RMA. The RMA authorities are immature with limited capacity, institutional culture for monitoring, and information systems and as such have limited ability to respond to the changing intensity of environmental effects that are more diffuse such as non-point pollution.

"Producers are consumers and production is consumption."[14] We believe that production needs to be seen as a consumptive act that uses natural and social resources; it imposes costs on the environmental and on people. As production systems create pollution, current institutional frameworks provide incentives for producers to generate responses or solutions that support the continuance of

their production systems through investment in mitigation technology (such as scrubbers, filters etc.) or management (e.g. riparian zone fencing) as opposed to seeking means that avoid or minimise the production of pollutants. A consumption perspective turns this around to consciously construe economic activity, as consuming, as depleting value, as risking ecological imbalance, and as stressing social capacity.

Current production systems can be considered not only as production and value adding but also as "consumption and value subtracting".[15] Many argue that increased consumption is an inevitable outcome of population growth. However, consumption is not solely determined by population growth. Recent rates of growth of food consumption, water withdrawals, forest product consumption, all markedly exceed the rate of population growth. Currently consumer demand is increasing on a per capita basis which combined with population growth leads to significantly higher levels of overall consumption, including the effects created by the production systems that necessarily consume both natural capital and human-made capital.

There is, as yet, no balancing incentive for producers to invest in innovation that reduces the consumption required by their production system. The incentive is for producers to keep increasing output through seeking greater efficiency or expansion either through the use of market priced inputs or non-market inputs that are external to their investment decisions. The incentive in a market-based system is for producers to minimise 'consumption efficiency' while maximising their productive capacity. A consequence of these incentives is a lack of reinvestment into resource conserving technologies[16] and increased use of human-made capital (such as fertiliser and agrichemicals) to substitute for limited or declining natural capital.

Consumption efficiency, as noted earlier, "is about getting more with less, not more stuff but more satisfaction, not quantity but quality… it is the level of social welfare and personal satisfaction obtained per unit of energy and materials unconsumed".[17] Materials include the inputs that reside within the non-market institutions such as natural capital. Consumption efficiency therefore differs from production efficiency in that it adopts a perspective defined from the view of demand and not supply. Typically production is considered to be the problem and therefore policy initiatives for production become the 'logical answer'. However, production as consumption is still beyond current policy scrutiny. From a consumption perspective, producers must internalise their costs and cease their abusive or degrading behaviours if the overall objective of social well-being throughout society is to be achieved.

Feedback and information are critical inputs for markets. Producers use a plethora of measures and indicators to assess the efficiency of their

'production' systems. Often measures such as the inputs or factors of production, labour and capital are measured in terms of input per unit output (kilograms of dry matter per kilogram of milksolids, stock units per hectare, wool per hectare, etc). These ratios are typically monetarised reflecting the process of how goods and services are commodified to reduce costs. These indicators support the concept of production efficiency and it is only recently that attempts to develop some consumption-based indicators has occurred. Often this has been as a means of defending existing production systems as opposed to a change in the philosophical basis of production.

In the context of global food markets, should public policy adopt additional goals other than increased production through allocative efficiency? Society has needs and priorities that are not well served by narrow efficiency-based agricultural and trade policy. The continued consumptive growth of production systems needs to be addressed and options that minimise the consumptive requirements need to be incentivised at least to the same extent that production increases are incentivised. The argument derives from a simple limits to growth theory where consumption is driven by both population growth and consumption per capita. Given the expectation that in the next 50 years there will be more people added to world population than in the period up to 1950, there is going to be a significant increase in the use of resources to produce sufficient food to meet the requirement of increased world population.

At the same time consumption per capita will continue to increase due to growth in economic activity both within the developed economies but also in the 'developing economies'. This is especially true for China and India where consumptive demand is rapidly increasing for more than one quarter of the world population. Consumption of resource stocks and flows will be an increasing challenge as the rate of depletion increases as the rate of extraction exceeds regeneration rates. The world fish protein supply is currently clear evidence of such trends. Von Weizsacker *et al*. (2003) estimate that there needs to be a factor of four improvement in the efficiency of production (i.e. consumption efficiency) to supply future needs successfully and present a range of examples of how this might be achieved.

Agriculture can reduce the need for energy and commercial fertiliser through alternative management practices but these are not yet widely applied. The ability to reduce the level of consumption is limited by both the institutional incentives and producers' lack of innovation. These deficiencies arise in large part from the current structure of the incentive system for material well-being. Our innovations result in continued investment to find technologies and techniques to serve existing production systems without a commensurate level of investment and innovation for environmental protection and consumption efficiency. We believe that innovation for environmental and social goals

through an increasing focus on consumptive efficiency is a high priority in public good science funding as it serves the public good as opposed to the private benefit.

The neoclassical model of economic development focuses largely on individuality and individual well-being, assuming that societal well-being or preferences can be represented as simple aggregation of individual preferences. Anyone involved in community processes or focus groups knows that this is simply not the case. There is a real need to develop clearer understandings of what the 'collective view or values of society' are. Once these are known, policy and institutional arrangements can be designed to protect these collective values. Prevention of public harms that result from increasing intensification of production requires feedback on collective values of environmental and social externalities that current market policies fail to signal to producers. Systems for providing this feedback necessitate knowledge of collective values and require cooperative or collaborative responses. For example, there is little point in one producer avoiding the effects of nitrogen on water quality if all other farmers continue to increase their use of nitrogen.

Public policy decision-making needs to reflect the collective definition of values rather than the summation of private preferences. It must allow for the give and take of debate, learning, changing of positions and development and conservation of shared values. People's own private preferences often differ from their public values. Preferences elicited through personal interviews are individual values but are reported as representing the 'collective view' of society. The problem for the private property free market model is that the property right framework is designed to maximise the value to the individual by minimising the cost of transactions. However, the system suffers from a high cost of collaborative endeavour resulting in collaborative responses being ignored or avoided unless localised crisis emerge. The unanswered question is: Can the institutional systems defined by sector policy and the RMA effectively address the needs for collectivity and consensus building on non-point source issues?

We believe that a rational policy framework needs to balance the current production orientation with consumption dimensions. This rationale addresses the constraints of what is or is likely to be the limiting factor facing society – its use of resources and the life support functions essential for society. If the stock or flow of raw materials is increasingly scarce it makes sense that society places greater consideration on options with consumption efficiency benefits. Such a reprioritisation seems to be a necessary step in the achievement of our national sustainability goals.

2.3 Commoditisation

A second factor that supports the continual trend of increasing productivity and current institutional arrangements is commoditisation. We suggest that the success of the allocative efficiency model[18] requires the continual commoditisation of agriculture and discuss what this means, how commoditisation contributes to the incentives for producers to intensify their production, and how this has become one of the key drivers for intensive agriculture's contribution to environmental damages.

2.3.1 Overview

The commoditisation of production is referred to as the process that preferentially develops goods and services suited to functioning as commodities, that is, good and services with qualities that facilitate buying and selling through market transactions (see Box 1). Commoditisation in this sense is comparable to industrialisation except it is viewed through the lens of 'consumption'.[19]

Industrialisation commodified manufacturing production systems through massive gains in labour efficiency. The effect of industrialisation is best represented by the time required to assemble a Model T Ford, which reduced from 13 hours to 90 minutes. This lowered the cost of buying a Model T, allowing the average person the opportunity to purchase what used to be a luxury good. New Zealand food production systems could be considered to be in a similar revolution where more and more food is being produced at lower cost. The reduced capital input enables cheaper and cheaper food such that the real price of food has experienced a 10 percent decrease during the 1990s compared with an 8 percent decrease for clothing, an eight percent increase for alcohol and tobacco, a 35 percent increase for education and health, and a 50 percent increase for communications.[20]

The food production revolution has a long history starting with crop rotations, chemical fertilisers, expansion of production areas with the development of transport networks, the replacement of steam traction engines with machinery, improved crop varieties, and the green revolution. It is estimated that real beef prices fell by a third from 1971 to 1997, during which time consumption increased five-fold in developing countries and milk consumption increased three-fold.[21] Simply, there has been an accelerating expansion of agricultural production in response to efficiencies introduced by improved signals of world markets and new technologies.

As production systems expanded their capacity, traded output needed to be distributed and retailed more efficiently. Historically, technology has contributed significantly to the ability for this to occur. Since the use of salt to preserve food

there have been further technological innovations with canning, followed by refrigeration. Refrigeration technology was expanded to the household allowing greater storage and enabling supermarkets to develop as local, regular market purchases were no longer essential. Supermarkets have kept a downward pressure on prices and as capital in the retail sector becomes more concentrated this downward pressure increases. Walmart in the US, for example, sells toothpaste at 63 percent of its competitors' prices and orange juice at 58 percent.

Within New Zealand the concentration of power in the retail sector is equally prevalent. The Warehouse Ltd reports its core values and principles as being people friendly, providing everyone a bargain, and being socially and environmentally responsible. The Warehouse reports that in 2002 the price for a bundle of consumer goods cost the consumer only 71 percent of the listed retail price in 1982. If the 1982 prices were adjusted to 2002 prices using the CPI the actual price in 2002 for the same bundle of consumer items is a mere 28 percent of the 1982 prices.[22] The concentration of capital in the retail sector represents a shift in power within the food production channel. Whereas, power previously lay with landlords it now lies firmly with the retailer who has a close link to the consumer and is increasingly distant from the producer. As a consequence, producers have less power to influence the value of goods produced and are increasingly price takers as profits flow more to the retail sector.

The concentration of power in the retail sector is creating private labels (39 percent of British grocery sales, 21 percent in France, and 16 percent in the USA) as a means of marketplace discrimination. These brands can only be developed if there are price cuts that offer more to the consumer. Producer margins are falling as a result of the price decreases and this is now flowing through to the retail sector where large outlets are experiencing significant layoffs to control costs and keep prices low. Duncan (2003) noted that this was contributing to a number of externalities including obesity and increased consumption per serving. They note that the less regulated a country (or conversely the greater free markets are used) the cheaper a 'Big Mac' tends to be.

The trend of cheaper food and greater productivity has spread throughout food market channels. This is demonstrated in the fast-food industry where success has been built on significant strategies for geographic expansion, increased labour productivity, and the simplification of systems. The extent of task minimalisation (although this is referred to as labour specialisation it is based on task reduction to remove the need for training and associated costs of labour inputs) and the use of franchise outlets are well described by Schlosser (2002). All these trends can be viewed as commodification occurring in the wider food chain including the commodification of labour.

New Zealand's food production systems are part of the above trends and influences noted above. The commodification of food production is akin to the industrial revolution and perhaps should be seen as a revolution. The commoditisation of the food chain is a revolution to provide cheaper and cheaper food to the global consumer. The purpose of commoditisation is to reduce the direct financial cost of products to the consumer by ensuring that goods are produced at the lowest possible cost through the efficient allocation of resources and technologies. The following section discusses the characteristics of commoditisation.

2.3.2 Commodities

Goods and services with the characteristics of commodities (see Box 1) are those better suited to low-cost transactions through current institutional processes between suppliers and consumers. For agriculture, this commodification extends back into the supply sector and into the downstream marketing and processing functions. Current incentives support production systems with the lowest cost of production or supply. Producers with lower costs can out compete other suppliers for a sale. Competition through price reduction requires producers to increase production efficiency by introducing new technologies and/or by reducing costs. In response, agricultural producers search for innovation that maximises the opportunity to win this right to supply. This search for efficiency is well understood in the agricultural sector where producers report having to 'run to stand still' because as they capture a competitive advantage through innovation it is invariably lost through the innovation of other producers. It is this process of competing to supply in conjunction with market signals that ensures efficiency.

To expand selling opportunities beyond local markets, market economies rely on the use of standardisation and specification to be able to accurately report the supply of products to global consumers, thereby expanding the potential pool of buyers. The notion of transacting at a distance by removing the necessity of human interaction for the purpose of trade is central to the globalisation of food markets. The physical separation or distancing between producers and consumers also minimises potential social and emotional entanglement that were a requisite part of traditional market trade based on personal transactions. It is through the process of simplification of transactions that the wider process of commodification is derived as it provides certainty to potential buyers of what they are bidding for.

Box 1 Characteristics of commodities

The qualities of a commodity are:

- Alienable: the ease with which ownership can be asserted, assigned, and transferred
- Standardisable: independence from the particularity of geography or culture
- Autonomous: the ability to be used independently, outside the constraints of social relationships
- Convenient: the ease with which it can be used
- Mobile: the ease with which something can be packaged and transported.

Source: Manno, 2002, p71

Through standardisation local products can be sold over distances, and it is this process of commodification that ensures that the direct linkages between goods and their producer or production system are no longer necessary. The detailed specification of product enables the use of money in return for commodities and commodities for money transactions, facilitating the ongoing separation of buyers and sellers.[23] The move to non-physical (electronic transactions) takes this one step further. It is through this process of commodification that capitalists are able to broaden their market, as they no longer need physical presence to sell their goods, enabling trade through wider national and international or global transactions based on coordinated systems that seek to emulate free markets.

The efficiency-based model preferentially exploits the commodity potential of goods and services to arrive at the goal of the lowest cost supplier of a standardised set of goods. Investment in innovation and research therefore is increasingly directed at options that lower production costs of standardised products which can compete in the commoditised food chain.

A good's commodity potential is determined by the qualities that enable it to be exchanged not only at a low cost but over a large distance. All goods and services have this potential, to a greater or lesser extent. The types of goods and services with high potential for commoditisation are those more closely linked to market-based efficiencies. This highlights the difficulty faced in achieving more sustainable food production systems from within the current commodity system. Most of the tools and skill inputs needed for sustainable site-based agriculture currently have limited potential as commodities and are therefore disincentivised by the current institutional framework (see Table 2.1). Such inputs are more personalised requiring greater cooperation and

coordination amongst producers to support sustainable food production.[24] This helps to explain why current institutional arrangements that support sustainability are few in number and collectively have little ability to influence the cumulative effects of food production on the environmental and social systems.

