

Sharp, Basil

Working Paper

Institutions and Decision Making for Sustainable Development

New Zealand Treasury Working Paper, No. 02/20

Provided in Cooperation with:

The Treasury, New Zealand Government

Suggested Citation: Sharp, Basil (2002) : Institutions and Decision Making for Sustainable Development, New Zealand Treasury Working Paper, No. 02/20, New Zealand Government, The Treasury, Wellington

This Version is available at:

<https://hdl.handle.net/10419/205495>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>



Institutions and Decision Making for Sustainable Development

Basil Sharp

NEW ZEALAND TREASURY
WORKING PAPER 02/20

SEPTEMBER 2002



THE TREASURY
Kaitohutohu Kaupapa Rawa

M O N T H / Y E A R

September 2002

A U T H O R

Basil Sharp
Department of Economics
University of Auckland
Private Bag 92019
Auckland
Email b.sharp@auckland.ac.nz
Telephone 64-9-9-373 7599

A C K N O W L E D G E M E N T S

The study was commissioned by the Environment Cluster within the Treasury. I am particularly grateful for the guidance and advice offered by Linda Cameron, David Wood, Sharron Came, Richard Lynch, Mark Sowden, Catherine Adams and Mary-Ellen Fogarty. Assistance with the literature survey was provided by Eithne Barry and peer review by Veronica Jacobsen. I would also like to thank staff of the Auckland Regional Council, Environment Canterbury and Otago Regional Council for their comments.

N Z T R E A S U R Y

New Zealand Treasury
PO Box 3724
Wellington 6008
NEW ZEALAND
Email information@treasury.govt.nz
Telephone 64-4-472 2733
Website www.treasury.govt.nz

D I S C L A I M E R

The views expressed in this Working Paper are those of the author(s) and do not necessarily reflect the views of the New Zealand Treasury. The paper is presented not as policy, but with a view to inform and stimulate wider debate.

Abstract

Economic theory provides a coherent framework for analysing the elements of growth and sustainable development. Robust policies and appropriate institutional structures are essential to achieving sustainable development. Environmental problems are rooted in failed markets and their resolution requires government taking some kind of action – to establish property rights, set standards of liability, apply polluter pays taxes, or regulate. There is ample evidence showing that market based instruments can achieve the same environmental outcome at considerably less cost relative to command and control. Rational policy must seriously consider the use of market-based instruments.

A framework for considering the quality of institutional structures *vis-à-vis* achieving sustainable development is presented. The framework is applied to aspects of the Resource Management Act 1991. Although the Act aims to promote sustainable management it is the primary legal foundation for sustainable development policy. One result of the Act was to devolve a great deal of environmental management and policy to local government. To a limited extent the Act is permissive and creates opportunities for local and regional government to find effective and efficient ways of achieving environmental outcomes that suit their communities. There is a clear preference for command and control in situations where statute provides a legal framework for market based instruments. But the options for using market-based instruments are limited. There are instances where attempts by regional administrators to implement market-based instruments are thwarted either by statute or by coordination difficulties at higher levels of government. Barriers to using market-based instruments are identified along with suggestions for institutional reform.

JEL CLASSIFICATION

P28 - Economic Systems, Natural Resources and Environment

Q01 - Sustainable Development

KEYWORDS

Sustainable development; institutions and decision-making; market-based incentives

Table of Contents

Abstract	i
Table of Contents	ii
List of Tables	ii
List of Figures	iii
1 Introduction	1
2 Policies to enhance sustainable development	3
2.1 Economic efficiency	4
2.2 Regulation	6
2.3 Market based instruments.....	8
2.4 Uncertainty	15
2.5 Removal of subsidies.....	16
2.6 Community based initiatives	17
2.7 Conclusions.....	20
3 Institutions and sustainable development	22
3.1 Institutions and sustainable development policy.....	22
3.2 Institutional structure	24
3.3 Property rights.....	30
3.4 Institutional change	31
3.5 Barriers to implementing market based instruments	35
3.6 Conclusions.....	37
4 Framework for assessment	39
4.1 Environmental governance	39
4.2 Features of sustainable development.....	41
4.3 Generic framework.....	42
4.4 Conclusions.....	48
5 Applications to New Zealand	51
5.1 Policy integration.....	51
5.2 Achieving clarity of purpose	52
5.3 Market based instruments.....	52
5.4 Conclusions.....	57
6 Conclusions and recommendations	59
6.1 Conclusions.....	59
6.2 Recommendations for future research.....	62
References	63

List of Tables

Table 1 - Costs of command and control relative to least cost	8
Table 2 - Key challenges of sustainable development.....	42

List of Figures

Figure 1 - Simple pollution model	5
Figure 2 - Costs of using BAT with regulation	7
Figure 3 - Achieving a target at least cost	9
Figure 4 - Revenues raised from environmentally related tax-bases	11
Figure 5 - Tradable rights to sustainable harvest	15
Figure 6 - Welfare losses with ex ante taxes and quota	16
Figure 7 - Dissatisfaction with public good provision	18
Figure 8 - The cost of owning and using property	24
Figure 9 - Hierarchy of external institutions	25
Figure 10 - Central or local control	27
Figure 11 - Production of private property rights	33
Figure 12 - Closed and open systems of governance.....	34
Figure 13 - Architecture of governance for sustainability	46
Figure 14 - The quality of water permits	55
Figure 15 - The quality of fishing rights	56

Institutions and Decision Making for Sustainable Development

1 Introduction

Sustainable development links the welfare of future generations with the capacity of the biosphere to sustain life. Sustainable development poses particular challenges for public policy because it is not a fixed state but rather a process of change in which exploitation of resources, the direction of investment, the orientation of technology, and institutional change are made consistent with the future as well as present needs.

The primary purpose of this paper is to focus on the environment/economic interface; identify key market-based approaches; identify the level at which market failure should be resolved in particular circumstances (ie, centralised vs. decentralised); explore ways to incentivise administrators to apply market-based approaches where this can result in more efficient environmental outcomes, while also being conducive to economic growth; assess the quality of institutional arrangements in New Zealand and areas to focus on for improvement; and consider access to resources and the decision-making structure. It also includes consideration of the integration and tradeoffs required between economic and environmental objectives.

Sustainable development has a policy focus because it is about the “design” of policy that ensures delivery of a set of quantitative and qualitative outcomes. The key to sustainable development is choosing robust policies. Institutional arrangements provide a fundamental link between public policy, commercial organisations that use (directly or indirectly) environmental resources and public organisations that are responsible for administering environmental policy (Sharp, 1996a). Many of the reforms introduced in the 1980s early 1990s fall within Williamson’s (1991) notion of primary reforms. For example, the introduction of tradable fishing rights was a primary reform that led to the formation of markets to solve the problem of allocating a sustainable harvest and unleashed incentives to form new businesses, invest in stock enhancement, and so on (Batstone and Sharp, 1999).

Frameworks whereby sustainability can be evaluated and measured are a crucial input. Environmental problems are rooted in failed markets. Their resolution requires government taking some kind of action – to establish property rights, set standards of liability, apply polluter pays taxes, or regulate. The economic literature on market failure is well known and economic instruments have received rigorous analysis over the years. Many externalities arise from a poor definition of property rights. For example, well-designed systems of property rights effectively manage externalities associated with water

use. It goes without saying that efficiency can also be enhanced by greater reliance on rights-based systems of management (Scott, 1996). Thus, rights-based instruments offer gains to both economy and environment. Of course, rights-based management may not be best suited to all environmental “problems”. Water pollution might be better approached by using the “polluter pays” principle endorsed by the OECD decades ago (OECD, 2001).

The Resource Management Act 1991 (RMA), along with accumulated legal decisions, provides the legal structure underpinning environmental management and policy in New Zealand. The overriding purpose of the Act is to promote sustainable management. Sections within the Act *viz* Section 32 were inserted to provide a degree of discipline – use of an appropriate cost-benefit analysis - in the formation and implementation of environmental policy. One result of the RMA was to devolve a great deal of environmental management and policy to local government (Sharp, 1997). The Act is permissive and created opportunities for local and regional government to find effective and efficient ways of achieving environmental standards that suited their communities. Policies of national significance can be “called in” and considered at the national level.

In New Zealand today, many environmental policies are based on a regulatory response without consideration first being given to the full range of options available. On this surface the prevailing preference for regulatory interventions is contrary to the intent of Section 32. In some cases regulation may be warranted, but it should be the result of careful analysis and evaluation of alternative options. Non-regulatory approaches, especially market-based approaches, can produce better environmental outcomes while also being conducive to economic growth. Why is this not occurring?

This paper emphasises the operation of existing institutional arrangements and systems of decision-making as they relate to the environment-economy interface. It includes consideration of the integration and tradeoffs required between economic and environmental objectives.

Five sections follow the introduction to this report. Section 2 provides an overview of the economic foundations for designing policies to enhance sustainable development. Section 3 moves from the standard economic treatment of externalities to discuss their incorporation into institutional arrangement and decision-making structures. Section 4 provides a generic framework for assessing the quality of institutional arrangements and decision-making structures. Section 5 applies the framework to a limited number of issues in New Zealand, highlights the progress made towards implementing policies to achieve sustainable development and identifies deficiencies in the current set of institutional arrangements. Section 6 provides conclusions and suggestions for reform.

2 Policies to enhance sustainable development

If we adopt the Bruntland definition of sustainable development, then policy should focus on the meeting the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987:43). Atkinson (2000) lists three key points of sustainable development as follows:

1. concern for future generations is the defining feature of sustainable development and to correct for the myopia of earlier policies, contemporary policy should be more forward looking
2. increased attention to economy-environment linkages
3. requirement to examine trade-offs between sustainable development and other goals

As noted earlier, environmental problems are rooted in market failure and their resolution usually requires government taking action. While correcting for market failures might be seen as a necessary condition for achieving sustainable outcomes it may not be sufficient. Additional challenges arise from the call to address poverty and the welfare of future generations. This section focuses on a range of broad approaches to environmental issues and their contribution to sustainable development. Although each instrument is discussed in isolation, a combination of instruments might best apply to the situation at hand. For example, tradable water rights can easily operate within a minimum flow constraint aimed at protecting conservation interests.

Two broad classes of market failure are relevant to sustainable development policy. Negative (pollution type) externalities attract most attention in the literature (OECD, 2001). As noted in Sharp, (2001) residuals are an inevitable fact of production and consumption. For example, a firm producing paper – a product that is valued in the market – may also produce waste that is discharged into a river adversely affecting other users and non-users of the river environment. A dairy farm relying heavily on fertilizers to lift production might contribute to groundwater pollution and possibly accelerate the eutrophication of a lake. The by-products of household consumption – solid waste, sewerage – also enter the environment. Vehicular transportation, of all kinds, contributes to environmental pollution. Urban development can enhance sedimentation and contribute to the destruction of waterways and wildlife habitat.

The Hartwick (1990) model reminds us that achieving sustainable development involves pricing the natural environment's services in general. In particular resource pricing should account for contemporaneous and intertemporal externalities. For example, uncontrolled access to fish stocks eventually leads to stock depletion, over-investment in harvesting capacity and inefficient outcomes. Competition for a common pool resource (eg gas field) will result in a lower economic dividend relative to a situation where access is priced so as to maximise net present value (Dasgupta and Heal, 1979). Of course, it is desirable that the optimal price of depleting a stock resource includes the cost of the externalities associated with extraction.