The extent of commodification changes through the life cycle of a product. New products may have limited commodity status immediately following an innovation. However, over time the product may become the 'the norm' and highly commodified. For example, organic potato production in the United Kingdom expanded rapidly with the specification and standardisation of products. This standardisation enabled organic potatoes to be commodified rapidly increasing the supply. However, it also erodes price premiums resulting in many producers withdrawing from production.[25] As Manno (2002) notes, "the selection pressures that favour commodities over non-commodities involves a gradual 'survival of the fittest' where what is fit is by definition what is marketable."[26]

Table 2.1 Examples of goods and services with high and low commodity potential

Goods and services with high commodity potential[27]	Goods and services with low commodity potential
a. Agriculture	
Proprietary hybrid patented seeds	Soil protection and management
Insecticides, pesticides, herbicides	Water conservation and management
Commercial fertilisers	Knowledge of climate, soil, local pests
Farm machinery	Energy conservation and management
Fuel and current forms of energy	Nutrient cycling and enhancement
Farm management books and magazines	Crop rotation and placement
	Rural networks of mutual aid
	Pest control and management
b. Environment	
Clean-up equipment and tools	Energy and material – conservation programs
Energy efficient appliances	Ecological design
Waste-management equipment and services	Watershed management
Environmentally friendly products	Voluntary simplicity
Photovoltaic cells	Community building and resource sharing
Biomass fuels	Environmental education
Parks and zoos	Waste reduction programs
	Extended producer responsibility
	Habitat protection and conservation

Source: Manno, 2002

2.3.3 Institutionalising commodification

Why commoditisation of goods and services occurs needs to be understood. The differing theories of public choice and bounded rationality and their prediction of pathway dependence provides insight into why these systems persist in the face of the negative social costs they increasingly create.

Public choice theory believes the main motive of actors irrespective of whether they are consumers, producers, voters, bureaucrats, politicians or even institutions is self-interest. As a direct consequence of this self-interest not only do market failures occur but also government failures contribute to the non-achievement of expected public policy outcomes. Government failure arises as the decision-makers are making allocation decisions using other people's resources or on behalf of other people for which they have no direct stake in the outcome. As such, the incentives for good management in the public sector remain weak. Interest groups, however, have very strong incentives linked to the potential gains that can be made from influencing public decisions which result in bureaucrat capture. The ability and incentive to influence public decisions on the basis that change, especially strategic change, would be too expensive, affect the workforce, require high costs of compliance and lead to uncertain outcomes remains one of the prominent methods to protect the status quo within public decision-making. Public choice attempts to structure these relationships to understand the rules and means by which public decision-making is carried out.

Bounded rationality recognises that decision-makers operate in an environment that is often highly complex as well as uncertain. Bounded rationality denotes the type of rationality used by people or organisations when the decision-making environment is complicated or, even more, fundamentally uncertain and complex. In these environments the decision maker often seeks multiple objectives that conflict and the alternatives are not necessarily readily available. The decision maker is burdened with the task of generating alternatives, and bounded rationality suggests that, in the process of doing this, options will generally only be developed from within their comfort zone. In this case, the comfort zone is defined by the decision-maker's knowledge, experience, and available information, all of which are linked to the pre-existing or predominant paradigm for the sphere of decisions. As systems become increasingly complex the decision maker is predicted to be even more selective in an attempt to satisfy as opposed to optimise. Bounded rationality predicts that institutions will rationally follow the business-as-usual pathway for as long as possible by excluding alternatives. Bounded rationality leads to or predicts that decision-makers will neglect novel or innovative solutions, instead adhering to safe ground on the existing pathway that institutions have evolved to define. For the public sector this is magnified by the lack of incentives for decision-makers as predicted by public choice theory.

The strength of bounded rationality and public choice is that they enable us to understand the dynamics relating to an economy, its production systems, the environment and the structure of society they serve. It moves beyond just the incentives provided and talks about the influences these incentives have on individuals affected by them.

For food production systems, it is important to carefully assess what is inside and outside the bounds of 'bounded rationality' within the institutional framework that supports agricultural production and how this defines the pathways that position intensive food production systems for this function.

The commodification of agriculture is well advanced compared to other sectors. Agriculture commodification operates on both inputs and outputs of the production process with the result that investment flows to commercial fertilisers, pesticide, machinery and standardised crops suited for long shelf life. Historically, as commodity-based agriculture reached production limits for the available technology, successful innovation enabled it to move into more productive states.[28] However, while commodity-based agriculture has been well served by research and development investment, there has been a commensurate under-investment into the development of site-specific knowledge and skills of soil management, site-specific service and managerial input, agronomy and diverse crops. In effect the commodity-based production system has become self-serving and works against the development of highly evolved site-specific skills and methods.

The institution of commodity-based food production in New Zealand has become pathway dependent. Institutional economics and organisational theory contend that agencies and corporations make decisions in a 'bounded rationality' based on their existing purposes and habits. These bounds interact with incomplete information to constrain the choices or options that institutions review and choose from. Therefore, it is the past and current institutional objectives and purposes that ensure certain information is made available while at the same time distancing them from other types of information, creating a predetermined tendency toward certain actions that are closely associated with existing behaviour choices. Institutional decision-making, like individual decision-making, is also 'pathway dependent' with an institution's past actions and choices constraining the choices and options assessed in the future. North used bounded rationality and pathway dependence to study institutional change through time, developing the notion of public agencies needing to move into 'adaptive efficiency' to ensure innovation.

Adaptive efficiency concerns itself with the manner in which society acquires knowledge, experiments and creatively solves problems. Adaptive efficiency does not maximise current present value but future choice under conditions of uncertainty by inducing experiments and innovation. Given the complexity of the ecological, economic, and social interactions associated with food production, a public policy objective of optimisation may be more appropriately caste in the notions of the precautionary principle. Herein lies one of the fundamental differences between a production efficiency view and that of consumption efficiency. Production efficiency is concerned about the short-run optimisation of wealth, while consumption efficiency – a requirement for sustainable food production – requires a longer timeline in which future choices are maximised.[29]

Public choice theory predicts that powerful interests (those with rights related to creation of wealth) have disproportionate power and influence over political decision-making. This means that the agents that get economic rents or profits from commoditised production systems can use these resources to influence decision-making and therefore 'lock in' on a pathway that maximises their personal wealth. This influence can be in many forms from lobbying, control of information, the use of due process to limit change to the ways of doing business. It is important to notice who the free market empowers.

The institutional framework for agricultural production in New Zealand evolved to support the development and growth of commodified food production. As a result everything from human capacity, information systems, physical infrastructure, financial and capital markets, research and development, and sector regulations and structure support the objectives of a commodified production model. This pervasiveness extends to the degree with which resource management agencies have been prepared to respond to the effects of commodified food on the environment.

Further indications are that public sector investment in research and development is orientated strongly to the production of commodities or at least their more efficient production. Current policy and institutional arrangements privilege commodities within the economy. When economic forces dominate society over time (rather than social or democratic forces), more and more of society's attention, resources, creativity and enthusiasm will be directed toward the production and reproduction of commodities or the qualities they need. To move toward improving consumption efficiency will be increasingly difficult over time as economies evolve in a direction that expands the reach of commodification. The key inputs for the current commodity system – investment, capital, time, skills, technology, and creativity are the real raw materials of economic life. The allocation of these raw materials is affected by subtle economic pressures that select options for satisfying wants and needs

that fit the current commodity-dominated production paradigm, as opposed to those that ensure economically and socially sustainable activity.[30]

Current policy views commodity-based agriculture to be more productive than alternatives. This is achieved largely through the capture of economies of scale linked to improved labour and capital productivity – but not necessarily land productivity. Labour is increasingly expensive relative to commoditised labour-saving technologies, resulting in labour substitution by human-made capital and technology. As Manno states, "eliminating skilled labour removes the very resource most essential to sustainable agriculture – that is, people with intimate, detailed knowledge of particular lands and soils."[31] Without these skills, producers rely on their ability to substitute natural capital with human-made capital in their drive to expand production levels.

Resources for agricultural training are directed at commoditised agriculture reinforcing the skill gaps through minimising the ability of new entrants to adopt the very sustainable practices desired. Examples of skills shortfalls can be seen in the limited use of integrated pest management (IPM) technology, which has been known to be beneficial for 50 years during which time world consumption of pesticides increased from 50 million kilograms to 2.5 billion kilograms. Even when agrichemicals were appropriately taxed IPM technology proved difficult to diffuse due to the higher degree of management decision-making required.[32]

The failure to adopt IPM derives from two facts:

- the full cost of pesticides in terms of environmental and health effects is not included in the price
- the implementation of IPM requires careful management, experimentation and observation.

Both factors have low commodity potential, face severe disincentives, and have comparative disadvantage in the prevailing institutional framework.

The assumption that natural resources (natural capital) are directly substitutable with human-made capital ensures that environmental damages are kept distant from producer decision-making. A consequence of this is that the production system can expand with no limit to the scale of production as human-made capital simply replaces ecological goods and services. The problems of scale as identified by Daly and Farley (2004) are hardly addressed by the neoclassical economic assumptions that underpin a commodity-based production system. While markets are efficient in optimal allocation relative to the alternatives of bureaucratic allocation or central planning, it is poorly placed to address overall scale. Prugh *et al*. (1995) liken this to rearranging the people on a boat but not recognising that when there is too much weight the optimal arrangement of

people will not stop the boat sinking. The critical aspect is throughput, which is determined by level of consumption and the number of consumers. As this becomes the constraining element in the economy, consumption efficiency should receive higher priority in public policy.

A number of New Zealand examples exist to demonstrate the issue of scale. The Rabbit and Land Management Program in the South Island high country addressed a number of system-wide issues relating to the ecological capacity or threshold for pastoral utilisation being exceeded that resulted in very significant impacts on production levels. The current concern about Lake Taupo and the Rotorua lakes represents another example where the sink capacity of the environment has been exceeded. The cumulative effects of past decisions highlight the complexity of issues that institutions have to address and the lack of knowledge and information available for decision-making. The complexity will possibly mean that much of the desired information will not be available until after the decision is actually undertaken. The capacity to effectively address complexity on an appropriate scale leads to the failure of natural systems, placing at risk the economic and social systems on which they rely.

Globalisation offers strategic choices. It can introduce a new wave of commodification pressures expanding the market further and increasing the incentives to continually expand production with the commensurate loss of non-market values. Or it can be used to take New Zealand production systems increasingly out of commoditised output with incentives to innovate for environmental and social protection. The current forces driving commodification derive from the institutional structure of the sector and the economy as a whole with resources flowing to the lowest cost production of marketable goods. The required changes for a more sustainable outcome from intensive food production will not develop in response to the set of incentives or disincentives created by current institutional arrangements.

2.4 Summary

Currently public policy in the agriculture sector faces a dilemma. The production models and supporting institutional structures are affecting the natural and social capital on which they depend. New Zealand society, as reflected in the concerns they raise about agricultural production systems, is becoming less tolerant of these effects and seeks redress. As resource degradation and non-point pollution grow and social systems are disrupted, the ability to make the transition to newer systems is reduced or makes the required changes more costly. We argue that the goal of agricultural policy must increasingly reflect the needs of consumption-based efficiency by recognising the limitations of commoditised systems. Policy must reflect not only market-based institutions but also non-market institutions within which

long-run ecological integrity and social well-being are manifest. To do so, non-market goals must be components of the public policy, now more so than ever.

We believe that the current institutional structure has provided significant gains to the well-being of New Zealand. However, we ask if this is being manifest in an institutional and policy framework that has become too pathway dependent. The real benefit of the 'free market' policy settings has been to get producers linked more directly to consumers, to get producers and processors to search for innovation with the goal of promoting production efficiency as represented by increasing output. We believe that the notion of using the same market forces to drive innovation toward a consumption efficiency goal has been largely missing or ignored due to both market and government failure.

The next chapter discusses the strategies that producers may adopt in response to the influences of a commodity-based food production model.

CHAPTER 3

Producer strategies

This chapter discusses the effects of commoditisation from the perspective of the strategies applied by food producers. It is often overlooked that farmers and producers run businesses that search out innovation and efficiencies to enable them to compete. They respond to the myriad of incentives and pressures for adaptation in order to reduce the risk to their families, business and general well-being. The effects of commoditisation can be reviewed in the context of business strategies available to farmers and then used to explain why unwanted outcomes arise.

This chapter addresses the political economy of degradation, pollution and social disruption. In doing so, we seek to understand the incentives of day-to-day decision-makers especially producers and consumers, the interactions of incentives, the resultant decisions and the effects of these decisions. A political economy of degradation posits that better attitudes, values or more data are not sufficient and not enough for change. Analysis of the distribution of short-run costs and long-term impacts are necessary to generate a better understanding and eventually a better prescription for a more sustainable food production system.[33]

Using this approach, it is possible to understand why the pursuit of wealth leads to unaccounted costs, and rather than accepting these as external and inevitable to be internalised or tolerated, it considers them as integral parts of a competitive business strategy.

3.1 Efficiency and expansion

As a result of the underlying efficiency pressures within commodity-based systems, producers are faced with limited choices to protect their well-being. To compete on price they are faced with the imperative to reduce costs to become more efficient. At the strategic level producers face a binary choice – seek greater production efficiency or externalise the costs.

Commodity systems incentivise increased production for both of these strategic choices. Irrespective of whether there are increasing or decreasing returns producers will seek to increase production of commodities. Under the scenario of increasing profits, a producer can choose to reinvest larger amounts to increase their production capacity through efficiency gains *or* expansion which (based on static average prices) will provide increased profits. In a scenario of increased collective production, commodity prices will fall, reducing the producer's returns and threatening their well-being. In this situation due to the limited choices of substitution the producer will also seek greater output through efficiency gains or expansion. An alternative strategy is to externalise costs either spatially, or temporally. Opportunity exists for farmers to mine the natural capital or ecological function to save costs and increase their margin on each unit of production. Cost externalisation may be either an active choice or an unintended consequence of their business strategy. The use of cost externalisation will be determined in part by the consequences on future production, personal goals and the expected probability of being caught if it falls outside current environmental regulations.

Cost externalising has been an attractive policy option in the past. Some of the examples of this include:

- The role of government in promoting agricultural production through subsidies that effectively externalised costs from producers to civil society.
- A desire to go to cleaner knowledge-based economies where the logic is that only five percent of advanced economies are natural resource based. There is however, no evidence to suggest that such economies limit or reduce their throughput of energy or materials. There is, however, empirical data to suggest that these economies simply cost externalise beyond their borders with the importation or exportation of goods and effects. The concept and application of the ecological shadow or footprint clearly demonstrate that cost externalisation is occurring on a large scale in service and knowledge-based economies.[34] The ecological footprint for New Zealand has been estimated at 3.08 and 3.4 hectare per capita (McDonald and Patterson, 2003, and Bicknell *et al*., 1998, respectively) and is considered lower than theoretical land-based carrying capacity, with about half its land embodied production for export. McDonald and Patterson

report that New Zealand's production system is some 34 percent below the theoretical land embodied carrying capacity. However, it is important to note that this does not account for the effects of this production on environmental services.

- International trade involving jurisdictional discontinuity. Where a firm works across borders it effectively operates, both *de facto* and *de jure*, in an economy where cost distancing is more readily available and accepted.

Local economies manage cost distancing through political and social processes to avoid the affected becoming disenchanted, and provide access to higher authorities to alleviate or compensate the harms. This is not yet possible across international borders and it is in the interests of both the exporting state and firm not to do so.[35] From a firm's perspective, the incentive is to be competitive through externalising costs, lowering its cost of production and enabling it to better compete. For the state it is about protecting jobs, economic growth opportunities and maintaining its political constituency.

From a business strategy perspective and the need to survive, producers can quickly move from applying technical efficiencies to the use of cost externalisation to retain their competitive advantage. Producer responses to prolonged droughts and rabbit infestations provide detailed evidence of this type of strategic dynamic being applied.

Expanding markets through globalisation provides access to increased demand to producers providing an incentive to increase production levels. Demand feedback in the form of increased prices influences producers to continue to expand their production even further. As commodity prices fall the scale of market opportunities increases, alternative uses of the commodity are developed and the price responds giving the producer the incentive to continue to increase production.[36]

Producers' strategies are incentivised in commodity systems through three feedback loops.[37] There are incentives for increased production arising from:

1. *Growth expansion feedback* where producing more from reinvestment of profits will increase producer returns further

2. *Efficiency feedback* where producers face price declines and they need to compete for their market through seeking greater efficiency – either through the use of technology or cost savings

3. *Demand response feedback*, where as prices fall, new markets open up and new uses of products are adopted, increasing demand and putting pressure on price increases, reinforcing the expansion and efficiency feedback incentives.

Growth expansion feedback occurs as total production rises; total profits rise too. Reinvestment in productive capacity through new technology, application of increasing levels of human-made capital, or simply increasing size follows, boosting total production yet again. The cycle therefore becomes self reinforcing as the more profit a producer receives the more opportunity there is to investment to increase future outputs and profits.

Efficiency incentive feedback recognises that as total production rises average prices will usually decline and profits per producer fall, creating more pressure to boost production per unit costs. This response includes increases to the size and technology level of the production unit for the purpose of restoring producer profits. However, increasing the size and technology level per producer also boosts the total production via a feedback loop which puts downward pressure on prices and profits and creates a vicious cycle of rising production and falling prices and the need to continually seek efficiency gains.

Demand response feedback is created when total production rises and the commodity supply on the market rises. More supply causes average prices to fall, increasing the demand and supporting and boosting total production. More supply also increases the pressure to expand markets, increasing demand for the commodity as in global expansion.

One consequence of these incentives and feedback loops is that many businesses that appear to be creating wealth often are merely converting renewable resources – resources and sinks – into non-renewable resources through over exploitation. Princen states "resource extraction becomes mining and not long-term management or stewardship."[38] If firms tip the balance to favour cost externalisation over technical efficiency (or in fact adopt both), they can succeed because some of their costs are less visible or even invisible to other stakeholders. This enables increased profits to the private individual due to some costs of their production being moved to the public. This point is developed further in the next section.

3.2 Cost externalising

3.2.1 Shading

The strategy of externalising costs that are less visible has been labelled 'shading'. As in the shadow cast by a tree, the costs exist but they are not visible or obvious.[39] Shading can be complex and may involve a range of effects and approaches many of which are lost or not understood if viewed as merely economic externalities. A typical shading strategy could be the manner in which a producers' relationship to its buyers, suppliers, consumers, government, and the public is managed or portrayed. Firms often portray this relationship in terms of emphasising their production contributing large immediate benefits,

while shielding the full cost of production systems as being 'commercially sensitive' or reporting these in a depreciated manner. From a strategy perspective, firms respond by using technologies and production patterns that engender the least resistance from recipients of external costs (including those who may represent them) and to minimise the likelihood of these costs returning to the firm. Commoditisation facilitates this through separation of product and producer.

While some costs may be externalised, many are simply rendered invisible to either the firm or to others. This shading can be structural and strategic. Princen (2002) identifies four types of shading or externalising of costs:

- *Passive shading* is used to obscure. Passive shading occurs when the benefits of production coincide with the interest of those promoting new technologies and markets. If passive shading produces long-term costs, and is associated with irreversible effects whether for individuals, the firm or the public, these effects should not be considered and accepted as mere externalities. The passive nature of shaded costs does not mean that they are trivial to those affected. A key policy issue related to passive shading is the 'burden of proof' that lies with those affected or harmed as opposed to those responsible for the costs. The current trend in the use of nitrogen in sheep and beef production systems may be considered a form of passive shading.

- *Parasitic shading* is used by firms to out compete others by weakening their competitor's ability to operate. Here the disparate application of agreed environmental regulations to encourage business investment despite the 'costs' of doing so is an example. Mining is a classic example relating to the use of non-renewable resources. Another is the support provided to the dairy expansion in Southland and parts of Canterbury. In this case dairying has been allowed to out compete alternate land uses despite knowledge of the effects of dairying on surface waterways and publicly expressed concerns. Shading occurs over time because the extractive agent and its beneficiaries enjoy the benefits but leave costs behind them and sees this result as just 'doing business'. In the dairying example, it is currently believed that some of the land that has been converted to dairy could convert back to sheep production. There is no malicious intent to deliberately export costs, but it is a function of the production system adopted and the incentives attached to these.

- *Price shading* is based on marketing techniques aimed at gaining market share. The pricing is used not for efficiency reasons, but purely for obtaining and protecting market share. When costs are diffuse and dispersed over time and space this business activity may appear desirable as

net benefits can be presumed. In the long run net benefits are rarely demonstrated. The use of price shading is described in business schools as an integral part of competitive strategy where competition is seen as outdoing competitors by weakening the opposition or cornering the market. An example of a dairy farmer installing additional irrigation bores before a water management plan is developed that could limit his access or right to groundwater is an example of attempting to corner the market to low cost irrigation water. The most successful are those that can move freely from one market niche to another, those that can vertically integrate or outsource as market conditions change. Difference is not between big and small, or immobile and mobile production rather the difference "with respect to resource use is time horizon and the institutional factors that influence that horizon."[40] A good example is the cod fishery off Norway's Lofoten Islands where local fishers (a very diverse group of people and boat technologies) have deliberately limited technologies and use rights that threaten the resource. Factory ships and seine nets are highly mobile, highly short-term and unregulated in behaviour and are therefore banned.

- *Shady dealing shading* is the disreputable side of business when costs and harms are purposefully exported through cheating or any means possible. This can be extremely subtle such as the pesticide residues that have hurt export crops resulting in manufacturers switching to products that are less persistent but more toxic to workers.

Shading is an integral part of a producer's business strategy. Costs are readily made invisible in an expansive highly decentralised (market-based) transaction economy. It is, however, a short-run strategy that cannot be reproduced because there are always new products that have the appearance of being long run. In much of the business literature, the notion of sustainability is being interpreted as how to sustain existing business through competitive strategy by innovation and cost externalisation. Here many believe that the notions of triple bottom line reporting and green accounting are simply strategies that 'green wash' firms as the reporting in and of its self does little to change the underlying consumption relationships of production. This is a dramatic example of pathway dependence at the level of the firm.

3.2.2 Distancing

An important effect of commoditisation that contributes to the ability of producers to externalise costs is the increasing separation of consumer from producer, product from producer. In a commodity-based system the source of product is rarely if ever known and if it is, there is little or no connection between the consumer, the effected, and the producer. The insulation of consumers from producers is referred to as 'distancing'.[41] Distancing can arise

due to various geographic, socio-economic, and industry structure reasons.

Geographic and cultural distancing refers to the reduced need for personal transacting between the consumer and producer due to distance or increased social heterogeneity. The primary effect is to block social and ecological feedback by inhibiting information flow between production and consumption. Distance is magnified through asymmetric bargaining, where there is one buyer and many sellers. When there is one buyer, the buyer can push prices down lowering producer costs who then must seek efficiency or compliance. Once efficiencies are exploited, cost exporting through shading comes into play as the scale or style of production is moved beyond ecological thresholds. It moves producer strategies from a search for technical efficiency to externalisation. Where there are multiple agents, a further dimension is added as these play out a strategic interaction, increasing the cost of linkages and increasing the probability of severing social and ecological feedback.

The loss of ecological feedback breaks the direct link of traditional farmer markets which supported the producer-consumer linkages and created accountability for effects. In a local market a farmer may shade their transactions or costs but there is a high probability of having to face the recipient of the costs. Traditionally this was supported by social norms and processes that created a rights-responsibility relationship in the use of property that incorporated both market and non-market institutions. The move away from face-to-face transactions created a decoupling or weakening of the rights-responsibility relationship.[42] This, in conjunction with pressure to convert land to high value uses to intensify production with increased human-made inputs, has led to many of the public 'bads' now being experienced. The long-term costs are often diffuse in time and space while the owners of land and marketing channels are doing very well.[43] It is also insightful to recognise that these changes have been happening for a long time. However, we suggest that the changes have gathered momentum and intensity as recent policy and institutional arrangements have continued to evolve the commoditisation of agricultural production.

To summarise, as distance increases:

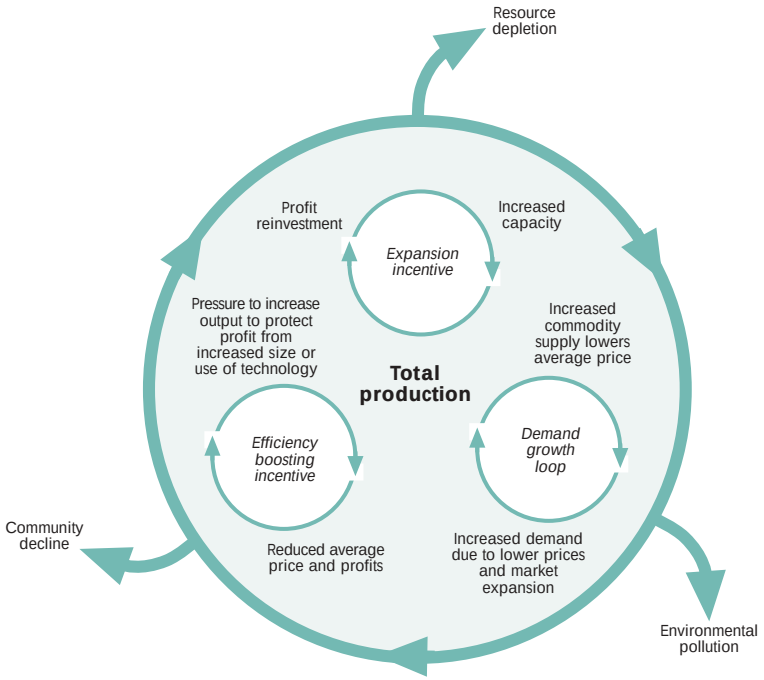
- negative feedback loops break down
- stakeholders expand in number yet production decision-making remains constant or contracts
- environmental problems are displaced
- the likelihood of shading and externalisation increases.[44]

3.3 Production incentives

Previous sections have highlighted that trends toward higher production and lower costs or prices for commodities are not coincidental. The production and cost factors interact within a causal capital growth loop[45] in which the profits from production are re-invested in innovation to further increase capacity. This is considered to be the core driving force for continued expansion of current production models (see Figure 3.1).

To understand the drivers from the perspective of a producer it is useful to include additional feedback loops relating to the need for efficiency which is based on the producers' initial short-run response to declining prices. Under this scenario the producer must increase output to maintain personal well-being so that when combined with the reinvestment loop they are faced with increased production under contradictory price signals.

Figure 3.1 Commodity production drivers and the three commodity system traps



Source: Sustainability Institute, 2003

As total production increases the average commodity price will fall and profit per producer falls, which in itself creates a pressure or need to increase production. The need to increase production requires the producer to increase the size of their production unit or the technological innovation to survive by restoring their profits and security.[46] In effect these new dimensions are added to balance the effects of the capital growth feedback through the addition of efficiency and expansion.

The overarching effect of balancing is to further increase production and reduce prices creating the 'running to standstill' or 'treadmill effect' producers continually refer to. These feedback loops and drivers mean that irrespective of high or low profits producers will seek production increases. With high profits reinvestment is made to increase production and lower the risk to future security of the family and business, whilst under falling profits efficiency measures and cost externalising along with expansion lead to increased production levels.

This is further reinforced by a demand feedback loop which responds to the falling prices of food products. As prices fall demand increases as more people can afford it. For example, specialty products such as bananas and organic potatoes were commodified such that the cost of consuming these fell, demand increased giving the producer increased signals to continue to increase production which lead to increasing levels of commodification. Increased supply creates additional incentives. For example, as supply increases there are incentives to expand the market for the commodity either through geographic expansion or through alternative uses. This magnifies the demand boosting feedback to commodity producers.

The production growth drivers create incentives for higher levels of production and ensure that the cost of output is minimised. These are the same drivers that encourage production to the extent that they contribute to commodity systems traps including:

- *resource depletion*: where the rate of use exceeds the rate of regeneration resulting in a declining resource level. As the cost of natural resources or human-made substitutes (e.g. fertiliser) are expected to limit total production often the signal to producers is extremely weak or unseen.

- *pollution*: where production drivers push the rate of waste generation upward. Over time and space if the rate of waste assimilation exceeds the rate of purification the waste level will increase. The link between waste level and total productive capacity is often missing or unseen.

- *community decline*: where production drivers increase production that reduces price which is magnified by greater producer-buyer power differentials. The decline in producers' income increases the consolidation rate of producers lowering the number of producers and the community well-being indicators. Feedback that may solve the problems is missing as neither the community well-being nor falling producer income affects productive capacity.[47]

3.3.1 New Zealand's agricultural productivity drive[48]

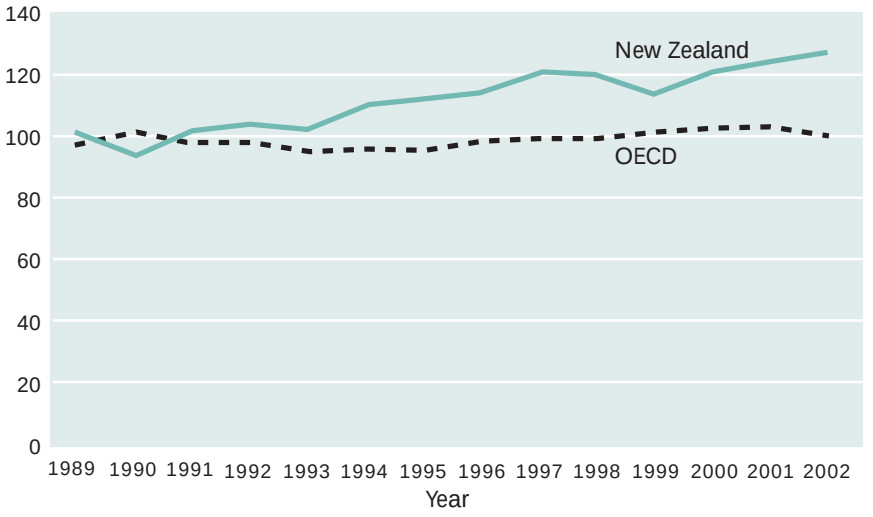
This section presents indicators of the direction of change in New Zealand agriculture that demonstrate many of the effects of commodity-based production and the drivers of increased production are reflected in the outcomes of the New Zealand agriculture sector. These indicators are presented to highlight the dynamics that New Zealand agriculture has undergone in the last decade. They also raise the question over whether there has been adequate monitoring of these trends and the likely effect of future scenarios.