The above externalities are not an economic issue in a world with no scarcity. In a world of scarcity and in the absence of appropriate environmental policies, externalities create opportunity costs that distort the principal mechanism that we rely upon to allocate resources within the economy. The efficiency properties of the competitive market

mechanism have been long established and need not be discussed in any detail (Nicholson, 2000).

It is also well known that an efficient outcome, in the presence of externalities, can be achieved by pricing the externality at its marginal (social) damage (Field and Field, 2002). This is the standard Pigouvian result that provides a framework for assessing the relative efficiency of alternative policy instruments.¹

The call to use market-based instruments (MBIs) to achieve sustainable development is not without critics. Some will argue against valuing adverse environmental impacts. However, the concept of total economic value is recognised as an important part of the environmental economist's tool kit when it comes to the practical implementation of MBIs (Sharp, 2001). Others will not be prepared to accept environmental degradation of any kind and the very idea of balancing the costs and benefits of pollution abatement is an anathema. The reluctance to accept trade-offs is implicit in the definition of strong sustainability. Critics may also object to the idea of tradable rights to the environment without fully appreciating the fact that property rights are associated with current regulations.

This section provides an overview of economic instruments to achieve sustainable development.² The range instruments is generous and includes traditional command and control (CAC), polluter-pays schemes, tradable rights, and mechanisms aimed at tapping into the preferences of individuals and the community. The economic underpinnings of the alternatives are described and discussed in terms of economic efficiency. The economic models provide a basis for the design of specific institutional arrangements as outlined in Section 3.

2.1 Economic efficiency

Why should society be concerned about externalities? In the New Zealand economy, the market is the principal mechanism that we use to guide production and consumption decisions. If the market is working "well" then all goods and services are priced at marginal cost and it would not be possible to improve the welfare of one individual without reducing the welfare of another individual. This outcome is Pareto efficient. Externalities drive a wedge between price and cost. To pick up on the above example involving pollution from the paper industry, in the absence of intervention the price of paper will not equal the full cost of production because the opportunity cost of lower water quality (as measured by the community's welfare loss) is not included alongside the cost of labour, capital and other inputs used in the manufacture of paper products. If the externality is significant, then it would be possible for those that gained from an improvement in water quality to potentially compensate polluters for incurring higher treatment costs and be better off. This is described as a potential Pareto improvement.

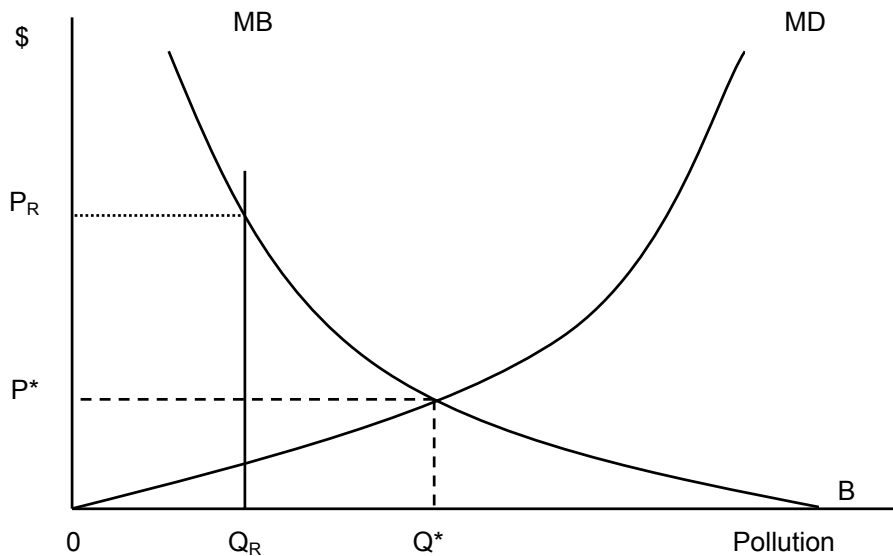
Economic efficiency is illustrated in Figure 1 using a simple "upstream polluter downstream community" model. The polluter derives marginal benefits (MB) from being able to use the river as a sink for waste; the community faces damages (MD) associated with the waste. Assuming that all costs and benefits are expressed in the dollar metric, the efficient level of pollution is Q^* where $MB = MD$. There are a number of points that

¹ The standard result depends on a number of assumptions viz convex production possibilities, well-defined property rights, (typically zero) transaction costs, and competitive markets.

² Those interested in more technical treatments should consider reading Stavins (2000) and Bromley (1995).

should be noted about this equilibrium. Time is not a factor in the model and would need to be explicitly considered given the intertemporal focus of sustainable development. Hartwick (1990) shows how adjustments would have to be made to the model if the pollutants accumulated over time.

Figure 1 - Simple pollution model



The equilibrium is determined by a balancing of costs and benefits at the margin. The shape and position of MD and MB is an empirical issue. It should be noted that techniques are available to estimate MD (Freeman, 1993). It is assumed that both functions can be expressed in the dollar metric. Industry's MB function can be thought of as profit or the difference between revenue and (private) costs valued at competitive market prices. Use of the river's assimilative capacity is not explicitly priced because it is not traded in the market. The opportunity cost (price) of the discharge is the impact it has on the welfare of the community down stream as measured by MD.

The price generating mechanisms embedded in Figure 1 are significant. Clearly, firms seeking to maximise profit will respond to market prices and in the absence of a price on pollution the equilibrium will be at B where marginal profit is zero. At B, MD > MB and the community could potentially compensate the polluting industry and both would be better off at a lower level of pollution. The efficient level of pollution Q* is where MD = MB.

In a nutshell, the policy problem is that there is no mechanism (eg, polluter pays charge, price of a tradable right) signalling the cost of pollution so that the adverse impacts are internalised into the polluting industry's decision-making calculus. The policy instrument for signalling MD is an object of choice within the context of environmental policy.

Many environmental services are characterised by a degree of publicness. For example, the services provided by the earth's atmosphere, and the attributes of endangered species, are close to the definition of a pure public good. Since a public good is non-exclusive, the price people are willing to pay for a given quantity is the sum of each individual's willingness to pay. Two attributes of a public good are emphasised viz nonexclusivity and nonrivalry. A pure public good is characterised by:

nonexclusivity, where no one can be excluded from enjoying the benefits; and

nonrivalry, where additional consumers may use the service at no additional cost.

Application of the “private good” “public good” dichotomy to problems associated with sustainable development has limited usefulness. For example, Nicholson (2000) defines fishing grounds and public grazing land as being non-exclusive yet consumption being rival. Better defining property rights can often solve the problem of non-exclusivity. Nonrival goods that permit imposition of an exclusion mechanism are referred to as club goods. Technology will continue to lower the relative cost of excluding those not entitled to consume the services available.

In the meantime let us assume that environmental services are public goods and cannot be efficiently traded in competitive markets. The efficient quantity of a public good is determined by balancing the sum total of individual willingness to pay with the marginal cost of service supply. If water quality is a public good, then MD in Figure 1 represents the community’s willingness to pay for cleaner water and MB measures the opportunity cost (foregone profit) of cleaner water. The efficient level of clean water (or pollution level) can, in principle, be described. But in practice how might this equilibrium be achieved?

With public goods the underlying problem is to get members of the community to “truthfully” reveal their willingness to pay (WTP). Returning to Figure 1, it is possible to show that Q^* is a Lindahl equilibrium where the tax share of each individual, is correctly assessed at the marginal value to each person (ie, each person’s share is WTP_i) and precisely pays to the cost. Thus, if *ex ante* pollution was OB then the total tax bill is $P(B-Q^*)$ and this would be shared across the community in proportion to each person’s willingness to pay. Although the equilibrium is efficient – tax shares mimicking the competitive pricing mechanism – it is not very realistic because of the free rider problem. The Lindahl solution requires knowledge of the optimal tax share for each person. Since no one can be excluded then it is possible for individuals to free ride on the supply of clean water. Voting might deliver an optimal outcome but in general a degree of compulsion is required to solve the free-rider problem.

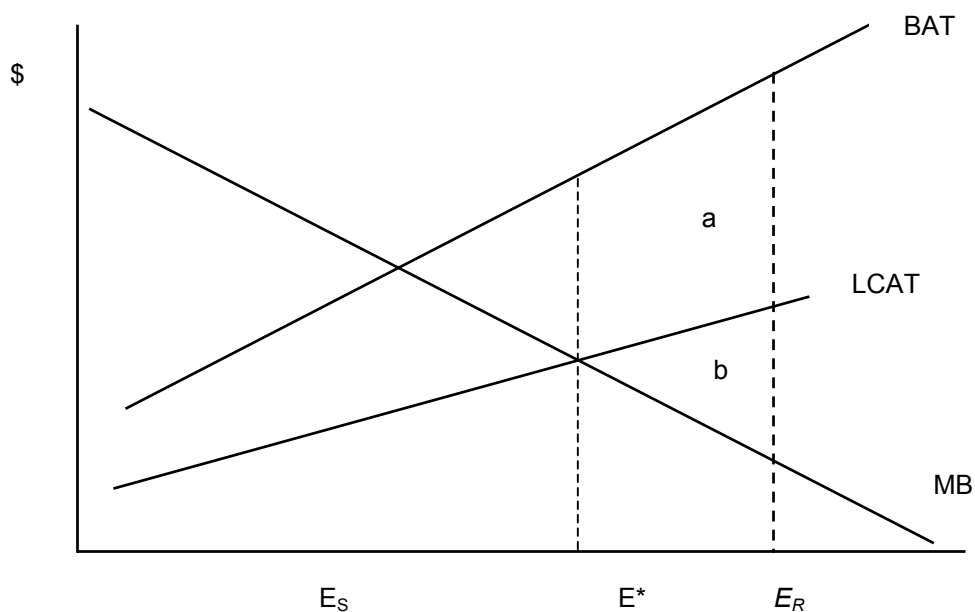
2.2 Regulation

The use of regulatory mechanisms is very common in environmental policy. For example, legislation or a rule might specify the maximum amount of SO_2 that a factory can emit over a given period of time. In Figure 1 we represent aggregate pollution as Q_R . The regulation is not efficient because $MB > MD$. Information on marginal costs is necessary to setting an efficient regulation.

Regulations can be expressed in many ways. For example, a regional rule might require the use of “best available technology” (BAT) coupled with an emissions reduction target. Figure 2 shows the *status quo* level of emissions reduction is E_S . Let us assume that the rule requires a BAT such that E_R is achieved. There are many ways to control pollution and we should be concerned that the least cost available technology (LCAT) a term that also includes technique and management. If LCAT is not used then X-inefficiency (labelled *a*) exists and the industry is paying a higher cost than necessary per unit of emission reduction.³ Relative to the efficient level of pollution reduction, there are two costs: unnecessary costs associated with the use of BAT and the cost (*b*) of not specifying the optimum (E^*) correctly (Pearce, 2000).

³ The term X-inefficiency is derived from Leibenstein (1966).