Total productivity

Commodity systems create strong incentives for increasing production. A review of New Zealand agricultural sector production highlights significant productivity increases, especially since 1990. At that time total production was four percent lower than the OECD. By 2002 it was 28 percent higher (Figure 3.2).

The increased productivity is reflected in the increased FOB value of its commodity production, which grew 34 percent during the period 1998 to 2002. Several categories of commodities increased their export value by more than 40 percent in this period.[49]

Figure 3.2 Total output (index) productivity of agriculture sector (1989=100)



While agricultural production grew through expansion of irrigation during the 1970s and 1980s, this trend largely stopped during the 1990s when state-funded irrigation schemes were no longer a priority. The effects of water on New Zealand agricultural production are summarised in Morgan *et al*. (2003) who highlight the potential for growth from increased irrigation but stress the resultant impacts on surface water quality. To comply with current European

Union water quality standards for nitrogen in New Zealand surface and ground water bodies would require downsizing *existing* irrigated agricultural production.

Capital growth loop

The relationship between land values and productivity is often emphasised in the context of increased commodity prices and productivity being capitalised into land values. The effect of increased land values reinforces the incentive to reinvest in the expansion of productivity through consolidation of land holdings and further benefit from increased capital values. For most producers, however, land value may have only a weak relationship to their current productivity. The market values land according to the best alternative use of the land at that point in time and not necessarily the value of current production systems. For many the value of land is simply not related to their productivity as noted by White *et al*. (2001). They concluded that: "income per hectare earned off the property appears to have a significant effect on property value that is not readily explainable by productivity-based arguments. It may simply reflect the influence of high incomes from other sources on capital investment in lifestyle properties, incorporating house quality and other developments…"[50]

Table 3.1 National average land value by sector – $ per hectare (number of sales)

Sector	1980	1990	2000	2003
Arable	3,824	6,023	11,129	61,739
	(94)	(157)	(141)	(79)
Dairy	4,353	7,898	21,541	33,342
	(568)	(808)	(1,252)	(635)
Forestry	970	1,534	5,745	7,013
	(36)	(65)	(168)	(102)
Horticulture	31,256	54,516	122,891	180,948
	(296)	(697)	(695)	(523)
Pastoral	2,663	15,314	16,541	20,740
	(863)	(2721)	(2387)	(1,217)

The trend in land values (see Table 3.1) highlights the growth in land capital values. This growth has resulted in land values that are seven to eight times the 1980 value with the exception of arable (17 times) and horticulture at six times. The relative value of land between sectors has changed from 1980 to 2003, with the value of dairying relative to pastoral farming ranging from 1.6 times to 1.3 times. Forestry land values have remained at about 0.33 to 0.35 of pastoral land values.

There has been a significant increase in the wealth from capital gain in agriculture over the last two decades. The 1990s was a period of substantial wealth creation in New Zealand agriculture. For a group of 12 case study producers their average net wealth increased from less than $700,000 to over $3.6 million during the 1990s.[51] During this period dairy farmer margins ranged from less than $0.5 per kilogram of milksolids to more that $2.50 per kg. This was combined with marked changes in the relative advantages of new land use systems, resulting in the geographic shifting and expansion of higher value dairy production into areas where natural capital attributes (rainfall and fertility) prevalent in traditional dairy areas were simply substituted for by human-made capital (irrigation and nitrogen). The effect of significant land use change has been the movement of land into higher value use and an increase in land values for all land in a region. The flow through effect of land increasing in value by 40 percent is considered less of a driver *per se* but more of an enabling factor for producers to finance and justify their search for increasing efficiency and productivity levels.

Where land prices are a factor is for new entrants into the sector. New entrants pay higher capital value and are then required to seek high productivity levels to cover the debt and equity servicing charges.

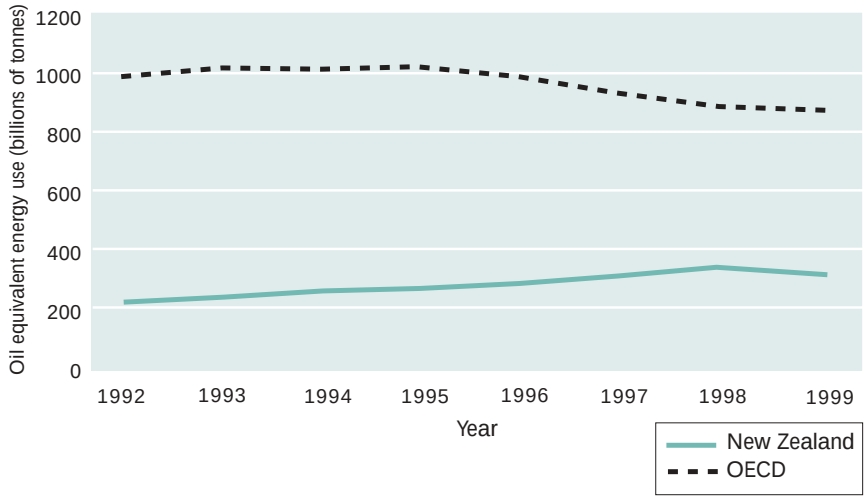
Efficiency and expansion

The case study results (see Watters *et al*., 2004) highlight the presence of real incentives for productivity. These are reported as being the difference between top and average farm production levels which for dairy producers amounted to 157 percent, and for sheep a massive 176 percent of current trading net profits. The difference between the top and average farm is considered to derive from ‘managerial input’, something with a high value but low cost. Top farmers’ production levels signal to average farmers significant opportunity for continued productivity gains while current price incentives exist.

The following section highlights some of the aggregate datasets that support the current expansion and efficiency growth within New Zealand food production systems. There are a number of indicators that support the presence of significant efficiency and expansion incentives as predicted for the commodity production drivers. New Zealand aggregate data (see below) indicates strong expansion of inputs into production systems, especially direct energy use, fertiliser and possibly agrichemicals.

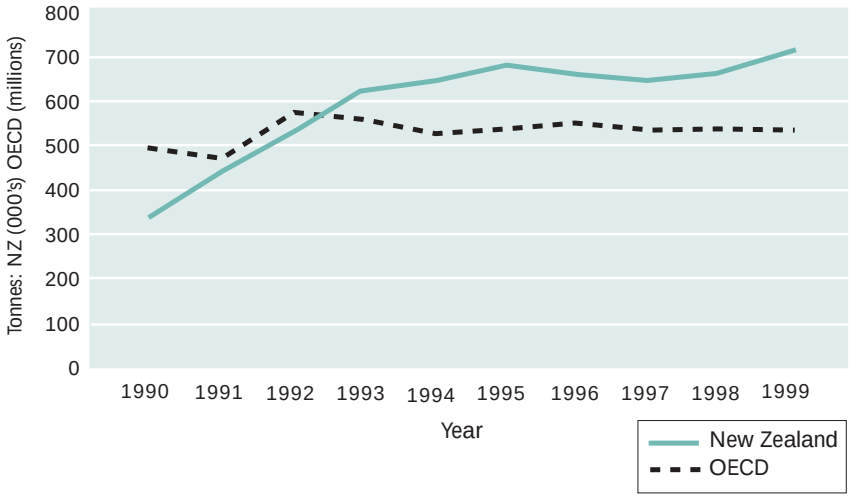
- *Total direct energy use*: total direct energy use by New Zealand agriculture continues to rise despite the trend for agricultural energy use in OECD countries declining, although output growth rates exceed the growth in energy inputs. The premise of future production systems remaining highly dependent on fossil fuels for energy is based on a number of basic assumptions. These assumptions relate closely to the continued availability of such energy sources at similar price levels. Those that support the peak oil hypothesis claim production levels of oil will fall by about 3 percent per annum from 2008. The work of Dr Pimentel of Cornell University finds that one-third of the energy input to crop production simply reduces labour input from about 500 hours to four hours per acre. A low energy production system would require the removal of most irrigation, fertiliser and agrichemicals with the resultant output level falling to about 25 to 30 percent of current levels.

Figure 3.3 Direct energy use by the agriculture sector



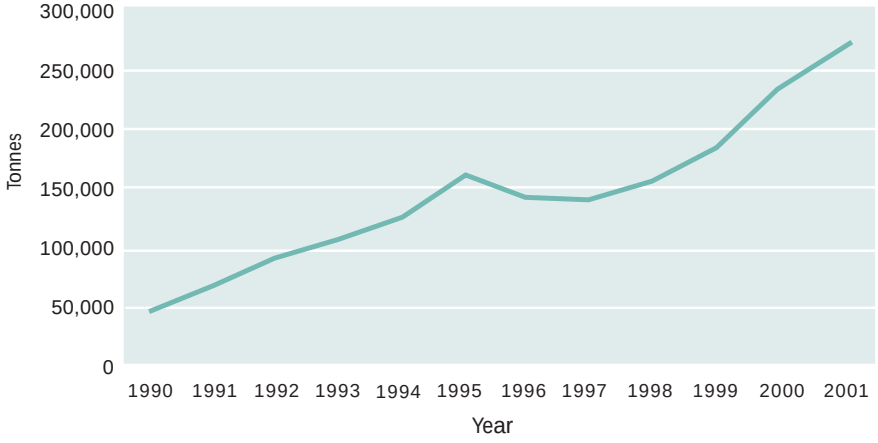
- *Fertiliser use*: New Zealand's productivity push is associated with the increased use of production inputs. Total fertiliser consumption increased by 170 percent in the period 1990 to 2000 compared with a similar increase of seven percent for the OECD countries.

Figure 3.4 Total fertiliser consumption



- *Nitrogen substitution*: the use of nitrogen fertiliser has grown by over 500 percent in the period since 1990. This trend highlights the uptake of a new technology that moved rapidly from being innovative in the early 1990s to mainstream and widely adopted in 2001. There is the expectation of continued usage spreading into the sheep sector where margins incentivise productivity gains following the dairy trend of the early 1990s.

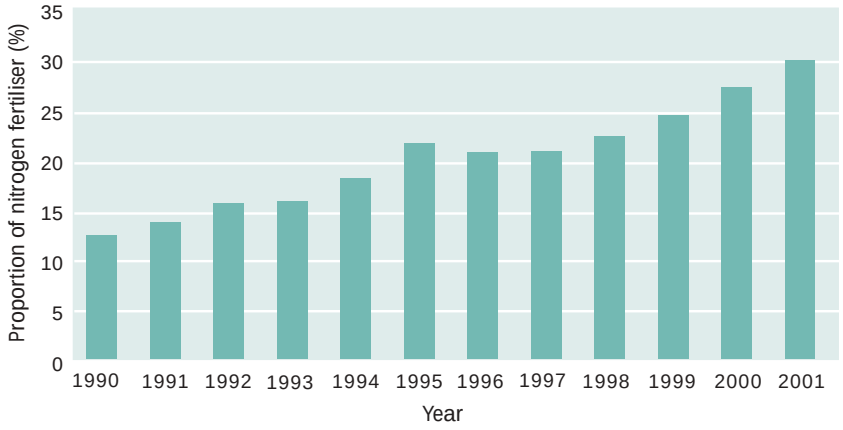
Figure 3.5 Total nitrogen usage in New Zealand



As a consequence, the proportion of total fertiliser being applied as nitrogen has more than doubled. The increased drive for productivity is closely associated with growth in fertiliser use and in particular nitrogen usage. Given the findings of Watters *et al*. (2004) that current productivity incentives are encouraging sheep and beef farmers to increase feed production by increased use of nitrogen, the significantly larger scale of the sheep sector compared with dairy, and its location on hill slope soils, there appears to be a growing risk of

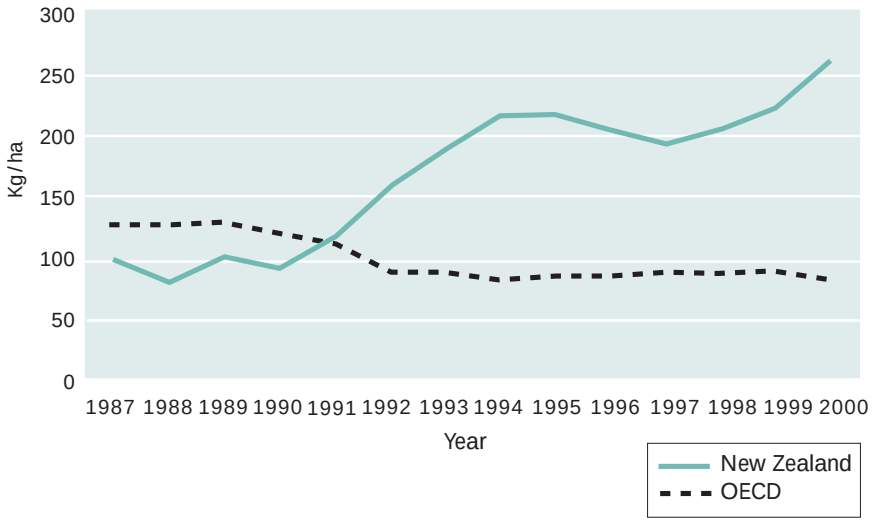
excessive future nitrogen loading on surface water ways. Further, the dependence on nitrogen productivity gains raises the concern over what happens if the real price of nitrogen increases relative to the price of commodities? Under these circumstances will current production systems remain sustainable?

Figure 3.6 Proportion of total fertiliser as nitrogen



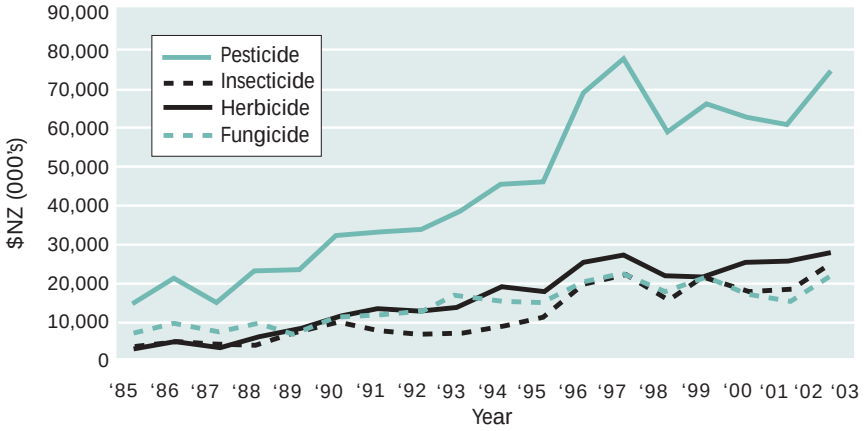
- *Intensification of fertiliser use*: as a result of the above trends in fertiliser use, the intensity of New Zealand's usage continues to increase while that of the OECD is declining due to increased social and environmental pressures. In 1987 the New Zealand intensity of use was 0.8 of the OECD average; however, by 2001 this rose to 3.3 times the OECD average. This trend highlights the increasing move away from reliance on clover based nitrogen production to more human-made resource substitution.

Figure 3.7 Intensity of fertiliser use



- *Agrichemicals*: New Zealand data for agrichemical application is poorly reported. Based on the value of imports for four categories of agrichemical an increasing role can be seen with importation costs more than doubling in the last decade. Since 1990 pesticide and herbicide importation increased 2.4 times, insecticide increased 2.8 times and fungicides 1.9 times.

Figure 3.8 Importation of agrichemicals into New Zealand



In summary there are consistent trends that show the current push for New Zealand food production is based on increased efficiencies, and the use of increasing level of human-made capital inputs such as fertiliser, energy and chemicals.

Demand loop drivers

Demand drivers derive from increased commodity supply lowering average prices or trade reform creating expanded market opportunities which signal producers to increase production.

The past trends of improved commodity returns is predicted to continue with a further 12 percent growth in producers' returns through to the end of 2010 forecast based on trade liberalisation policies within the OECD. The growth in commodity returns will be supported by modest increases in trade flows of around three to four percent suggesting real product price increases for producers and a continuation of the incentives to grow the productive base of New Zealand food systems.

Market expansion and shifting is a notable occurrence in the export destinations for New Zealand food production. For commodity categories with high FOB export value, countries ranked in the top three in 2002 were often only in the top five or six during the 2000 export year.

In addition to demand drivers based on price elasticity and changing trade liberalisation, demand is continually being affected by consumer concern for higher quality food attributes in price-sensitive markets. Increased affluence results in consumers seeking to maximise the quality of food and not simply gain access to sufficient quantity. Attributes such as 'naturalness', 'taste', and 'safety' increasingly come into play and the retail sector is responding through proof of production schemes to minimise their risk with consumers. The net effect is an increase in socially defined consumer perceptions and preferences for not only the food itself but also the way it is produced and processed. A consequence of the proof of production systems is a narrowing of distance between the retail sector and consumer in our export markets. Most producers remain unaware of specific consumer preferences and the opportunities that these may create as they receive few if any signals on which to adapt their production systems.

A major concern regarding the intensification and expansion of food production systems are the possible implications of the above trends and how these relate to the OECD. Consumer and political pressures in the OECD countries are increasingly leading to the reversal of input intensification. Consumers are expressing their desire for 'responsible production systems', resulting in controls over nitrogen use and stocking rates. EU policy under Agenda 2000 prioritises food safety and quality, the full integration of environmental goals into the CAP, employment schemes and creation for rural landholders, and a fair standard of living for the agricultural community (contributing to the stability of farm incomes).

A consequence of these changes has been increased demand for imported food products that reflect the changing social values. This provides increased opportunity *and* pressure for New Zealand producers to supply these markets. The effects of trade liberalisation are simply reinforced by the Agenda 2000 environmental integration policy of the European Union which is predicted to increase New Zealand producer returns by approximately six and 14 percent based on 15 and 30 percent yield adjustments in EU production systems.[52] In effect, the cost of intensification of food production in the consumers' country is predicted to be exported or externalised back to the country of origin. However, as knowledge of such cost externalisation grows, the risk is that consumers and retailers will demand 'responsible production systems' in the country of origin. This is something that New Zealand, according to the above data, is increasingly moving away from.

In summary, trade reform and changing domestic policies in our export markets are creating signals and incentives for increasing production that combine to validate the claim of a demand driven productivity loop.

3.4 Effects and public harms of commodity systems

The net effect of neoclassical assumptions and market-based transactions linked to commodified food production is an increasing number of environmental and natural resource effects along with impacts on social systems. These 'public harms' can typically be summarised in three categories as summarised below.

3.4.1 Resource degradation

The influences that drive production levels can result in the extractive capacity of commodity systems exceeding the sustainable yield of the natural capital. Market signals of capacity (higher costs due to scarcity) are too weak and often too delayed to influence the rate of harvesting or extraction – resulting in over-exploitation. Some producers will face incentives to reinvest in new technologies to increase the rate or efficiency of extraction even as the resource becomes degraded. All players within a natural resource system benefit from avoiding degradation. However, due to the above delays such actions need to be taken well in advance of over capacity being achieved. The impacts of increased production on water use, energy demand and soil acidification arising from the use of nitrogen are examples of resource degradation influences in New Zealand.

3.4.2 Environmental pollution

Commodity systems grow to a point where they overload the ability of the environment to absorb their waste products. As the costs of wastes are shaded and rarely felt by the producer, these systems are not able to avoid overshooting their limits. Further, waste may be cumulative and requires spatial and temporal dimensions within the feedback system which currently do not exist, and which may extend some distance from the point of pollution and outside the social and geographic borders of those whose decisions created the pollution. The obvious New Zealand example from the indicators above is water quality through bacterial contamination, and the loading due to fertiliser use – both nitrogen and phosphate.

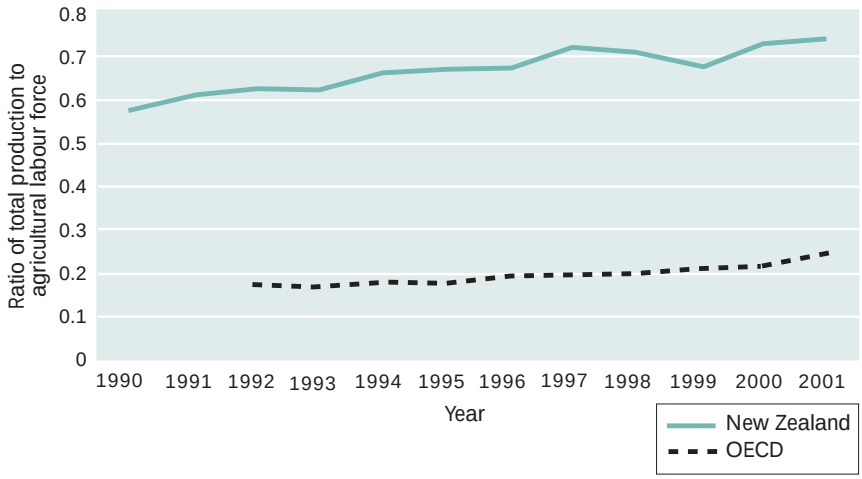
3.4.3 Loss of social capital

As commodity systems respond to productivity incentives, the price of the commodity falls reducing producer incomes. They are then required to seek efficiencies to maintain their well-being. The search for efficiency has generally resulted in factor productivity gains through the substitution of human-made capital for natural capital and the substitution of labour with human-made capital.

New Zealand data highlights the strong labour productivity gains in agricultural production. Since 1990 there has been close to a 30 percent increase in labour

productivity in the sector, highlighting its role in the search for increased efficiency.

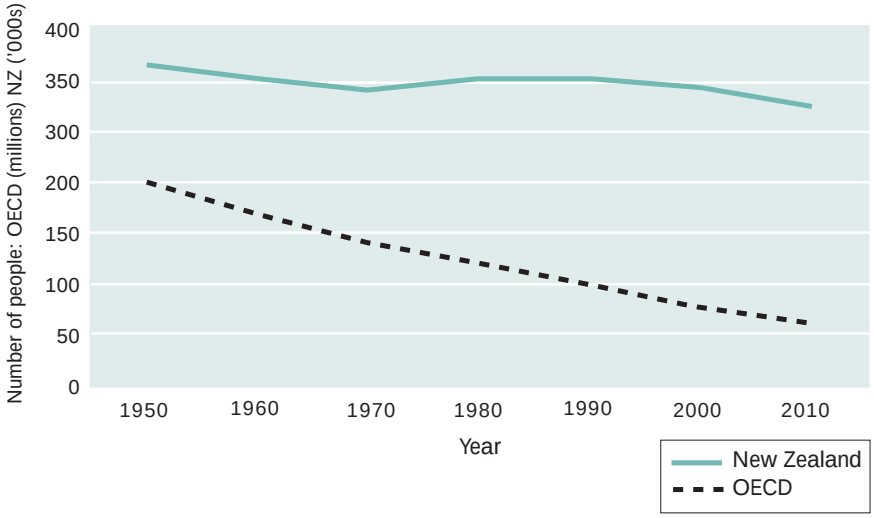
Figure 3.9 Agricultural labour productivity



Producers' respond by adopting efficiency and expansion measures that result in less labour requirement. This reduces the number of producers and limits social capital within rural regions. As the number of producers fall the indicators of social well-being also decline.[53] However, as neither declining well-being nor falling producer income feeds back to the over capacity in production, there is no mechanism by which this process of decline can be addressed.

The effect of increasing intensity and efficiency of food production systems on rural population in New Zealand has followed a similar trend to OECD – of rural *depopulation*. However, change is not to the same extent as in other OECD countries. Currently, the decline in rural New Zealand amounts to a 12 percent decline compared to a 70 percent decline in OECD countries.

Figure 3.10 Size of the rural population



CHAPTER 4

Policy options

This chapter provides an overview of some options for addressing the effects of intensive farm production. The options include responses that are currently being debated in New Zealand and overseas to offset cost externalities and the effects arising from the expansion of commodity production.

Current free market policies and commodity production systems serve an important function in society's goals. The primary goal has been to provide plentiful raw materials at the lowest possible cost. These policies have served this goal through stripping away information (and the associated costs) of how commodities are produced and instead focus on volume and price relationships. As a consequence, producers are increasingly distanced from feedback or signals about the signs of pollution, degradation and the decline of rural community. Even with signals, it is unlikely that most producers would respond since altruistic goals linked to 'sustainability' and 'stewardship' are generally addressed only once producers face a neutral incentive scenario and when higher level personal goals are secure.[54]

Acting as individuals the only option is to step outside commodity production and to market a product outside the structure of the commodity system. Producing highly differentiated products and marketing these directly to well-defined consumers effectively minimises the distancing created by commodity systems. The value of closer linkages should not be downplayed as a worthy contribution to societal goals that individuals can make. The difficulty is the

extent or scale to which such strategies can be adopted. With 10 percent of producers involved it still leaves 90 percent facing the incentives of commodity production and the social cost and public harms that this entails. The policy management responses need to address this 90 percent more effectively.

Commodity production systems dominate agriculture, fisheries, and forestry worldwide and much of the output is not suited to niche markets. Individuals can respond, and will need to, but this requires a wider collective response. Simply having one farmer limit nitrogen use while all others in a watershed increase their use does not reduce the size of the harm. Nor does having one farmer install water saving devices while others sink additional bores in an over-exploited watershed or aquifer secure societal goals for sustainability. Commodity production has created benefits which are increasingly offset by social and environmental costs resulting from the same production systems. The driving forces are systemic and as such they will require policy and structural change in the manner in which food is produced.[55]

Any policy option should be viewed as 'a behavioural tool'. Honadle (1999) states that policy and institutions "are not aimed at natural resources or the environment – they are aimed at people. Nature does not respond to policy, but it contends with human behaviour."[56] It is the human behaviours that policy targets and aims to modify in a predetermined manner. In the next section (4.1.1) we introduce some key aspects of producer behaviour and adoption of more sustainable practices. This is presented to support the sections that follow. They provide an outline of three policy options: collective agreements, certification, and government tax and subsidies.

4.1 Incremental options

4.1.1 Farmer behaviour

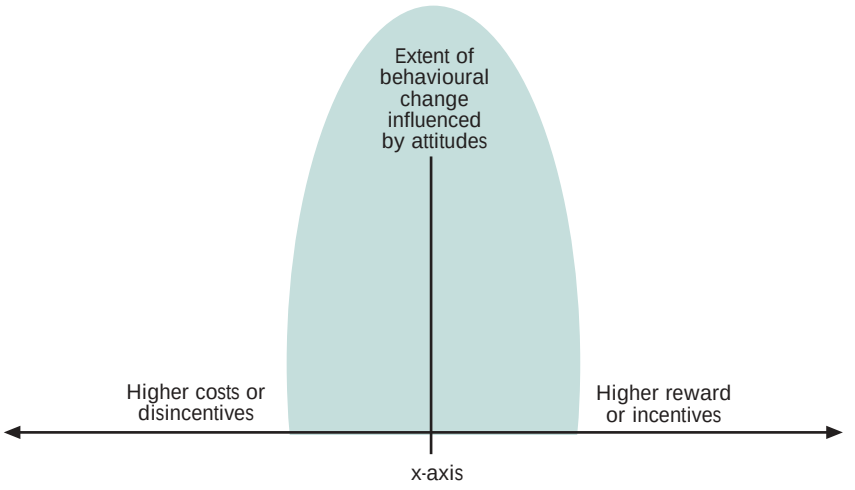
In this section we briefly outline some of the critical factors that influence producer adoption of sustainability practices. The PCE interviews of producers report some producers as limiting their production systems due to a feeling of 'enoughness'. The commodity system drivers generally counter notions of 'enoughness' by creating ongoing incentives to keep producing. This feeling, while expressed in terms of limits, is consistent with the wider understanding of farmer adoption. It is considered appropriate to present a brief description of the current state of understanding about farmer adoption of sustainable practices as an introduction to the range of issues that need to be addressed in any institutional reform program.

Sustainable food production is often contrary to the economic incentives faced by current food producers effectively decoupling private and public interests in the use and treatment of resources. This conflict of goals can be serious and in the case of environmental protection the potential for goal conflict is

considerable. Adoption research highlights the importance of risk in producer behaviour and indicates that family, personal, and financial security are generally the highest priority goals. This hierarchy is repeated in problem listings given by farmers, with concerns over prices, weather and costs rated higher than concerns over resource issues.[57] Cary *et al*. (2002) report "that it is inevitable that, at times, a conflict of interest will arise when promoting sustainability practices which often create increased management complexity, have significant off-site benefit and an increase in financial risk. Adopting these practices may not be in the short-term interest of the individual land owner."[58]

The influence of financial versus attitude and awareness determinants on behavioural adoption is portrayed in Figure 4.1. This highlights the limited role for attitudinal and awareness strategies, given the rather strong incentives and disincentives created to commodity producers.