Figure 2 - Costs of using BAT with regulation



Many governments throughout Asia have opted for CAC over the use of MBIs. Weak enforcement and widespread exemptions have resulted in declining environmental quality (Markandya, 1998). The ratio of proposed cost to least cost reductions in air pollution emissions (particulates and SO_2) is 10 for the People’s Republic of China and 3 for India. In the case of achieving water quality targets in the People’s Republic of China (reducing total suspended solids, chemical oxygen demand and biological oxygen demand) annual cost savings of 70 % are achieved relative to regulation. Table 1 provides more evidence on the ratio of CAC to least cost. The studies are somewhat dated but nevertheless illustrate the potential magnitude of losses to the economy. For example, a ratio of 6:1 tells us that the total cost of a CAC regulation is six times more expensive than the least cost approach. This suggests that resources allocated to pollution abatement could be released for use elsewhere in the economy.

The cost of pollution regulation is often difficult to determine. McClelland and Horowitz (1999) estimate the marginal cost of pollution abatement for pulp and paper plants in the US. Pulp and paper is the largest water polluting industry. Actual emissions of biochemical oxygen demand were found to be about 50% of the amount allowed under the Clean Water Act. Why industry incurs the additional costs is not known, although uncertainty and non-smoothness in production are likely causes. Industry attributes the over-compliance to its “good neighbour” policy.

Table 1 - Costs of command and control relative to least cost

Study and Year	Pollutants	CAC	Ratio
		Benchmark	CAC to least cost
Atkinson and Lewis (1974)	Particulates	State plan	6.00
Roach <i>et al</i> (1981)	SO ₂	State plan	4.25
Hahn and Noll (1982)	Sulphates	State plan	1.07
Krupnick (1983)	NO ₂	Standard	5.96
Seskin <i>et al</i> (1983)	NO ₂	Standard	14.40
McGartland (1984)	Particulates	State plan	4.18
Spofford (1984)	SO ₂	Uniform % reduction	1.78
	Particulates	Uniform % reduction	22.0
Maloney and Yandle (1984)	Hydrocarbons	Uniform % reduction	4.15

Source: Tietenberg 1996

2.3 Market based instruments

Two policy instruments are suggested in Figure 1. Price or quantity can be used to achieve the same result. With perfect information and certainty about the relevant MB and MD functions, a regulatory agency can auction off rights to Q^* and obtains P^* or set a price P^* with the result Q^* - the outcome is the same. One important difference is the revenue effect. With a tax, revenues go to government whereas with quotas, either government could auction them off and get revenue equal to the capitalised value of the tax or government could grandfather them and not enjoy any revenues.

2.3.1 Polluter pays

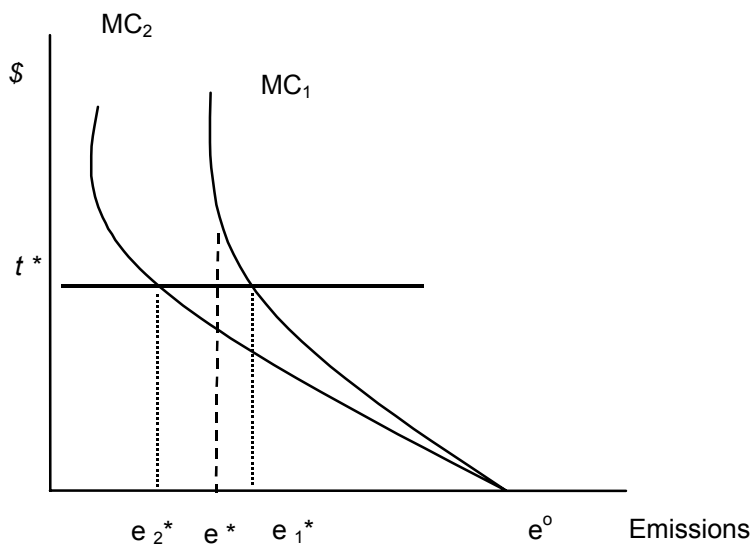
The polluter pays principle, endorsed by OECD in 1972, is a direct descendent of the Pigouvian tax scheme used to establish efficiency within the context of competitive equilibrium. Figure 1 shows how polluter pays would work. Industry's profit maximising equilibrium is B. If a fictional environmental agency were to price use of the river according to the MD schedule then efficiency would result. The agency would only have to set a charge of P^* to achieve the efficient outcome Q^* .

Setting political considerations aside, knowledge of marginal damages is one of the more significant barriers to achieving efficiency. Recognising this difficulty resulted in an alternative approach that seeks to minimise the cost of meeting a standard. Returning to Figure 1, a standard set by the agency is shown as Q_R units of pollution. If the agency set a charge of P_R per unit of pollution then the environmental outcome Q_R would result. Two points should be emphasised. First, it would be highly unlikely that the agency has the information needed to set the efficient target (Q^*). Second, whether or not the target is met depends on the charge – if too high ($P > P_R$) then target will be exceeded, if too low ($P < P_R$) the outcome will not meet the target. The flexibility required to perfectly achieve the target may be difficult to achieve because proposed changes would be decided in the political market.

Economists favour the polluter pays approach, relative to regulation, because it tends to produce the desired result at lowest cost to society and provides an on-going incentive to implement less polluting technology. Rather than trying to achieve economic efficiency the aim is reduced to achieving the desired outcome at least cost to the economy. Figure

3 shows two firms 1 and 2 with an unregulated equilibrium of $2e^o = e_1^o + e_2^o$. Let us assume that the agency wants to reduce emissions to $2e^*$. Requiring each firm to emit e^* will achieve the desired target. This is not a cost-minimising level because the marginal costs of reducing emissions are not equal $MC_1(e^*) > MC_2(e^*)$. A charge of t^* will provide the necessary opportunity cost to each firm. If firm i pollutes then it pays t^* , the alternative is to treat wastes at a marginal cost of MC_i and avoid paying the charge. A charge will result in $t^* = MC_1 = MC_2$ and $2e^* = e_1^* + e_2^*$. The information needed to achieve this result is considerably less than the Pigouvian ideal. The agency need only specify the target $2e^*$ and set the charge. There is no need to know each firm's marginal abatement costs. The agency must of course monitor and measure discharges but there is no a priori reason why this must result in a net cost to the agency over and above the CAC alternative.

Figure 3 - Achieving a target at least cost



A charge levied on polluters for use of the environment provides an incentive to change behaviour in ways that can promote sustainable development. According to the OECD evidence of their effectiveness is given by the higher responsiveness of energy demand to changes in energy prices in the longer than in the shorter run (OECD, 2001). For example, fuel taxes differentiated according to environmental criteria on gasoline (leaded and unleaded) and diesel fuels (ordinary and ultra-low sulphur) have led to a reduction in the use of the most-polluting fuels.

The difficulty of measuring and monitoring externalities has limited the wider application of environmental taxes. Ideally, taxes based on emissions should reflect differences in environmental impacts. Most taxes are levied on the products associated with pollution rather than the environmental impact of pollution. Two diesel vehicles could consume the same amount of fuel – and therefore pay the same charge - but one generates less pollution. In some cases fuel characteristics (eg, sulphur, lead content) may be a reasonably good proxy for the externality.

The idea proposed in Figure 1 shows the tax being directly associated with the level of pollution from the industry. In a real-world situation, the production of externalities arise from particular technologies and behaviour. The environmental tax base can be defined in a number of ways. For example, the tax might be levied on an input or output.

Regardless of whether it is defined on an input (eg, diesel) or an output (eg, sulphur) it is highly likely that the tax is imperfectly correlated with the level of emissions that we want to control. In some cases we can measure and monitor emissions and the best (efficient) solution is to tax emissions provided, of course, the causal relationship with damages is known.

Charges create an element of certainty in prices of the externality but the behavioural response depends on price elasticity of demand and income. For example, in New Zealand the short-run price elasticity of petrol is -0.11 and short-run income elasticity is 0.57 (Hughes, 1980). Although dated, these results tell us that demand is relatively price inelastic and petrol is a normal good. In general, a “problem” with multiple dimensions requires use of a combination of taxes. For example, externalities associated with traffic congestion might be more efficiently dealt with using a combination of congestion pricing and environmental taxes.

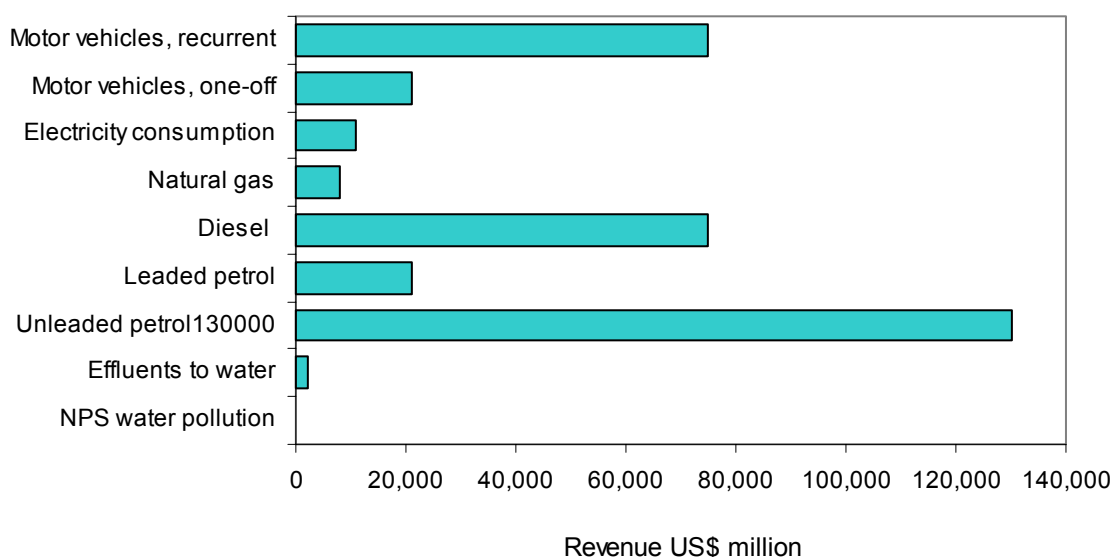
Figure 4 shows that transportation fuels and vehicle related charges provide the largest tax base within the OECD. Thus it would appear that polluter pays has a limited range of use, especially if one considers the possibility that governments may be targeting the tax base simply for revenue raising and not necessarily for improving environmental quality. Environmental taxes per capita are highest in Europe (eg, Denmark, Norway US\$1,200-1,400) and relatively low in the USA and NZ (US\$250).

Choice of the correct tax base is sometimes difficult. For example, consider choosing to levy a tax on diesel. The impact of the tax on environmental quality will depend on the interaction of many variables that are exogenous to the use of diesel, such as climate, neighbourhood and time of day and, the age of the vehicle, its maintenance and driving behaviour.

Conceptually, each variable could act to determine the environmental impact of diesel use. A tax on diesel will imperfectly discriminate among different vehicles and drivers. It is not necessarily true that there will be a trade-off between efficiency and equity. Suppose that a diesel tax leads to efficiency gains by bringing marginal costs and marginal benefits closer together. There is no reason why the tax should increase inequality – this is an empirical issue.

Most stylised versions of taxation show externalities being corrected independently of the effects on the distribution of welfare in the economy. The reason is that this version assumes government makes lump sum transfers to redistribute income and welfare. As Sandmo (2000) points out, the use of taxes is to correct for an externality – one target, one instrument. The difficulty associated with the distribution of welfare is that government does not have the information to individualise lump-sum payments.

Figure 4 - Revenues raised from environmentally related tax-bases



Source OECD 2002

There are, at least, two aspects to the distributional issues associated with environmental policy. To illustrate, consider imposing a tax on diesel and assume that the waste associated with diesel combustion impacts both air and water quality. First, it is quite conceivable that the distributional impact of an increase in air quality will differ from the impact of an increase in water quality. Second, a tax on diesel will have distributional effects that depend on the income elasticity of diesel (impact on households) and the ability of producers (impact on business) to pass the tax on.

A double dividend has been attributed to environmental taxes. The idea behind a double dividend is that if we implement more environmental taxes then other taxes can be cut and this can lead to other non-environmental gains. The underlying assumption is that government revenue stays the same. Economic theory does not give unqualified support to the view that both dividends will be positive. Although this is likely to be the case for the environmental dividend but there is no general case for the tax revenue dividend to be positive. To say anything with confidence requires further assumptions about the initial state of the tax system and the demand interrelationships among goods and services.

2.3.2 Tradable rights

An alternative approach to addressing market failure is to establish a set of property rights that enable markets to develop. The approach is a direct attempt at correcting ill-defined property rights. Once again, we can use Figure 1 to illustrate the idea. Assume that the environmental agency establishes rights to discharge $X = OB$ units of pollution over a given period of time. Firms must hold a right in order to use the environment's assimilative capacity. Rights are assumed to be tradable. From the point of view of economic efficiency it does not matter who gets the initial entitlement of rights, provided they are tradable. Thus, the community (C) could initially hold all the rights $X_C = OB$ and industry have no rights $X_I = O$. Moving from OB, the community would be willing to face pollution to the point where it received compensation equal to MD, industry of course would not pay more than the addition to profit it enjoyed as a result of being able to increase production. Trade would establish $MD = MB$, $X = X_I^* + X_C^* = OB$ and the price of

right would be P^* . A similar result holds if industry initially held all the rights $X_i = OB$. This result is attributed to Coase (1960).

2.3.3 Water pollution

Transferable discharge permits (TDPs) were first applied as an instrument to manage water pollution in 1981. The assimilative capacity of the Fox River (Wisconsin) was inadequate to maintain water quality standards even when point source discharges satisfied federal standards. Additional proportionate reductions were introduced to meet water standards. The TDP system came into operation once this initial allocation of daily pollution was set. In order to achieve a least-cost outcome a policy instrument would have to account for differences in both the impact of discharger wastes and in marginal abatement costs. O'Neil, David, Moore and Joeres (1983) show that TDPs allow annual cost savings of around US \$6.8m relative to a regulation achieving the same standard of water quality.

2.3.4 Air pollution

Tradable rights have proven to be superior to traditional methods for dealing with acid rain in the US. An important departure from traditional CAC was introduced by the Clean Air Act 1990. The Act established the first large-scale environmental policy based on tradable emissions permits (Schmalensee, Joskow, Ellerman, Montero and Bailey 1998). This program was designed to cut acid rain by reducing sulphur dioxide (SO_2) emissions from electric generating plants to about half their 1980 level, beginning in 1995. Legislation established two phases: in phase I total emissions from the dirtiest generating units had to satisfy a fixed cap by 1999; in phase II (beginning in 2000) virtually all existing and new fossil-fuelled electricity generating units became subject to a tighter cap on total emissions. Generating units were given fixed numbers of quantity-based (tons of SO_2) tradable permits following rules that depend primarily on historic emissions and fuel use. The allowance can be used in the year issued or banked for use in any subsequent year. Auctions were used in subsequent years to allocate permits. The SO_2 program not only over-achieved the emissions cap, but it did so without extensive litigation and at costs lower than had been projected. It took a number of years for a "competitive" market to develop and the development may have been sensitive to program design. Schmalensee *et al* (1998) note that the program rests on accurate monitoring and enforcement of the property rights involved.

2.3.5 Pricing access to natural resources

Pricing access to natural resources can be achieved through tradable rights.

Water rights

In New South Wales, the Water Management Act 2000 introduced licences for 10-year periods. The terms are the same for all users. The regulated river licences are either high security or general security. High security licences get 100% of the entitlement in all but bad drought years. General security licences get an allocation each year, which is less than 100% of the entitlement. This is determined and announced annually based on storage volumes. Water licence costs are determined administratively by the Department of Land and Water Conservation (DLWC). The Natural Resource Pricing Unit is currently preparing a submission to the Independent Pricing and Regulatory Tribunal so it can set

licence fees (DLWC is a monopoly). Price is set at a maximum of the cost of delivery and it varies from valley to valley. Prices on the temporary and permanent transfer markets are set by the market (in addition to government water charges) and are generally well in excess of water charges.

Water can generally be traded within a valley subject to some geographic rules. Once water is available, licencees have the choice of using or trading their water (temporary transfers). Redistribution is on a commercial basis – it goes to the highest bidder. Licences can also be traded permanently. The Department plays a limited administrative role in the water market. Restrictions in flow or other “natural chokes” can limit transfer. There are many traders/brokers in the industry.

In NSW, Victoria and South Australia markets are developing quickly. For example, the Central Irrigation Trust offers 1,2,3,5, and 10 year leases through their water exchange. Internet exchanges exist, and broker services are available. Most trades are temporary and prices reflect variations in duration. Producers of grapes and citrus require long-term secure access to water. Farmers producing annual crops such as rice and vegetables are happy sourcing their water from temporary markets. Interviews with buyers and sellers in Victoria, NSW and South Australia indicate that up to 65% of irrigators who lease out water rather than selling it, do so because they believe that the value of their property will be disproportionately affected by sale. A similar proportion of buyers lease water simply because they cannot afford to buy water. Policy uncertainty is another factor influencing temporary trades. Uncertainty arises over environmental standards and Native Title. These uncertainties are reflected in the lower price of permanent water.

The Murray-Darling Basin Commission implemented an inter-state water trading trial in 1998. The first permanent inter-state trade was completed in September 1998. Over the next two years, 51 transactions have seen a total of 9.8 GL has been traded among states (Young, MacDonald, Stringer and Bjornlund 2000). The total value of the trades exceeds A\$9.9 million, more than 90% of the water has moved to South Australia. The volume traded represents about 1% of the total water applied in the area. Intra-state trading drives the market for water.

The existing arrangements for inter-state trade are complex because it involves transferring an entitlement to water among quite different licensing systems. It can take up to 32 days to settle. In part this arises out of differences in water legislation across states. Exchange rates – that take into account losses through transmission in the river channel and losses in changes in the security of supply of water resulting from transfer - add a layer of complications. For example, to protect supply security trades involving sellers in SA Murray (high security) to NSW Murray (high security) occur at 0.9. Brokers argue that establishing a simpler, quicker and more transparent water registration system is the most pressing issue in lowering the transaction costs of trade.

Inter-state trading is increasing the value of water in the Murray-Darling Basin. Almost 90% of the water sold was not being used by sellers. Most of the water has gone to high value uses. Around three-quarters has gone into new irrigation development using state-of-the-art technology. In South Australia, water prices have ranged from \$500/ML to \$10,000/ML in the McLaren Vale. Murray River licenses in South Australia are currently trading for \$1,000 to A\$1,500/ML. Wine is the key driver. Although water is key to wine production, water costs are a small proportion of production costs – 5-20% for grape growers.

Inter-state trading has produced no measurable adverse social impacts. The environmental impact has “probably” been positive but the volume traded is small in flow terms. Over the long-term inter-state trading is expected to increase river salinity and the impact of trade on the environment will depend on the environmental standards in place and their enforcement.

Brozovic, Carey and Sunding (in press) report on water trading in the Westlands Water District in California. Water is allocated according to a priority system – first in time – senior rights through more junior rights where right holders get their water only after the more senior claims have been satisfied. The system is hierarchical and analogous to a queuing system. One of the distortions to occur with this system of allocation is that junior right holders – who often own superior quality land – are unable to obtain secure rights to grow high value tree crops. There are few administrative barriers to trading and an informal market has developed. By informal, it would seem that farmers must locate potential trading partners – this distinction is not particularly significant because presumably brokers would fill the gap if there was money to be made from a more formal market.

During the 1993-96 study period 10-14% of the district’s total allocation was traded. Trading patterns suggest that some farmers rely on the water market to allow production choices that would not otherwise be feasible. Brozovic *et al* conclude that the large volume of water traded suggests large benefits to those farms participating.

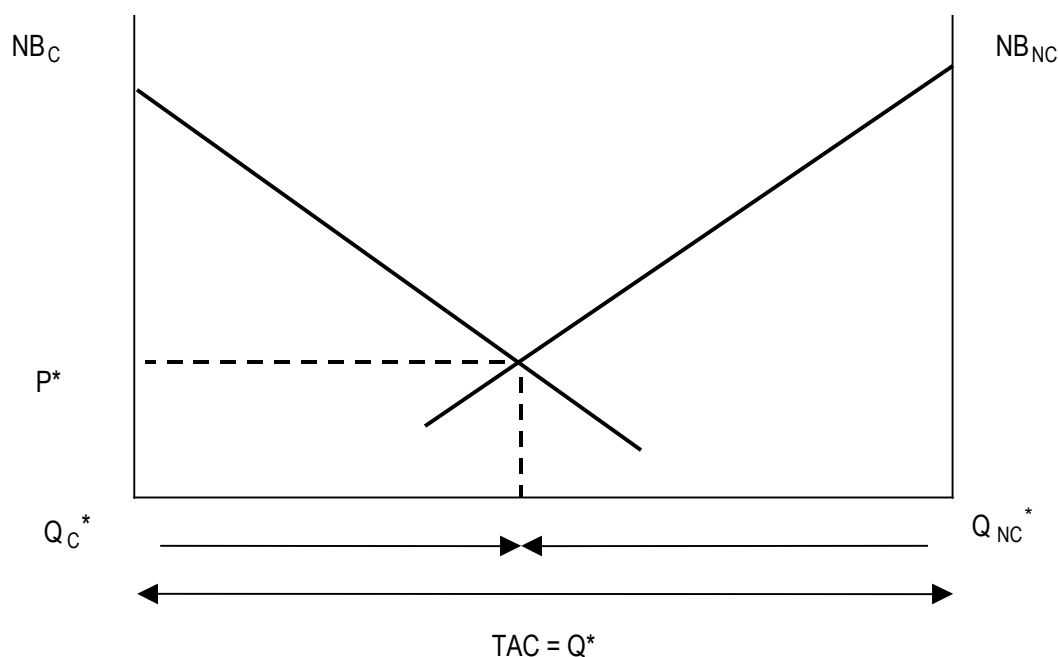
One prerequisite for water marketing is that the right to water can be bought or sold separate from ownership of the land. In Chile, Easter, Rosegrant and Dinar (1999) report on gains from trade – measured as the difference between the value of water to the seller before the sale and the value to the buyer after the sale - for agricultural purposes (urban supplies were adequate) in the order of US \$2.47 m³ with a transaction cost of US \$0.069 m³. In California transaction costs were US \$0.041 m³ in 1991.

Fishing rights

New Zealand’s quota management system (QMS) is a world-leading model of a rights based system of management in which profitable enterprise can operate within the constraints of sustainable harvest (Sharp, 2002). With respect to individual quota, competition will ensure that the more efficient firms get to harvest fish. Furthermore, the market value of quota provides summary information about current conditions and future expectations in the fishery (Batstone and Sharp, forthcoming). The basic idea of the QMS is illustrated in Figure 5 using a shared fishery.