Figure 4.1 Conditions for maximum influence of environmental values or attitudes on individual's decision to adopt sustainable practice



Source: Cary *et al*., 2002

Cary *et al*. (2002) found the attributes that contribute to increasing probability of adoption:

- Relative advantage in terms of financial gains to the business and or adopter. This will happen where there are strong incentives for economic production that require shading of social costs.
- Locations differ. Not all locations have the same relative advantages due to natural resource, physical infrastructure, and social structure factors.
- Risk management is a strong influence. Motivation for behaviour is not only profit but also risk orientated. Producers of commodities have already been

demonstrated to respond to risk of falling profits by increasing production levels. Producers are motivated by the balance of profit and their well-being which minimises their risk. Risk balancing (where financial risk is balanced with business risk – see Newman *et al*., 1990) has been demonstrated to be an important component of overall farmer decision-making and responds to changing market and policy incentives. We consider the notion of 'enoughness' to be misleading and interpret this to mean that producers who are considered to have enough have in fact been able to achieve the well-being they require with an acceptable level of risk to their business and financial futures at that point.

- Management practices for sustainable food production are often complicated and in some instances complex,[59] requiring high levels of managerial expertise with little demonstrable feedback. Simple innovations may in fact be complicated and even uncertain in the context of changes to a production system and are less likely to be adopted. If they are, it will often be through trial and adaptation and observation of outcomes – something which is challenging for sustainable practices.

- Compatibility with which the practice fits the existing knowledge or social practice. For many pastoral systems the traditional indicators of 'good farming' are linked to tidiness, good fences, good stock, etc. Sustainability practices are not necessarily part of the description of 'good practice', highlighting the manner in which bounded rationality and pathway dependence flow through to social interpretation of food production.

- Trial ability or the ability to experiment to lower risk compared to a full scale re-engineering of the production system.

- Observability producer that can observe practices and their outcomes are more likely to respond positively towards their adoption.

Producers have four options for responding to environmental problems.[60] These are:

- do nothing especially when the cost of taking action (the mitigation or prevention costs) may be greater than either the private or social benefits[61]

- tackle the problem where there is a net benefit to society which is difficult given the expected time frame, and spatial extent of such problems

- adapt to the problem to tolerate the effects and impacts

- add to knowledge to improve future responses.

To assist the adoption process, Cary *et al*. (2002) suggest the success of technology transfer for most sustainable practices is limited and recommend

that systems of adult education involving sharing learning and collaborating as necessary. This situation raises some fundamental difficulties for sustainable rural development as opposed to agricultural productivity. Policy institutions in New Zealand are agricultural productivity focused and the policy agenda has prioritised 'free trade' initiatives through strict application of user pays systems. Where the role of extension targets agricultural productivity objectives this was justified on the basis of the private nature of benefits. If under the emerging scenario the need is for management systems and practices that protect the public interest, current extension systems are poorly placed to do so as they focus on delivering private benefits. Cary *et al*.'s conclusions suggest that traditional extension services will in fact be unable or unlikely to be effective in delivering more sustainable outcomes. Even the recommended approach by Cary *et al*. does not provide many of the conditions necessary for adoption, including the ability to observe, trial and experiment at a low risk to the producer and his well-being. This simply highlights the almost total dominance of commodity production incentives over the current and immediate future trajectory for intensive food production systems in New Zealand.

The following sections address how some of the incentives arising from the commoditisation of food production may possibly be changed or addressed. These systems aim to broaden the reach over which attitudes and values can influence behavioural choices for sustainable practices as depicted in Figure 4.1 above.

4.1.2 Collective agreements

Public harms arise from commodity systems when the collective effects of individualistic behaviour erode natural resource and environmental services. If producers agree on new rules they may restructure the system to make their individual choices collectively more sustainable. For example, where fishers have agreed and managed to control catch under the ITQ system in New Zealand increased biomass of the fish stocks has resulted. Research has demonstrated that the increase in fish biomass has enabled fishers to reduce their harvesting costs partly offsetting the loss of income from controlling their catch.[62] The west Australian rock lobster industry limits the number of fishers, introduced harvest controls, set capacity limits, and limits the introduction of new technology resulting in an annual catch that has avoided the commonly experienced stock collapse in most lobster fisheries.[63] In effect, these collective agreements are adding a further feedback loop to the commodity model. As capacity to exploit increases there is a collective agreement over the sustainable harvest rate and how current capacity to exploit can be limited to this level. Through harvest controls, the total production is limited and lobster is tracked from fishing boat to buyer using shared information systems that include producers and management agencies.

Collective agreements have also been used to break the efficiency boosting feedback loop of commodity systems. As producers seek increased efficiency and scale it was recognised that many existing producers would be forced out of business. To avoid this burley tobacco producers in the United States of America set guaranteed minimum prices based on supply controls and collective marketing.[64] The producers set quotas for production based not on the extent of production (number of hectares) but on the volume of commodity that could be produced by an individual producer as well as the number of producers. This guaranteed prices and enabled small producers to stay in business. That is, until GATT trade requirements enabled the importation of cheaper tobacco that caused prices to collapse from $3.50 (over a period of 40 years) to less than $2 as the percentage of imported tobacco increased from nil to 40 percent in a period of 30 years. This demonstrates the need for supply controls but also raises the issue of cost externalising. Through importation of tobacco, tobacco users in the USA were able to smoke at a lower cost. This cost saving was in part due to the environmental and social costs now exported to the country of origin that had previously been avoided through the supply controls and higher cost of tobacco.[65]

Collective agreements contribute to the management mechanisms and processes by ensuring the flow of benefits to defined groups and according to Pinkerton (1989) provide a process for involvement to address the needs of cooperative management.

Key points relating to collective agreements are:

- resource depletion or persistent low incomes are not inevitable aspects of commodity systems
- balancing harvest or waste rates with regeneration rate is essential and may actually be beneficial even if the stock of resource is currently high
- multiple goals will require multiple entry points, including production limits, price supports, consolidation limits, technology policies, etc
- continued monitoring and responsiveness are essential – something almost totally lacking for food production systems in New Zealand
- collective agreements can not rely only on goodwill or trust – they require effective enforcement through legally binding provisions
- intervention in production growth drivers can provide multiple benefits where due to social concerns (loss of producers) environmental benefits were achieved.
- quotas that limit the ability to harvest rather than the amount to be harvested are vulnerable to changes in technology

- the boundaries of a collective agreement must include all producers selling into the market for the commodity, such that as the breadth of markets increases so does the scope of the collective agreement.[66]

4.1.3 Certification systems

Eco-certification or labelling schemes (ECLs) provide a means to narrow the distancing created by commodity food production systems. Within the neoclassical model assumptions underpinning free markets, there is strong rationale for promoting ECLs. According to the theory of perfect competition, buyers and sellers are assumed to have 'perfect information' which is what the ECL is attempting to contribute to by informing the buyer of the production practices used to bring a product to the market.[67] ECLs have expanded through several sectors and markets driven by a range of concerns relating to health, safety, and environmental concerns.

Certification schemes are a form of collective action, enabling producers to make decisions about multiple goals for their systems and to take action to balance output growth with these goals. To be effective, a large proportion of, if not all, producers, need to be involved in such labelling and certification schemes.[68] This is not always easy or cheap to achieve. Certification for environmental practices, fair treatment of producers, or regional identity through ECLs provides one mechanism for internalising environmental and social goals into commodity systems. The momentum for certification often comes from consumers expressing a willingness to pay more for products produced in accordance with their values. Examples include fair trade coffee, child labour policies in footwear production, shrimp production without antibiotics, and sustainable forest production and wood products.

Standards for production systems place constraints on the extent that cost externalisation can be maintained in food production. Certification can therefore be seen as a means of achieving ratified 'responsible food production systems' – responding to the social and environmental preferences of consumers *or* simply as a marketing image for current commodities.

The issue of food labelling and branding is equally controversial within the globalisation of food production. Producers in specific regions of Europe are currently fighting to protect the identity of their production and to protect the premium that consumers have applied to specific products from these regions. In 2002 the European Court rules that only cheese produced in Parma could be labelled as Parmesan cheese. Further, the 2003 World Trade Organisation round saw the European Union request that geographic labelling be controlled to enable 40 foods with specified geographic indications the authority and power to ignore existing trade mark regulations. This power would include the power to require food from outside the specified geographic regions to be relabelled.

This approach was quickly dismissed by US Grocery Manufacturers who responded: "Why shouldn't we have the rights to names bought over hundreds of years ago. Some are generic. It's too late to ask for them back."[69] Traditional foods are seen by the producer to be outside of the commodity dominated world food trade, however, the increasingly powerful retail sector recognises the additional value of such labels and the value these bring to their ability to sell with the commodity markets.

The case of organic production is of interest. Price differentials are often achieved with certification, although the certification process may increasingly expose a crop to commoditisation pressures as in the case of UK organic potato production. In the case of other crops such as soya, price differentials have been maintained reversing falling incomes and the process of consolidation and expansion of production units. Reviews of organic soya suggest that, while some benefits have been achieved, additional sector structural issues will be necessary to address the issue of cost externalisation.[70] This arises for the same reasons as the burley tobacco producers' dilemma. Having achieved price premiums and with the requirement of GATT and WTO new suppliers are entering the market from countries such as China and Brazil with markedly lower prices and environmental standards. It was noted in Resource News International in 2000 that some 250,000 acres of Chinese production had entered the same market that the previous total of USA producers (some 200,000 acres) had supplied.

The effectiveness of certification in the forest sector was reviewed by Gale in 2002. In rating forest certification on criteria for scientific, representation, accountability, transparency and equality, Gale found strongly for the Forest Stewardship Council approach. It is based on defined standards of social and environmental responsibility, while other systems were seen as marketing of prevailing industry interests. That is, other schemes were about maintaining the current industry and their pathway by excluding data and consumer preferences related to social and environment protection in forest production systems. As such, certification changed from a means to move out of commodification to a means of maintaining the commodification of wood production and acceptance of the effects of such systems – something akin to greenwashing. This is a strategic choice New Zealand needs to discuss and decide on. Should New Zealand market commodities as clean and green or should New Zealand develop policies and systems that enable products to move outside of the commodity production loops? Unfortunately, current institutional actors have vested interests in supporting status quo commodification processes.

After reviewing three operational forest sector certification systems, Gale concluded that:

- consumers should purchase goods from certification schemes run by reputable environmental organisations
- it is wise to be sceptical of industry and government sponsored logos as these were generally designed to protect large scale production industries and their comparative advantages
- many government and industry based schemes were simple greenwashing
- consumers should be cautious in making validity assumptions or as he stated the rule of *caveat emptor*, buyer beware has a counterpart in certification – that of *caveat certificatum,* beware of a certificate. Most certification schemes do not validate wider environmental or social values and when combined with commoditisation, shading and distancing, purchasers need to be sceptical about them. What ECL can do is make choice available to interested consumers who want to do the right thing at low personal inconvenience. For the wider mass of consumers, this is not yet part of the purchasing decision.

Key points for certification are:

- certification brings multiple goals into commodity systems and enables some producers to survive
- certification requires a change in practices but does not necessarily address the drivers for increased production and the associated public harms
- certification needs to build on all goals including social and environmental
- higher returns may simply be reinvested in productive capacity, thereby raising harvest and production rates as per the UK organic potato sector.
- not all goals need to be served by certification and not all goals can be served
- voluntary consumer behaviour is the power behind certification, but is also the limit of certification schemes
- do not expect certification schemes to change the bulk of commodity flows in the near future if at all.[71]

4.1.4 Taxes and resource pricing

The third approach is to use a number of economic or market-based instruments to put the costs that are now externalised by producers back into their decision-making. This option relies on the Government's ability to redefine

the situation faced by producers through taxes and incentives that inject costs into the commodity process, such that the lowest cost includes the 'social costs' of damage to natural resources, environmental quality and healthy rural communities.

The underlying argument for doing so drives from neoclassic thought in *that society will accept an optimal level of disruption and that the amenities of natural resources and ecological processes are part of the resources it allocates for deriving well-being.* How much is optimal is determined by whether society's cost is equal in value to the effects cost (social cost) or the estimated cost of damage if the damage was allowed to occur.

The neoclassic view is that the prevention cost should never exceed the social cost or effects cost. As such the polluter or degrader may be asked to pay the effects or social cost as part of his production costs. The notion that this should be set at the effects cost as opposed to the real prevention cost is derived from the theory that government should include externalities into pricing through means of a Pigovian tax equal to the social cost. The notion of the effects cost option is based largely on the efficiency criterion defined by Kaldor-Hicks that posits that a change in the wealth for one actor should be enough to fully compensate the loser and if so is considered efficient – whether or not the loser receives the compensation (which they rarely do).

This raises a number of concerns as to ethically why the effects cost is accepted over the cost of prevention. This discrepancy may be magnified by the means with which the social cost is constructed. Collective decision-making should focus on the collective definition of values rather than the simple aggregation of individual private preferences. Through this process the collective would debate, learn and change their positions and the collective value may differ significantly from the underlying individual preferences. Even without debate, there is considerable evidence that peoples' own private preferences (i.e. what might benefit themselves) often vary from their public values of what they think the society should look like. Driesen (2003) uses the example of people seeking tax concessions on additional homes privately but then the same people publicly recognising that feeding the poor, providing health services, etc., to be higher priorities for the use of public funds. Currently, the use of effects based on individual determination is likely to be inaccurate and questionable in that it re-imposes costs on producers that carry a bias for production objectives as opposed to an environmental quality objective that the prevention cost would support.

There are a range of policy options that may be used to address the driving forces of commodity systems and their associated public harms. These include the use of taxes on inputs that affect the environment, the pricing of resource use, the subsidisation of good land practices, and the use of subsidies to

protect society's goals of clean water, biodiversity and landscape.

The taxing of production inputs or the pricing of resources to reflect the true social costs externalised by producers is often talked about, but in New Zealand the dialogue has not progressed past that point.[72] One international example is the Groundwater Protection Act of Iowa that requires chemical manufacturers and the dealers that distribute these products to pay fees to register their products.[73] Further, producers are taxed on their fertiliser usage creating feedback to the producer that fertiliser usage is creating pollution of waterways. The tax level is small, but the revenue raised is earmarked for producer education, training and research to help producers reduce their usage. Indications are that a drop in use has occurred. However, the approach does not provide a *continuous* incentive to reduce nitrogenous fertiliser and the gains have reached a plateau and reflect changing commodity returns.

This raises issues about the effectiveness of taxes and fees. Given the underlying incentives to search for efficiencies and cost savings within the commodity model does the introduction of taxes simply increase this search? Using the dairy industry as an example, the scale of productivity and technological gains, and increased commodity prices over the last decade are so large, the ability to set 'taxes' and then to maintain these at an efficient level is limited. The producer response may simply be to seek greater labour and capital productivity to offset the cost of the tax and in doing so alleviate the benefits of the tax. The Iowa case is interesting in the earmarking of the taxes for education and the creation of options to enable fertiliser reduction – the effect of the tax may in fact be the effect of providing alternatives.