Each year the Ministry of Fisheries sets a total allowable catch $TAC = Q^*$ and after making an allowance for recreational and cultural needs, sets a total allowable commercial catch (TACC). Fishers hold a proportional right to the TACC. Full economic efficiency depends *inter alia* on whether Q^* maximises rent and net-benefits across competing interests are equalised. If the right to harvest is not differentiated, then competition will result in a uniform price P^* . Commercial fishers will harvest Q_C^* and the non-commercial Q_{NC}^* . Provided the TAC is set at the optimal level Q^* use of the right is immaterial to achieving efficiency. In the uncertain world of fisheries management it is highly unlikely that Q^* will be discovered.

Figure 5 - Tradable rights to sustainable harvest

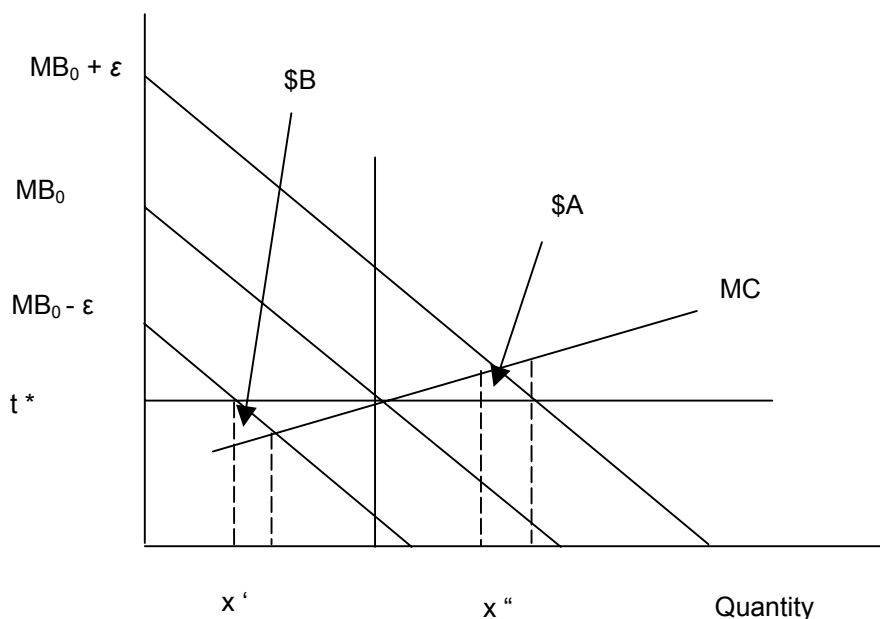


2.4 Uncertainty

Weitzman (1974) examines the choice between prices and quantities of MBIs under uncertainty. Although we could account for uncertainty in an Arrow-Debreu framework by designing a tax schedule that is contingent on stated outcomes it would be complicated and difficult to implement. In practice a tax schedule (eg, \$ per tonne of SO_2) or quota (eg, total allowable discharge of SO_2) has to be fixed *ex ante* without knowing the exact nature of the costs and benefits. For example, it might be that climatic conditions are stochastic and impact the relevant cost and benefit functions. Weitzman shows that instrument choice cannot be settled definitely in favour of either prices or quantities. Choice depends on the relative slopes of the cost and benefit functions.

Figure 6 shows marginal external costs (MEC) increasing with output. Marginal benefits (MB) are stochastic and each state occurs with equal probability. Expected welfare is maximised where $MB = MC$ and the Pigouvian tax should be t^* . Now let us assume *ex post* that $MB = MB_0 + \varepsilon$ consumption is x'' and the efficiency loss will be \$A. This arises because the tax rate is set *ex ante* instead of *ex post*. Alternatively we could use quota of q^* which maximises expected welfare. However if $MB = MB_0 + \varepsilon$ obtains then the efficiency loss is \$B. In this case the tax turns out to be superior than quota. Relative efficiency can easily be reversed by simply rotating MEC anti-clockwise around point e, \$A will increase and \$B decrease. The general Weitzman result is that taxes are preferred if $|\text{slope MEC}| < |\text{slope MB}|$ while quotas would perform better if $|\text{slope MEC}| > |\text{slope MB}|$. It has to be remembered that either instrument has to be implemented before the future state of the economy is known. While the result is useful it should not be interpreted as an argument against the use of MBIs because quota in the example could easily be interpreted as regulation.

Figure 6 - Welfare losses with ex ante taxes and quota



2.5 Removal of subsidies

Panayotou (1996) reports estimates of subsidies worldwide that amount to about 5% of the world's GNP. He estimates that removing one dollar of subsidies generates 24 cents of reduction in environmental damages. Price support programs work to alter relative prices faced by producers and consumers. While these programs may lead to increases in production they can result in at least two externalities. First, subsidies accelerate resource use and depletion. Second, spillovers are likely to be associated more intensive resource use. For example, subsidised irrigation development can lead to excessive use of water, higher inputs of fertiliser into the ecosystem and more livestock waste. The range of possible subsidies is large and includes market price support, payments for production, input subsidies, income payments, and subsidised access to natural resources.

Explicit financial support to promote and encourage activities that contribute to positive environmental outcomes is often argued – for example, flood control services, landscape protection, wildlife habitat and creation of marine reserves. While these subsidies may be effective in the short term they dampen innovation and increase demand on government revenue. In principle it might be possible to target subsidies to the more efficient providers so as to minimise market distortions and avoid permanently subsidising the costs of meeting environmental standards.

A major obstacle to subsidy reform is the rent that producers derive from their supply. For example, if water is delivered free to agriculture then its value will be capitalised into the value of land. Often the benefits of reform are dispersed while the welfare loss is concentrated. For example, a common problem with irrigation development is that users derive economic benefit (capitalised into land values) from un-priced water yet users of water *in situ* tend to be dispersed (anglers, recreational groups, etc).

2.6 Community based initiatives

The answer to a simple question: “who should provide public goods?” has not yet received a satisfactory answer (Itaya, de Meza and Myles 2000). National Parks in the US are supported by voluntary contributions but in New Zealand they are almost entirely financed by government. The early literature assumed consumer utility was derived solely from the total quantity of the public good and that there is no benefit *per se* from the level of individual contribution. The idea of “warm-glow preferences” grew out of the idea that a contribution to the public good (eg, species preservation) generates utility over and above the additional level of the public good. Thus consumers are seen to derive utility directly from the act of charity. A further and related refinement looks at the extent to which consumers take into account the implications of their choices on government revenue and spending decisions. Labelled “see through”, this assumption recognises the ability of consumers to anticipate a significant reaction from government. Consumer see-through in the case of a donation to a national trust to preserve species would differ according to whether the trust operated at a national or local level. One would expect see-through to be greater at lower levels. The action of a single individual would probably have little impact at the national level. Even with these refinements to models of public goods it is not possible to generalise on the optimal mix of government to private contribution to a public good. Much depends on whether private contributions and government expenditure are equally efficient in generating public goods.

The provision of environmental services outside the government sector can be analysed using a model developed by Weisbrod (1975). Using a three-sector model he identified factors determining what goods will be provided by government, by private (for-profit) markets and by voluntary (non-profit) markets. Weisbrod allows any tax (or user charge) system provided the system does not permit every consumer to equate their tax liability with his or her individual marginal benefit. This effectively excludes the possibility of a Lindahl equilibrium. The assumption also excludes vote trading, bribes or log rolling if the effect was to leave each person with a net tax price equal to their evaluation of the marginal output.

Government is assumed to supply a quantity X as determined by the demands of the median voter. Therefore, if consumer-voters know the rule by which government will allocate costs among them, their utility functions will generate a set of demand functions for government provided goods. The inability of government to tax/charge individuals at their marginal valuation is vital to Weisbrod's model because it means that some voters will receive marginal benefits from the collective-consumption good that exceed marginal tax, others will receive marginal benefits that are less than the marginal tax. To simplify the exposition, Weisbrod assumes: 1) there are 7 voters, each with a different demand D_i for water quality (X); 2) the tax-finance rule specifies that costs are borne equally which implies that the marginal cost of supply is a constant; and 3) each voter pays the tax paid by the median voter, who has demand D_4 . To simplify the illustration let us assume that demand by voters 5 through 7 is such that $D_7 > D_6 > D_5$ and demand by voters 4 through 1 is $D_4 > D_3 > D_2 > D_1$ over all X .

Figure 7 - Dissatisfaction with public good provision

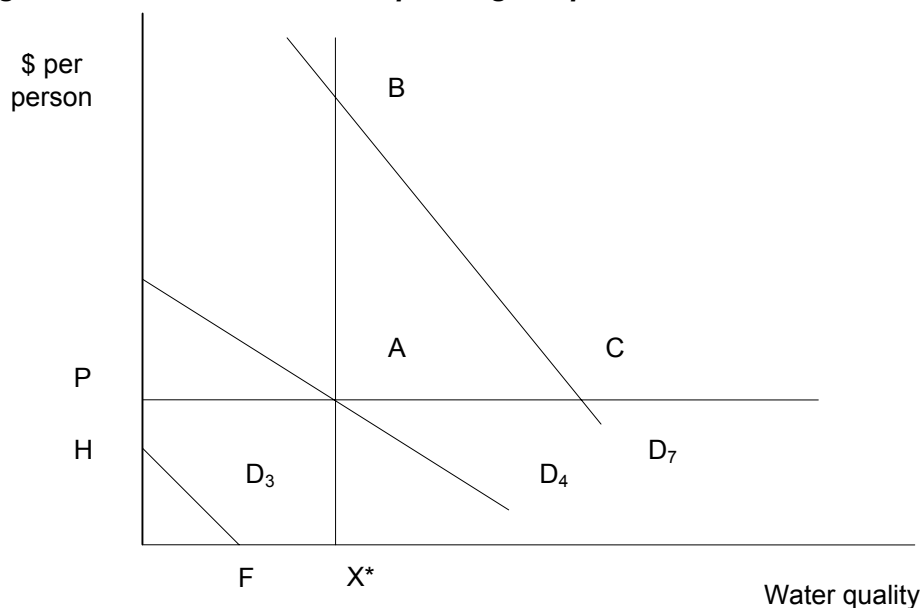


Figure 7 shows each person paying \$P per unit of output. The majority (persons 4-7) prefer to improve water quality (WQ) to X^* . A minority (persons 1-3) prefer to reduce the tax and would prefer a lower level of WQ. In contrast, persons 5-7 would prefer to increase tax and a higher level of WQ. Assuming a majority voting rule, person 4, the median voter, rules the day. Notice that the intensities of dissatisfaction vary. For example, person 7's dissatisfaction with X^* is given by ABC and person 3's dissatisfaction is measured by PAX^{*}FH.

If the supply of WQ is institutionally constrained to be either public or private sector, choice might well be sub-optimal because of an adjustment to the non-optimal level of provision of the public good by government. Individuals are left in non-optimal positions in both private and government markets. For example, X might describe water quality at a local beach. If supply is determined by the median voter then X^* will prevail. Weisbrod suggests that dissatisfied members of the community can take a number of actions.

They can migrate to another government jurisdiction in which the output and tax pricing system improves their economic welfare. This follows the Tiebout (1956) hypothesis. Therefore, some over satisfied and under satisfied consumers may choose to vote with their feet. Those who are willing to pay for more of X may lobby to form lower levels of government. Dissatisfied community members can look to other means of WQ.

The homogeneity of the voters within the political system is an important determinant of the relative number of people desiring change. The more homogeneous the voting group - in terms of tastes, incomes, wealth, etc - the smaller will be the expected variation in individual demands and therefore, the smaller the likely degree of dissatisfaction with the level of X.

Contract failure offers some insights into why non-profit organisations are common in the provision of public goods. We use lake management as an example. Recall that a public good has two attributes. First, the marginal cost of additional consumption is zero, once the good has been provided. Therefore, if a non-profit organisation improves water quality by an additional unit then, in the absence of congestion, an additional visitor to a lake can derive utility from this improvement at no added cost to the organisation. Second, for reasons of economic efficiency each individual should contribute his or her

marginal valuation. But there is no incentive for the individual to do this because the amount contributed is so small relative to the total that the person's non-subscription would have little impact on total supply. The individual can free ride which suggests that the private market is an inefficient means of providing the goods and services.

Why could we not expect the use of for-profit organisations in lake management? A for-profit organisation would have an incentive to get as much money as possible and distribute this to its owners. However, with a non-profit the supplier of money is assured that the money will in fact be used for the service and not for profit disbursement. The problem relates to the indivisible nature of the service involved. Assume that we are dealing with water quality. There is no obvious connection between a dollar contributed and water quality. But, this being so, the contributor can be assured that the dollar contributed will in fact be used for water quality improvement. If the individual could ascertain the incremental amount of water quality provided by the contribution then there is no *a priori* reason why non-profit should be preferred over for-profit organisational form. Free-rider refers to the lack of incentive to contribute to the cost of the public good. Whereas contract failure refers to the inability to control the use of monies obtained from contributions.

Hansmann (1980) argues that non-profit organisations are a response to contract failure. Another interesting issue becomes apparent when we follow this line of reasoning further. Each individual could set up a contract with the organisation to prevent profit disbursement, which places the costs of contracting and policing on the individual. With a non-profit organisation, the state and members of the community can take action if management compensates itself too generously. In this light, the non-profit is a means of economising on the transactions costs of contracting and enforcement. Transaction costs are minimised by putting them under one umbrella organisational form. The contract is determined by the state's corporate law and policed by the state. Therefore, rather than requiring each organisation to set its own rules, the state is able to set the broad parameters under legislation thereby economising on transaction costs.

2.6.1 Other initiatives

Initiatives undertaken by firms and groups are important for diffusing improved environmental practices. Increased attention by firms to their environmental and social performance often reflects market pressure and many are beginning to incorporate triple bottom line reporting.

Corporate codes of conducts are within firm initiatives for sensitising employees, suppliers and contractors to management's expectations concerning environmental and social performance of the enterprise.

Negotiated agreements involve voluntary adherence to a public program or a negotiated commitment for specific improvements. Agreements are typically self-monitoring and non-binding which may lead to concern. Negotiated agreements often suffer from weak controls, free riding, high transaction costs and regulatory capture (OECD, 2001). However these agreements may contribute to raising awareness and disseminating information.

Voluntary agreements can play a role in improving environmental quality. Economists have traditionally taken a sceptical attitude to the idea that persuading people to change their behaviour can correct externalities. The standard objection is that individuals with stable preferences will change behaviour only if incentives change. If environmental

quality is in the nature of a public good then the incentive to protect and improve environmental quality on a voluntary basis is dilute. However people do volunteer, recycle and join in to clear the litter of others. Of course, preferences can and do change as individuals receive information but the incentive problem remains. Even if consumers are aware of global warming is this sufficient to get them to switch to alternative modes of transport?

Information programs can play a role to increase awareness and action by consumers to reduce the environmental impact of their consumption patterns. These initiatives may include eco-labelling and certification schemes.

2.7 Conclusions

Economics provides a conceptual and analytical framework for developing and applying market-based instruments to environmental externalities. The efficient price of pollution exactly balances marginal damage with marginal benefit. Looked at another way, the marginal cost of abatement equals the marginal benefit associated with pollution reduction. In order to achieve the efficient outcome, we need information on both costs and benefits – both sides of the “market” must somehow reveal these data.

Turning to the practical aspects of policy, the cost of abatement should in principle be known to industry and it is plausible to assume cost-minimising behaviour. When faced with a price for pollution individual polluters will seek less polluting technology, including adjusting management. Obtaining information on the damages avoided is not as straightforward. Damages are measured in terms of their impact on the welfare of consumers and producers. Furthermore, the damage estimate is assumed to include different spatial and temporal impacts. Obviously, the benefit side of the equation is absent in real world settings. Unlike costs, there is no market mechanism in operation that we can rely on to signal the value of damages avoided.

We cannot assume that the environmental regulator is omniscient. Although practical policy might – and indeed should be – guided by estimates of value we are left with a “second-best” approach where a standard is set. This issue is how best to achieve the desired standard. Historically, central and local governments have relied primarily on regulations to meet their environmental goals. From the outset we must note that both CAC and polluter pays require a standard. Governments usually set standards after considering scientific evidence and stakeholder preferences. Thus the issue for sustainable development is whether or not a policy instrument achieves the standard at least-cost. To do otherwise unnecessarily increases expenditures in the present. Regulations that impose a technology on industry will not adequately account for the heterogeneity of firms nor will the imposed technology minimise cost. Regulation will not produce the desired outcome at least-cost. Empirical evidence supports this conclusion.

If we step away from the Pigouvian ideal and admit the practical (costly) difficulty of measuring damages then the damage function can be thought of as a target (ie, a vertical line in terms of Figure 1). Policy makers have a choice of using a pricing instrument or quota. Polluter pays provides an opportunity cost to the polluter that acts as an on-going incentive to implement less costly abatement technology.

Defining tradable rights to the standard provides similar incentives. Tradable permits provide a degree of certainty over achieving environmental outcomes, provided of course, enforcement is effective. Defining the permits as shares – as opposed to a quantity –

provides flexibility for temporal adjustments to the target. Factors limiting the use of tradable permits include complexity of establishing a functioning market; agreement on how to initially allocate rights; and, concerns about market concentration. In contrast, although polluter pays may prove easier to set the initial “price” this price may not result in the environmental outcome desired. Getting price adjustments through the political process might prove difficult.

Economic instruments produce a richer response on both sides of the market. For example, a tax on the sulphur content of fuel would work on both sides of the market, consumers would be encouraged to save on fuel and producers encouraged to supply lower sulphur fuels. Tradable rights also create incentives. For example, the cost of TDPs would become an integral part of the cost of production – firms will face an incentive to develop and use less-polluting technologies and consumers of the product will have to at least meet the additional cost of production.

There is no blueprint or algorithm to follow when considering whether to regulate or turn to market-based instruments. Good economic reasons might exist for adopting regulations. For example, diffuse non-point sources of pollution are difficult to tackle using market based instruments. Technology will continue to offer scope for switching from regulation to market based instruments. For example, road access is electronically priced in Melbourne, some cities overseas are seriously considering pricing access to storm water, the technology exists to price vehicle emissions, and so on. Analysts and policy advisors must first be able to characterise the problem and carefully weigh-up the relative merits of each approach. Furthermore, choice between taxes and quotas as instruments of pollution control should be sensitive to the nature of the uncertainties involved.

This section has shown how better defined property rights can make a significant contribution to sustainable development. Devolving rights to communities, empowering them to “manage” the local resource, providing technical (and possibly financial) assistance, is a powerful instrument. There are good working examples of how devolution to non-government organisations has produced significant environmental gains.

In conclusion, market based instruments score relatively highly in terms of sustainable development. Concepts such as total economic value and concern for future generations can be directly addressed and incorporated. Within the generic set of options laid out above, there exists a huge range of potential applications. Discovering the most appropriate instrument can only come about from careful analysis. Ill-conceived proposals for the use of MBIs will not gain the acceptance needed for implementation.

3 Institutions and sustainable development

In Sharp (2001), sustainable development was shown to encompass four categories of capital, concern for intergenerational equity and the explicit recognition of total economic value. The instruments discussed in Section 2 provide a basis for the formation of policies for sustainable development. Understanding the mapping of policy instruments (MBIs and CAC) into economic and environmental outcomes is crucial to providing a foundation for sustainable development. Policy instruments belong to the set of institutions that exist within New Zealand society. The set of institutions (S) refers to the laws, rules, and restrictions that directly and indirectly constrain the opportunity sets and influence the decisions of individuals within society. Institutional structure includes all the formal and informal rules that provide opportunities for economic growth including rules that work to influence the actions of people where externalities are involved. For example, rules governing the use of water sit alongside rules protecting environmental interests. Property rights associated with water use combine with laws and rules governing the formation of irrigation companies, contracts governing the supply of inputs to and outputs from agricultural firms.

This section is aimed at providing a basis for assessing the quality of institutional arrangements and decision-making structures within the framework of sustainable development. At a conceptual level, we have the following relationship:

$$Q = f(P,S,R)$$

where:

Q = set of sustainable development indicators;

R = resource endowment;

P = preferences of people, objectives of firms and agencies; and,

S = institutional structure.

In the context of sustainable development, we are interested in the relationship between indicators of sustainable development Q and the variables R, S and P. For example, $q_w \in Q$ might represent the flow of economic benefits associated with water allocation (use and nonuse) (R), regional water allocation rules (S) and the preferences of individuals and firms (P).

3.1 Institutions and sustainable development policy

Institutions provide a fundamental link between sustainable development policy and public sector organisations, commercial organisations, communities and individuals. Looking at the Resource Management Act we see that its purpose is to promote the sustainable management of natural and physical resources. This is not to say that parliament-made rules are primal source of society's institutional framework.

Kasper and Streit (1998) distinguish between external and internal institutions. External institutions are imposed on society by political action. External institutions can be procedural rules that instruct agents of government on process, consultation, and so on.

Because they are prescriptive, external institutions place a high requirement on information and knowledge. For example, water pollution might be governed by rules that instruct public sector officials to set standards at a predetermined level. Officials then set limits on discharges that are considered to bring about the predetermined outcome. External institutions can also provide a platform for decentralised decision-making. For example, New Zealand's quota management system is an external institution that provides the basis for the trade of rights to harvest fish.

Internal institutions evolve within a group or community as a result of experience. For example, quota owner associations are internal institutional arrangements that evolved as a result of a group forming to protect and enhance the value of quota rights.