Many public harms can be considered a mix of both public harms and private benefits. An example of this is the relationship between landowners in a water catchment and urban waters user that depend on the water catchment for supply sources. New York, for example, draws water from the Catskill Mountains where farmer practices placed the water quality at risk and raised the prospect of needing to treat water at a substantial cost. Eventually it was negotiated that the benefits of clean water would be paid for by New York ratepayers, and this would form a payment to land owners for adopting best practices, thereby removing the need for a large capital investment.

The use of resource pricing is a similar instrument, with resource use charged back to the producer or user of the resource. The efficiency model requires that water be charged up to the point where the marginal cost of water equals the willingness to pay or the value of water to the producer. To do so requires strong property rights and marginal pricing of goods and services. This is far from the current New Zealand situation. As such, producers continue to expand their use of water, as it in itself does not have any cost. For ground water

extraction and spray irrigation there are significant electricity costs in the application of water with one case study farm incurring an average annual bill of $20,000 per annum that increased to over $100,000 during years of high electricity spot prices. Even at this higher cost, the producer proceeded with the development of a further bore.[74]

Resource pricing, especially for water, is still under consideration in New Zealand. There has been limited work on developing the data sets and knowledge necessary to introduce effective water pricing and the supporting water market institutions. We are aware of only one study into the value of water in New Zealand for the Waimea plains,[75] which estimated the marginal value of water to the users to be $240 to $300 per allocated cubic meter. There is little or no information on the value of water to the range of intensive food production systems that the PCE review focuses on, despite years of talk amongst resource management agencies and policy analysts. While the importance of water to agriculture is recognised and the effect of adopting more stringent water quality standards has been estimated, there is no evidence of public good science funding mechanisms prioritising the development of data and knowledge that will enable management responses to be designed and implemented. The Waimea study was funded by the Foundation for Research, Science and Technology (FRST) and despite producing important data for the case study site, proposals to extend this to other land use situations were not supported. This suggests that it may be more appropriate to move funds for public good environment research and knowledge development away from FRST back to MFE with a stronger mandate to address sustainable practice priorities.

Policy agencies have invested funds into developing impact studies presumably to make the case for the importance of water in agriculture. The recent study of water in New Zealand agriculture highlights the dependence of agricultural growth in dry east coast regions on irrigation and water resources.[76] The study models future scenarios based on adopting EU water standards, removing various institutional constraints, and a 'blue skies' (anything goes) set of assumptions. Current irrigated agriculture does not meet the EU water standards and the imposition of such standards on irrigated agriculture is estimated to cost New Zealand $2.4 billion in GDP (net of processing). If adopted, output in the Waikato, Taranaki, Gisborne, Otago, Southland and Canterbury would all face significant downside to their economic output. While this is an interesting contribution it does not provide the data on which resource management policy instruments can be defined.

The Sustainability Institute (2003) summarises key points on Government taxes:

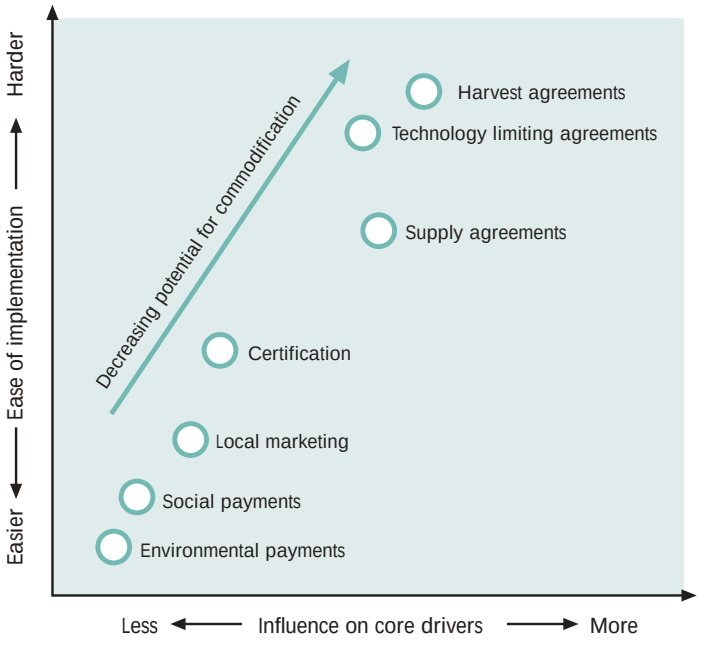
- citizens can use the power of government to tax and reward specific practices that reflect the multiple goals for commodity systems

- taxing inputs to a commodity system can support waste and pollution reduction programs
- even as government introduces payments for 'social goods' and taxes on 'harms', production drivers remain in place and determine commodity system behaviour and are thus unlikely to be a long-term solution.

4.1.5 Summary

The above options highlight a major issue facing policy: the best options are complex and difficult to implement. Positioning of the above options – based on their effectiveness and ease of implementation – is presented in Figure 4.2.[77] The major dilemma is that the effective options are more complex to implement. This should not be a surprise as these options require working in collaborative models to establish collective agreements – something which the current policy, based on private property and individual decision-making, is poorly structured for (see Figure 4.3).

Figure 4.2 Options for intervention strategies

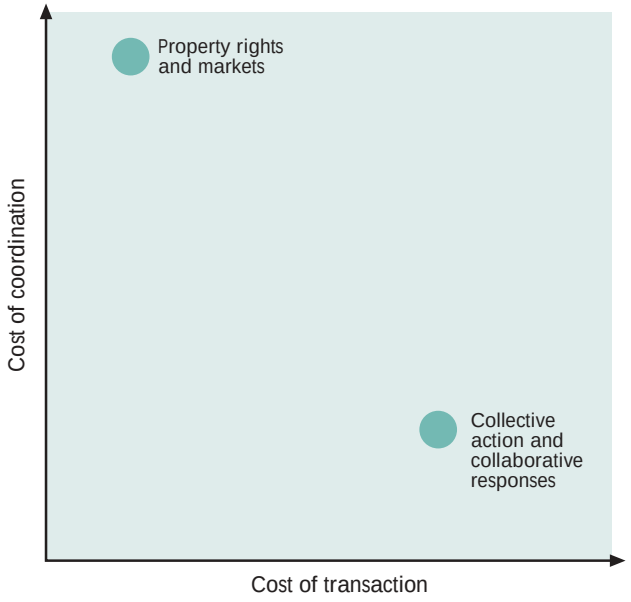


Source: Sustainability Institute, 2003

Figure 4.3 highlights one of the reasons why the relationships in Figure 4.2 exist. A commodity-based system is about low-cost transacting. As in the quote "you get nothing for nothing", it indicates that this is achieved but at the cost of making coordination and collaboration higher cost. Collaboration costs increase as the number of decision-makers increases and the individuality of property rights creates a need to negotiate agreements including an agreement on how to reach an agreement. Cooperative and collaborative mechanisms are

under-developed in market-based systems that have developed comparative advantages from individuality and distancing of people.

Figure 4.3 The dilemma of property rights and coordination



Source: Saunders, 1996

The policy objective must be to decide what can be done. The challenges in addressing the effects of agriculture on natural resources, environmental quality and social systems is massive, and will require a portfolio of change strategies before significant progress can be made. Each of the options provides some potential for improvement and should be exploited wherever possible.

Creating feedback, achieving influences on an appropriate scale, and having options for people to move into systems that do not threaten their need for security are the challenges that can start to be addressed. Ultimately, as asked by the Sustainability Institute's report on building sustainability into natural resource economies: "What type of efficiency do we as a society want?"

In the previous sections we have stressed the need for balancing allocative and production efficiency goals with the needs of consumption efficiency. We realise that this is a strategic leap from current policy, but something we feel is imperative if New Zealand seeks to achieve its stated sustainability goals.

4.2 Consumption efficiency and environmental innovation options

This section starts to address the issue of creating institutional arrangements for consumption efficiency and sustainability. It starts from the premise of using free markets as the driving force for these changes. As such, it envisages

building on current policy as opposed to constructing new philosophical positions. To do so suggests that the efficiency features of free markets may not be the most important attributes of a free market that the policy and institutional arrangement should seek to emulate. Rather it is the role of free markets to stimulate innovation – including environmental innovation and innovation for material well-being.

4.2.1 Innovation

The discussion of commoditisation highlights the need to place greater emphasis on consumption efficiency, especially the ability to produce outputs at far less cost to the environment. Current free market systems and the commodification that they build on generate continuous incentives for the purpose of innovation for material well-being. These systems excel at this function, but do so without regard for the associated public or social costs. With market-based economies effectively decentralising decision-making, there is a real risk of a growing number of decisions being undertaken for material well-being and at the same time creating an accelerating demand for natural resources and the environmental functions. Uncertainty over long-run capacity of natural systems to support increased output and the increasing resistance of some consumers to food produced in socially irresponsible systems supports the need for prioritising consumption efficiency along with production. There may be greater value in production systems that require less inputs, as even with reduced outputs the overall value of output may be higher.

Current production systems and the supporting institutions are poorly placed to deliver the level of change or innovation required. In addition, the limited levels of investment and the manner in which investment is targeted highlights significant constraints within the current institutional arrangements. The effects of bounded rationality limit the likelihood of current food chain managers innovating on a sufficiently large scale to make a difference. Bounded rationality suggests that firms may not include scale and cumulative effects in their individual decisions. Current systems also preclude collective and collaborative approaches considered central to the successful management of these changes. Agency culture is based on a centralised environmental management (regionalised). This institutional arrangement attempts to deal with diffuse decentralised decision-making with limited feedback and information. If the environmental effects reported by the PCE team continue to accumulate there is a need for significant change to existing production systems to bring harvest or exploitation rates within the natural regeneration rates that would signal a sustainable management and production system.

A priority for policy is to develop systems and incentives that stimulate innovation for the purpose of consumption efficiency. Current policy is based on the assumption that efficiency goals support innovation goals. Driesen

(2003) presents strong arguments why this is a fallacy and that innovation for consumption efficiency is poorly served by production efficiency policy goals. This is compounded by traditional approaches to regulation that only provide an episodic incentive for innovation at the point when there is a need to adjust pollution levels to achieve compliance and that is all. There is no ongoing incentive to continue to seek means for reducing resource demand or pollutant output once the standards are achieved. This places an added burden on the regulator to adjust penalties and standards with the changing needs of society and to reflect the growing accumulation of wastes. Public agencies lack the political will or are inefficient at achieving this requirement. In fact, they have been labelled as being 'slovenly' in this regard.[78] The slow or limited ability to adapt reflects high degrees of pathway dependence in the gathering of information, the need for caution in public process to avoid being challenged, politicisation of processes, and a disproportionate influence of those who are to be regulated. The disproportionate influence is due to the regulated being able to use the profits generated from their polluting activities to lobby politicians and challenge public decision-making. The same firms have control over the information necessary to make improved decisions and as such get privileged access to the decision processes. As a consequence the instruments adopted often best suit the interests of those responsible for damages – that is, the 'regulated' – as opposed to society and the environment.[79]

There needs to be a separate assessment for innovation and efficiency, as both use differing time frames and require differing sets of incentives that form the dynamics around which change is stimulated. To date there has been little research into the effect and importance of innovation at this level.

Innovation is about what we do and how we do it, by changing the products or services people purchase to meet their needs and the methods of production to create these. As such, innovation needs to be seen as not just "changing how we perform a function but also must address the need to fundamentally change the function itself."[80] A typology of innovation (see Table 4.1) based on the purpose of innovation (material well-being or improved social outcome including environmental innovation) and whether the innovation represents a quantitative or qualitative change highlights the different approach to innovation. Material well-being is effectively a supply side response while environmental innovation represents a demand side need. Often quantitative innovation is prioritised, however, it is qualitative innovation that contributes most to defining future pathways. Unfortunately qualitative innovation is often limited by institutional constraints that continue to support business-as-usual through pathway dependent decision-making.

Table 4.1 The characteristics of innovation

Innovation style	Innovation for material well-being	Innovation for social/ environmental
Quantitative	Lower costs of existing goods and services	Reduces cost of achieving environmental quality
Qualitative	Introduces new or improved products or services	Changes underlying environmental characteristics of production to cause less disruption to natural systems but may not lower price

Source: Adapted from Driesen, 2003

The scale of issues associated with commodification strongly suggests that radical innovation is needed. Simple incremental gains or diffusion of existing ideas will contribute to reducing the problem, but probably will not assist in their solution. When people talk radical innovation, it raises fears of compliance costs.[81] This means that agencies limit the goals they set, which, in turn, contributes to the ongoing failure of achieving effective environmental protection. Current institutional arrangements determine technological choices. We believe that the technological choices for New Zealand need to be reoriented to achieve increased incentives for consumption efficiency. To do so will be difficult, however, the alternative choices for achieving sustainable development may prove to be more difficult and more costly.

The next sections outline some of the ideas for creating incentives for environmental innovation from within free market systems. These are policy options, and there will be more ideas and options in the wider audience that need to be discussed, analysed and understood. The question is how to create the necessary dialogue from within current institutions that face strong incentives to avoid doing so? The change is conceptually simple in that we challenge policy makers to use the strength of free markets and competition to create incentives for environmental innovation and not simply efficiency productivity gains.

4.2.2 Privatisation options

Privatisation options recognise the need to operate and develop management systems within a decentralised market-based framework.

Privatised enforcement

Enforcement of environmental protection and the need to achieve a more

sustainable food production system is faced with a number of challenges. No longer are the sources of threat simple discreet point source, rather they are diffuse, differential and difficult to link between cause and effect. The source of pollution is derived from decentralised decision-making while enforcement remains as a largely centralised function.

The United States of America entry into privatised enforcement is based on citizens' lawsuits.[82] A dynamic assessment shows how precise incentives interact with bounded rationality of the person subject to incentives. Citizen lawsuits are supposed to provide incentives for lawyers to represent citizens, however, those capable of doing so increasingly receive economic inducements to work in other areas such that there is no body of lawyers to detect and enforce the law. This especially handicaps the more remote or poorer communities as they lack resources to contract expertise.

One option is to provide the penalties to those who take the case. This would create incentives for the legal professional to support the notion of citizen lawsuits and also ensure that malicious litigation is minimised, as rewards are only available from successful outcomes.[83]

Privatised standard setting

- *Information strategies*: Empirical research suggests that significant gains can be achieved through privatised standard setting in response to laws generating information about pollution and the cost savings available from alternative management regimes (FAO, 2000). There is no reason why such public reporting of pollution loadings would not contribute to reduced pollution, creating an incentive to innovate and adopt management practices that are more benign in terms of their effects on the environment. The basic assumption in the free market framing of policy is that perfect information rarely exists, creating distortions that are often overlooked or simply ignored. If the agencies that promulgate free markets are unable to provide the information for market participants due to cost or unavailability there is a real need to privatise the provision of information as much as possible.[84] An area that would be of value for future research is the interaction between the drivers for production and the bounded rationality of food producers and how producers and policy agents may be better informed.