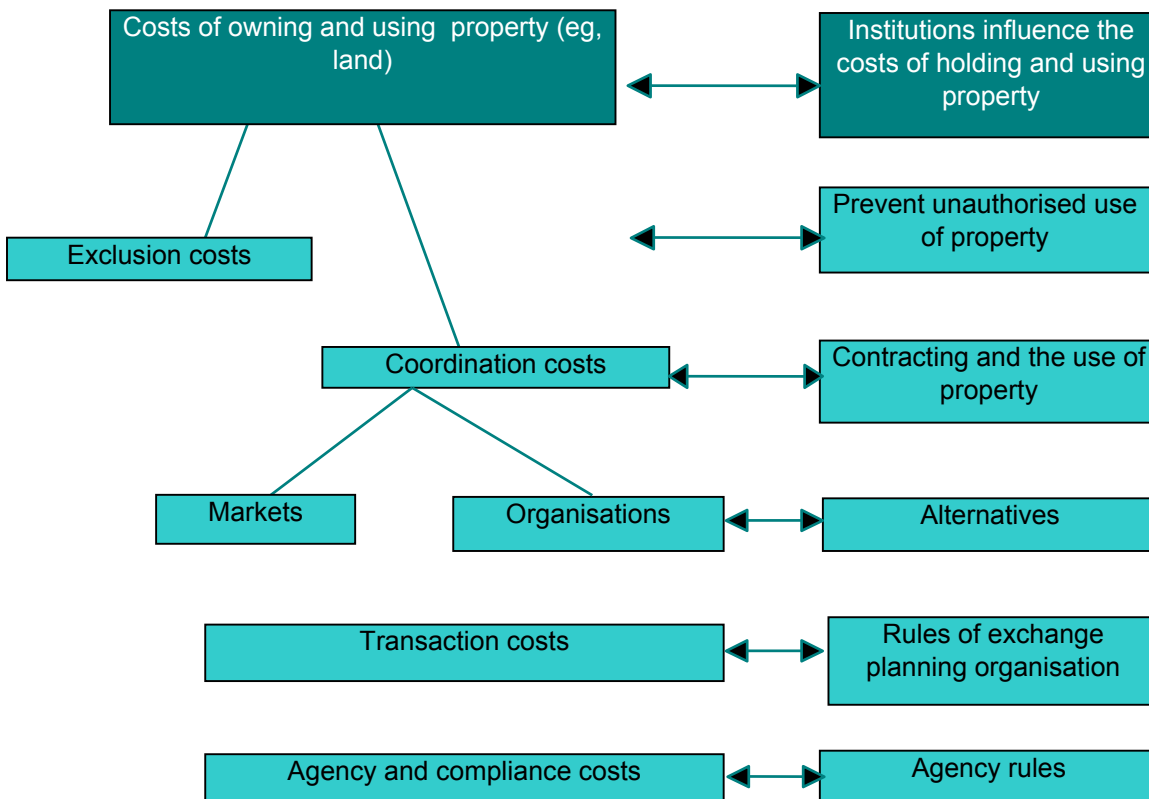
Philosophers such as John Locke and Friedrich Hayek emphasised that the structure of politically determined institutions (external) had to rest on internal institutions such as conventions about behaviour, custom and manners. External institutions are designed and imposed on a community by government with the political power to coerce. Institutions constrain opportunistic behaviour and carry sanctions for breaches of the rules (North, 1990; Ostrom 1990). External institutions imply a degree of hierarchy, formal sanctions exist for violating the rules (eg, a firm caught violating the conditions of its discharge permit) and are often backed-up by a third-party (eg, civil law).

At the most fundamental level, institutions can be thought of as rules that apply to the community. In a narrow sense, institutions provide a set of rules that govern market exchange, the supply of services from government and the distribution of goods and services in the economy (Davis and North, 1971). These rules can be the product of parliament (eg, Resource Management Act) and regional government (eg, pollution regulations in a Regional Plan), the Environment Court (eg, a ruling on best management practices), company-specific rules (eg, a stock enhancement company's rules on quota violations), rules set by government to guide the management of a community resource (eg, coastal care groups), and so on.

In the context of sustainable development some of the major reasons given in the literature as to why governments become involved in designing and imposing institutions include the so-called "tragedy of the commons", which arise because of ill-defined property rights; attempts to overcome the problem of free riding assets that have indivisible costs or benefits, where exclusion is difficult; and, the provision of a basis for people to make credible contractual commitments that can be enforced by third parties.

In most modern economies, significant resources are used to coordinate the activities of individuals, firms and units of government. According to Arrow (1969) coordination costs are simply the costs of running the economic system. Figure 8 illustrates the costs of owning and using property.

Figure 8 - The cost of owning and using property



The above distinction (external/internal) is useful if we link the external rules (which are controllable to varying degrees by policy makers) to observable sustainable development outcomes. For example, in principle it should be possible to link regional rules governing land development with economic benefit - net of development costs, opportunity costs, external costs and compliance costs. In addition, external institutions also provide an opportunity for innovation and wealth creation by providing a basis for the development of new, possibly internal, institutions and unleash a dynamic that fosters sustainable development.

3.2 Institutional structure

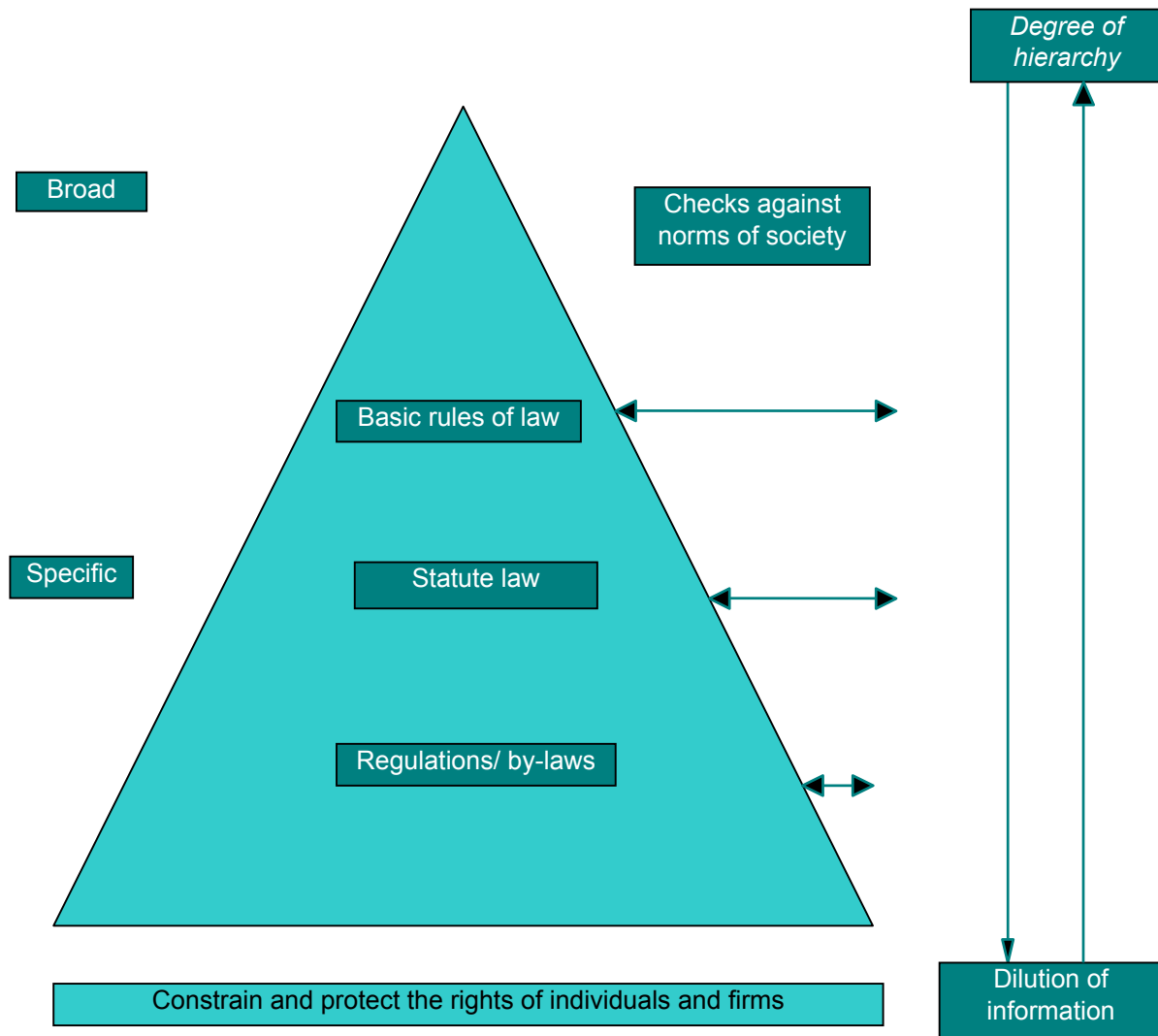
In the case of environmental externalities, information on willingness-to-pay and opportunity cost will not directly emerge from the market. As was noted in Section 2, the market price of goods and services will not signal the relevant marginal cost of using the environment - information that the objective of efficiency is sensitive to. Information costs are important when analysing the relative efficiency of alternative structures for controlling externalities. What organisational arrangement will produce information about the costs and benefits of environmental management most efficiently?

3.2.1 Hierarchy

Hierarchies of external institutions consist of rules at a number of levels. Figure 9 shows a hierarchy of rules, beginning with a written constitution (which NZ does not have); statute law and regulations at the bottom. The hierarchy provides a basis for private contracts that occur at a decentralised level and how they are to be interpreted should

disputes arise. Hierarchies of this nature provide a basis for creating order and maintaining consistency over time.

Figure 9 - Hierarchy of external institutions



Hierarchies are characterised by status and authority being ranked vertically. The key function for a hierarchy of rules is to provide a basis for the evolution of internally consistent rules and governance. Higher order institutions (eg, Resource Management Act) provide a framework confining change and laying out how changes should be made at lower levels (eg, rules specified in regional plans). This is essential for a predictable functioning of the institutional system over time. A lack of hierarchy can inhibit institutional evolution and result in uncertainty.

3.2.2 Locus of control

When considering the institutional structure for dealing with the problem of externalities it is natural to ask: at what level should the environmental externality be resolved? To examine this question let us assume that non-point sources of pollution are having an adverse effect on the water quality of lakes in region 1 and region 2. Should pollution control activity be decided at the central or local level? To examine the arguments for and against national control of pollution let us assume:

$y_i = F_i(x) =$ net output per capita, where $F_i(x)$ is unique to local environments, $i = 1,2$

$p = (p_x, p_y) =$ price of pollution and net output, $p_y = 1$.