- *Information on pollution levels*: Environmental effects data is normally provided in response to a request from management agencies. However, the regulated can control or restrict access to much of the data required, often partially constraining future decision-making. A good example of this is the case of Rotorua lakes where declining water quality has been known for a considerable period. Where regulation or law requires disclosure of

such data at various points in a market channel, the data has often been astonishing and the polluter has often experienced strong public and media pressure to innovate and change.

Empirical evidence finds this to be inconclusive in all cases and the reasons for success or failure are not well documented to inform the design of improved interventions. A key finding is the effect of information on changes to behaviour that are cheap, visible, non-disruptive and often not relevant. The research of Watters *et al*. (2004) on farmer involvement in pole and tree planting may represent a similar finding. Likewise, Watters *et al*. state the contribution of nitrogen from fertiliser application in the dairy production system on a per hectare and annual basis. While this is accurate, it in no way tells the extent of the issue. A 50-kilogram per hectare contribution if sustained over a decade represents 0.5 tonne of nitrogen per hectare passing into waterways which totals 5,000 tonnes for a 10,000-hectare catchment over 10 years.

- *Information on profitable pollution reduction*: The provision of information on changes or means to change the level of pollutants created by a producer has proved to be effective. In fact, the Iowa nitrogen tax is possibly more effective than it would otherwise be because tax revenues were uses to create and disseminate management practices that enable producer to restrict their nitrogen use – at least in the short run.

- *Privatised certification schemes*: Certification schemes are in effect both a form of privatised enforcement and an information strategy for the producer and the consumer. While advances are possible there is considerable doubt about their ability to spur rapid innovations. Consensual standard setting by the industry itself "seems to be the wrong process for doing that".[85] The Dairying and Clean Streams Accord (Fonterra Co-operative Group, LGNZ, MFE and MAF, 2003) is an interesting example of privatised certification.

Environmental competition statutes

Options exist for statutes that enable and create incentives for environmental innovation. Driesen (2003) outlines a range of provisions that could be applied, including the ability of innovators to receive payment from polluters, effectively passing the revenue from negative incentives into the creation of positive incentives. The New Zealand fishing industry using proceeds from enforcement to retire fishers from the industry is one type of provision that could be used. The basic tenant emulates free market support for innovation. An example may be that IPM innovators could be funded by the chemical companies to diffuse their innovation more widely. While some will say that this could force people out of business its no different than competition using technical innovation to

out compete others who may then leave the sector. If this is acceptable for private gain, it should be equally acceptable for the protection of the wider public good. While Driesen's concept is far-reaching and rather radical in today's institutional framework, it provides some clarity on a number of options that simply do not make it to the agenda for current policy making. It is introduced here as one of the options to be learned from.

Summary

It is possible to design systems that increase the extent of privatisation of environmental law which is predicted to stimulate environmental competition. Options such as an environmental competition statute would provide a stronger incentive for environmental innovation and as a result more continuous environmental quality improvements. Little progress is likely if institutions continue to focus on efficiency gains and assume that environmental innovation will result.[86] If consumption efficiency is a priority, environmental innovation is critical and policy should increasingly focus creating the incentives for environmental innovation as well as the current incentives for material well-being innovation.

The clear difference between public and private sector decision-making structures, and how each responds to proposals for or the need to innovate, strongly highlights the need for greater privatisation if innovation is to develop. New Zealand policy needs to understand the nature of how innovation works and to do so requires a movement from the current static impact analysis to a more dynamic recognition of how incentives actually operate. This understanding needs greater precision than is currently applied. Where it has been undertaken, it sheds light on the value of greater privatisation.[87]

4.2.3 Equitable and fair decision processes

Opportunistic regulation

The current approach to regulation is to engage the industry to be regulated and discuss with them the option of more stringent controls. This engagement elicits, as expected, responses on the cost of controls, compliance costs, and the loss of production and profitability.[88] The process of regulation can be considered as a negotiation between the regulator and the regulated to a point where both parties suffice. Whether this creates the necessary environmental protection or quality outcomes is often lost or mute.

An alternate would be cast the role of the regulator into the very free market philosophy that most have espoused in New Zealand. That is, they would be required to develop regulation that emulated the free market benefits, not of efficiency but of innovation for material well-being. This innovation is driven by competition between entrepreneurs. In this light, policy makers could seek to

adopt a positive view by approaching not the existing industry players responsible for the current situation but potential competitors that would supply substitutable goods and services at higher levels of consumption efficiency. For example, instead of talking to the coal-fired generation industry the policy agent would engage with the potential hydro-electric, wind or solar providers and seek to find how policy conditions could be improved for their entry and or expansion into the energy production sector. The concept being that these more consumption efficient industries would enter and compete with existing providers. If existing providers could not compete for the provision of energy services they would face the risk of needing to exit.[89] In terms of food production systems, this could be represented by what farmers need to produce food with lower levels of nitrogen. It is an interesting question for policy agents to ask not only of those who depend on nitrogen, but those that have alternative options.

Administrative law reform

Administrative agencies will always need to respond to a range of pressures. Some of these will be political, others will involve the need to demonstrate due process if they are to avoid the fear of being challenged and litigated against.[90] We do not envisage the redundancy of administrative agency input, however, there is an urgent need to address the slowness with which such agencies are able to act and respond. Comprehensive assessments of how to streamline procedures are urgently required, something for which the Resource Management Act 1991 is regularly criticised. Currently, many of the processes of the administrative agencies and the judicial system attached to these favour existing producers at the expense of the public interest or public values.

This may require a review of the principles that the public apply to administrative agencies and their processes. The current need for transparent processes has opened the door for participation. However, the equity of participation is often overlooked, with those that are gaining benefit from the damages occurring able to reinvest their gains to dominate participation and decision-making procedures.

Several options exist for reforming the issues of participation, including the ability to limit volume of submissions, limit an agency's time responding to inputs, capping the investment into participation by vested interests, and publicly funding participation of the disadvantaged or those not currently privileged.[91]

Bypassing administrative decision-making

One option that proved effective in the USA is the manner in which the administrative agencies can be by-passed or their role limited to a greater extent. The manner in which rule making was predefined for sulphur trading resulted in greater certainty and less administrative procedure attached with standard setting.[92] In effect, the negotiation was not over the standards but over the rules for setting standards and once these were agreed the agency was charged with the responsibility of implementing the rules and not defending the outcomes of the rule-making process. As a consequence, standards were moved in response to technology and the needs for environmental quality in predetermined ways. This resulted in far greater innovation for more significant environmental gains. Setting of environmental standards and controls costs in New Zealand should consider how to reduce the delays and uncertainty of requiring open contested decision-making processes as opposed to agreeing on how the rule making will be undertaken.

Summary

If administrative law provides inadequate incentive for continuous improvement and innovation, and compares badly with decision-making structures that govern innovation for material well-being and increased food production, it is necessary to consider what reforms may be needed to provide more effective and targeted decision-making. If reform is always efficiency based, there is little concern shown for the effectiveness and frequency of decision-making to support environmental quality and improvement. Instead, each decision is a simple transaction for the efficient use of private sector resources that the potential policy will affect. Current policy decision-making does not appear to adopt a dynamic view for the issue of environmental innovation that is seemingly necessary. As Driesen (2003) notes "it cares not one jot if the system as a whole produces lots of decisions or few." By adopting such a view the free market is seen as a rapid dynamic system of decentralised decision-making providing a source of energy from which environmental innovation (including radical innovation) may be created. It therefore demands policy agencies to consider how to make policy as a whole perform better.

4.2.4 Improved regulatory design

The ability to review regulation within a dynamic framework should enable regulators to improve the quality and effectiveness of their regulations. For example, if firms must absorb *all* costs required to clean up their pollution, there may be a basis for moving forward. If a firm can externalise the costs of clean up without substantial administrative involvement and compliance cost, just as they externalise pollution costs, then small premiums may provide significant incentives for change. Such options are a direct consequence of the proposed environmental competition statute described above.

Other aspects for improving regulation design relate to the manner in which institutions define themselves. If these institutions are designed with the purpose of being the source of demand for environmental protection whose function is to set environmental standards based on environmental needs, rather than concerning themselves with the cost or technical feasibility of response options, less uncertainty would exist and the pace of decision-making could increase. Current institutions have such large mandates, often with interacting and conflicting incentives, that environmental quality is easily negotiated away. The upcoming review of the RMA should be made aware of the need for a strong demand focus from environmental and sustainability institutions.

CHAPTER 5

Future needs and recommendations

There are a number of responses recommended as a result of the above discussion. When placed in the context of other study components, the over-riding reasons for the food production revolution are linked to the incentives that derive from a commodity-based food chain. Irrespective of price signals being favourable or unfavourable, the short run incentive for producers is to increase their production further. These increases may be driven from increased use of technology resulting in higher productivity from the capital employed. To date the most significant productivity gains are related to the use of labour and capital. Land productivity data is harder to discern, however, research suggests 'smaller' may be more productive. The challenge for producers is how to respond when available technical efficiencies and productivity gains are utilised. At this stage options include increased cost externalisation and structural reforms. The system of commodification takes no account of scale of production and scale of effects, concentrating on lowering the cost of production to enable suppliers to compete for market share.

We suggest that there needs to be greater balance between the productivity gains from efficiency that current policy influences with increasing consumption efficiency. We do so from the position of viewing production as a consumption activity – it consumes resources. Given increased populations and consumption per capita, our production systems need to be more efficient not just in producing material goods and services but in terms of greater social satisfaction and well-being. This requires increased recognition of the non-market values which largely fall outside our current institutional arrangements. As a

consequence, producers are distant from consumers and the institutions that bridge this gap are rewarded on the basis of their market transacting. Information and decision-making are bounded within the market-based institutions leaving the non-market institutions poorly represented in decision-making. This enables producers to consume resources that have no price or cost and, therefore, fall outside the consideration of producers when they consider the cost of production.

It would be easy to cast this as doom and gloom. It is not. The dialogue and analysis that is started in this project has already highlighted significant potential gains for producers and for New Zealand in terms of economic value and also for environmental protection and social well-being. The challenge is how to make the necessary changes to incentivise the very markets that continue to drive food productivity gains to ones that increasingly support environmental innovation. While many (including ourselves) ask what efficiency should society strive to achieve, we also ask who will or should lead this search?

Endnotes

[1] Consumption efficiency is about getting more with less, not more stuff but more satisfaction, not quantity but quality… it is the level of social welfare and personal satisfaction obtained per unit of energy and materials consumed (Manno, 2002, p67).

[2] Sustainability Institute, 2003

[3] See for example, *Trends in river water quality in the Waikato Region 1987-2002* (Environment Waikato, 2004).

[4] Cary *et al*., 2002

[5] An estimated 82 percent of point source and non-point source nitrogen in the USA is derived from agriculture.

[6] Heilbroner, 1985

[7] De Soto, 2000

[8] *ibid*.

[9] Saunders *et al*., 2002

[10] Wills, 1997

[11] Prugh, 1995

[12] Wills, 1997

[13] Driesen, 2003

[14] Princen *et al*., 2002b, p16.

[15] Princen *et al*., 2002a

[16] Pretty, 1995

[17] Manno, 2002, p67.

[18] Allocative efficiency is used here in the pareto optimality context of no-one being worse off from alternate allocations.

[19] Manno, 2002

[20] Duncan, 2003, p7.

[21] *ibid*.

[22] Information derived from www.thewarehouse.co.nz

[23] Manno, 2002

[24] Cary *et al*., 2002

[25] The effect of eco-labelling and or standardisation certification programs raises an interesting paradox. Certification schemes are promoted as a means of product differentiation, however, they also increase the potential for commodification and may possibly accelerate their commodification.

[26] Manno, 2002, p72.

[27] It should not be surprising to notice that those goods and services with high commodity potential are those that link closely to individual actions with well-defined property rights.

[28] Barr and Cary, 1992

[29] Princen *et al*., 2002b

[30] Driesen, 2003

[31] Manno, 2002, p86.

[32] Pimentel *et al*., 1995

[33] Driesen, 2003

[34] MacNeill *et al*., 1991; Wackernagel and Rees, 1996

[35] Princen, 2002

[36] Sustainability Institute, 2003

[37] *ibid*.

[38] Princen, 2002, p107.

[39] Princen, 2002

[40] Ostrom, 1990

[41] Princen, 2002

[42] *ibid*.

[43] As witnessed by the accumulation in wealth for the 12 case study properties – see Watters *et al*., 2004.

[44] Princen, 2002

[45] Sustainability Institute, 2003

[46] See Cary *et al*., 2002.

[47] Sustainability Institute, 2003

[48] The depicted trends are based on data assembled from the Food and Agricultural Organization of the United Nations (FAO) and World Resources Institute (WRI) 'Earth Trends' searchable database.

[49] Saunders *et al*., 2004

[50] White *et al*., p68.

[51] Watters *et al*., 2004

[52] Saunders *et al*., 2004

[53] Smith and Saunders, 1995

[54] Cary *et al*., 2002

[55] Sustainability Institute, 2003

[56] Honadle, 1999, p11.

[57] Barr and Cary, 1984; Newman *et al*., 1990

[58] Cary *et al*., 2002, p10.

[59] Complex in the sense that future effects and outcomes may simply not be known or predictable at the time of a decision.

[60] Edwards and Byron, 2001

[61] Driesen, 2003

[62] Sharp, B., pers. comm., 2003.

[63] Sustainability Institute, 2003

[64] *ibid*.

[65] *ibid*.

[66] *ibid*.

[67] Gale, 2002

[68] *ibid*.

[69] Elder, 2004

[70] Sustainability Institute, 2003

[71] *ibid*.

[72] Some experts are reportedly so frustrated with continual referral back to the concept of water pricing and water markets by policy agencies that they now are choosing not to participate in requests to discuss these issues – given that there has been no commensurate investment into the research necessary to develop the data sets for assessing policy instruments and for implementation. There is a view that the continual dialogue is one means of being seen to be involved without actually addressing the issue.

[73] Sustainability Institute, 2003

[74] Watters *et al*., 2004

[75] White *et al*., 2001.

[76] Morgan *et al*., 2003

[77] Sustainability Institute, 2003

[78] Driesen, 2003

[79] *ibid*.

[80] Driesen, 2003, p76.

[81] Driesen, 2003

[82] *ibid*.

[83] *ibid*.

[84] *ibid*.

[85] *ibid*.

[86] *ibid*.

[87] Lewin, 1995

[88] Driesen, 2003

[89] *ibid*.

[90] Young, 2002

[91] Driesen, 2003

[92] Sandor, 2002

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