To begin, let us restrict our attention to region 1. Efficient use of the environment is priced at p_1 where the price of pollution $p_1(x_1)$ equals the marginal value productivity of pollution ($F'(x_1)p_1$). If we now consider two regions 1 and 2, located at their respective optima x_1 and x_2 , we see that region 2 has lower pollution control costs because $p_1 > p_2$. However optimality for each local region is given by:

$$p_x^1 = MP_{x_1}^y, p_x^2 = MP_{x_2}^y \text{ and } p_x^1 > p_x^2 \Rightarrow MP_{x_1}^y > MP_{x_2}^y$$

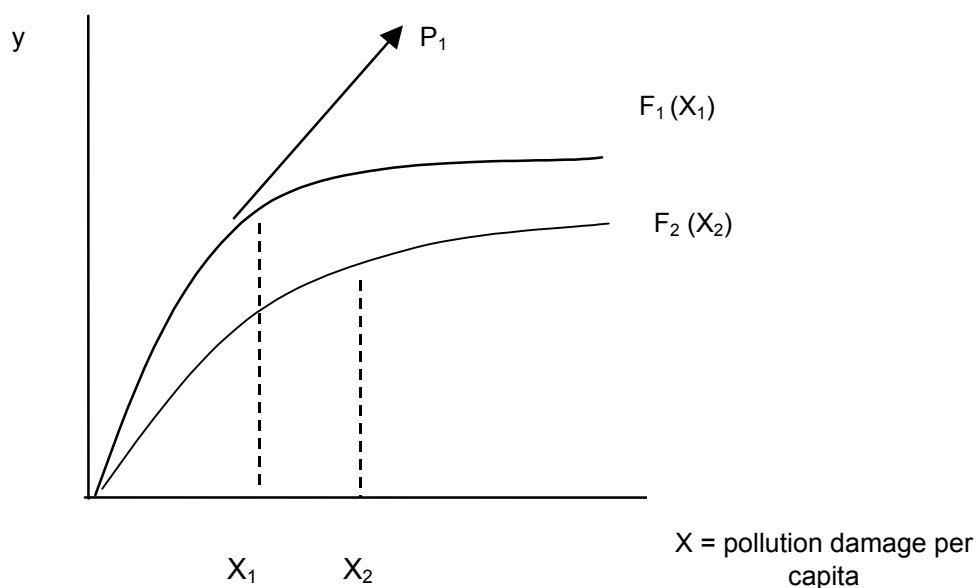
which violates the necessary conditions for Pareto optimality. In other words, pollution producing activity should be shifted from region 1 to region 2 because this will result in a smaller sacrifice in output in order to achieve the same level of environmental quality. Achieving equality in prices may be difficult because each locality might consider the adjacent community's environment as a free good. The threat of relocation is considered as an argument in favour of central control. For example, assume that region 1 proposed a levy of p_1 so that X_1 could be attained. A large industry could act as a monopsonist and threaten to relocate which could lead to a decrease in regional welfare. This threat would be less credible if a national levy on pollution was implemented.

The strength of the argument for a national environmental pricing policy depends on the public good nature of the externality. If there are no spillovers between regions then there is no need for the price of pollution damage to be the same in the two areas. Even if regional interdependencies require identical prices for pollution damage this does not mean that regions should levy the same price on emissions. Differences in the relationship between emissions and damages may require different charges on emissions. The apparent economy of information is perhaps the strongest argument in favour of local control. In any event, if the Teibout (1956) hypothesis is accepted then relocation will tend to bring about national price uniformity in the long run.

If we were to vary population, incomes, tastes, topography, climate and so on, both price and quantity could be expected to vary across regions. Information on the equilibrium will not come cheap and we might ask the three questions which arise from the model shown in Figure 10. Will evaluation of costs and benefits be more accurate if made the responsibility of localities experiencing the costs and benefits? How will the correct price be determined? What is the cost of providing the information?

The logic of this model suggests the outcome associated with local decisions is efficient and the organisation need know nothing about the price attached to pollution elsewhere. Furthermore, a net-benefit maximising government organisation would not impose a different set of prices. Efficient pricing is therefore consistent with both state and local control and the issue becomes: which form of control is likely to yield more accurate information on costs and benefits?

Figure 10 - Central or local control



The public good nature of the output (cleaner air) requires local decision making to consider those significantly affected by pollution. Unless it is a national externality, such as might exist with an endangered species, then it would appear that local organisations should be more efficient. In addition, it is plausible that local organisations have a comparative advantage in obtaining information on preferences and implementing decisions, provided of course, they are so empowered. However, there would be situations where economies of scale associated with certain projects that would give a national-level agency a comparative cost advantage. For example, although it might be reasonable for all ports to have an oil-spill strategy it would probably make sense to share the burden of supplying the necessary clean-up technology.

3.2.3 Subsidiarity

Looking elsewhere for models dealing with the question of central or local control we find similar arguments emerging over the principle of subsidiarity. Van den Bergh (1996) proposes fundamental questions about the role European institutions are playing and about their capacity to exercise power in a way that enhances economic welfare. Arguments in favour of decentralisation derive from the Tiebout (1956) hypothesis that individuals and firms will vote with their feet by moving to jurisdictions that best suit their preferences. Arguments in favour of decentralisation are listed below.

In practice there is a need to cope with informational asymmetries between regulatory authorities and regulated firms. Regulatory authorities (principals) may have an informational disadvantage *vis-à-vis* the firms (agents) they seek to regulate. For example, polluting firms may not fully reveal information on their emissions to the environmental agency. Monitoring and auditing will of course limit non-disclosure but this comes at a cost. Although information asymmetries might suggest greater decentralisation there remains a possibility that the benefits gained from a reduction in information costs are outweighed by regulatory capture. Regulatory capture can be attenuated by improving accountability either through the competitive market mechanism or through the political process to the general public; promoting a degree of operational independence from politicians; and improving the transparency of process and linking actions to outcomes.

Differences in rules provide an opportunity for “learning from doing”. For example, two jurisdictions might approach the control of point sources of water pollution using two different instruments - A might choose to use transferable discharge permits while B chooses to use polluter pays. Provided we can adequately control for other differences a cross-jurisdictional comparison might provide useful information on the design and application of MBIs. We might also learn why firms choose to locate in one jurisdiction over another.

Arguments in favour of centralisation are based on the existence of externalities, scale and transaction cost economies and game theory.

Central rule making might be more appropriate if there are significant spillovers between jurisdictions. If there are significant economies of scale (falling average costs) associated with governance and the provision of services then centralisation may be required. Scale economies may be important in the production of information needed to formulate and enforce rules. It should be noted that contracting out provides an opportunity to substitute for centralised production. For example, it would probably be difficult to argue that every regional council should have the research capacity of major research providers in order to fulfil their statutory duties. Contracting specifically for these services is an obvious substitute.

When jurisdictions compete under prisoners’ dilemma conditions the outcome may be worse than a centrally produced rule. A jurisdiction can gain in the competition for industry by choosing lax rules, when others don’t act in the same way. The idea of the “race for the bottom” follows the prisoners’ dilemma model where if all jurisdictions follow (ie, adopt lax rules) then industry gains. According to Van den Bergh (1996) this phenomenon has yet to be empirically substantiated.

3.2.4 Moral hazard

Another result is offered by Caillaud, Julien and Picard (1996) who build a hierarchical model of contractual relationships under moral hazard (Grossman and Hart, 1983) to analyse subsidiarity. While their study was looking at optimal (de)centralisation of industrial policy it does provide some insights for sustainable development policy. Producers make unobservable decisions that have spillover effects. A central agency designs and proposes a system of incentives for firms whose decisions involve private costs and are imperfectly observed. Then local regulators and their firms negotiate a contract that complements the central contract. It is assumed that each local regulator has more precise information on domestic firms than all other regulators. Full centralisation is not optimal when local regulators have an informational advantage. The optimum relies on both central and local policies. The tradeoff involves rents left to producers because of inefficiency arising from poor information at the central level versus rents left to producers endowed with some bargaining power in local negotiations. Full decentralisation may be optimal when the information advantage of local regulators is large and they have sufficient bargaining power in local negotiations. Full decentralisation means that the centre does not design incentives for firms. At least partial decentralisation is optimal provided that the regulatory bodies in the locality have better information than central government.

The optimal assignment problem has at least two dimensions: 1) how many hierarchies are optimal; 2) what is the optimal size of jurisdictions at each level of the hierarchy? Gilbert and Picard (1996) developed a model of optimal territorial decentralisation in which smaller units of government have an informational advantage concerning the costs of

producing public goods and central government has an informational advantage on spillover effects induced by local projects. They limit themselves to a hierarchy of two and focus on the optimal size of jurisdictions. The main argument for giving local government more powers is the potential ability to achieve their tasks with respect to the information they are able to gather. Their model deals with local government contracting with a firm to produce a local public good. The public good is cost-shared between central government and local taxpayers and involves national spillovers. Local government is only concerned with maximising the welfare of its own citizens. The information local government has about the project's costs increases as the jurisdiction gets smaller but greater decentralisation entails more uncertainty about spillover effects. The optimal size results from two diverging objectives: to save costs by delegating the decision to a smaller unit of government or to internalise externalities more easily by delegating powers to a larger jurisdiction.

Offsetting the argument that greater knowledge and concern that smaller jurisdictions have for their environment are a number of counter-arguments. First central government has the resources and legal standing to act in the international domain; national governments can resist two structural forces that systematically favour less environmental protection. Second, there is a race to the bottom in regulatory policy as jurisdictions compete to keep and attract investment. Third, there is greater sectoral concentration of smaller economies.

Canadian experience – where provincial governments are highly solicitous of predominant local industry and resource sectors - supports the last case. However evidence on the race to the bottom is ambiguous. Empirical studies in the 1980s found that environmental standards were a strong location factor for only a few extremely dirty industries. As Parson (2000) points out, to observe that capital rarely leaves because of environmental regulations does not mean that firms threaten to do so. In Parson's view, politicians and officials do believe the risk of losing investment and job creation even though studies show the risk to be low.

Is appropriate environmental protection systematically more likely to be blocked at smaller scales than national? The evidence in Canada is mixed. The most pervasive argument for smaller scale is that it allows diverse standards and approaches. Such diversity should promote learning about the effectiveness of alternative responses, provided variation is informative and adequately monitored. Diversity should reveal real costs.

Canadian environmental institutions are following a trend toward intentionally devolving some aspects of their authority to non-state sectors. Firms have better access to information about their operations than regulators do so delegating implementation should realise environmental goals with greater efficiency. The essence of MBIs is that they seek more efficient division of responsibility where the state sets environmental goals while firms use their greater knowledge of technical possibilities and influence over internal behaviour to find better and cheaper means to those ends.

The environmental trends project undertaken in Canada described three challenges for environmental governance: (1) need of adaptive management; (2) increased institutional capacity to deal with environmental protection at the international level; and, (3) networks of shared authority to reconcile overlapping capacity and authority between levels of government. Given uncertainty and complexity of environmental management, precise and static divisions of responsibility are unlikely to be viable. Thus we need to examine: the resolution of coordination problems between different levels of government and between private and public sector actors; information flows and sharing of authority; and,

the competitive dynamics between authorities and evaluate particular innovative forms of governance, including how have they performed in terms of behaviour and environmental outcomes.

3.3 Property rights

How people use environmental resources is not simply a technological matter, rather it is a result of the institutions governing economic activity. Property rights institutions are especially important when considering policies for achieving sustainable development. Property rights are as fundamental to economics as scarcity and rationality. Property rights include the laws, customs and regulations governing the rights and obligations of individuals and firms to have access to and use the environment. The standard economic model is a private (excludability) property rights economy. Under private property rights any mutually agreed contractual terms are possible although not necessarily supported by government enforcement (eg, illegal transferring of rights).

For decentralised coordination of production and consumption to work efficiently, in a society with diffused knowledge, individuals must have secure private property rights that are tradable at mutually agreed prices with relatively low costs of contracting. There is little disagreement that stronger private property rights are more valuable than weaker private property rights.

Many different types of property rights exist in the economy, including private property, collective property and public property. This broad categorisation is of limited use for analysing systems of property rights. Scott (1996) describes three essential powers enjoyed by a sole owner of land: (1) to manage the land; (2) to dispose of the land by selling, leasing or bequeathing it; and, (3) to appropriate the rent for income flowing from the land. A measurement of the strength of power (ie, the value of property rights) depends on the nature of the property rights in land. In the market we observe that the unit price of a 30-year lease is less than freehold title. Similarly, land differentiated only by the relative threat of land use controls will trade at different prices. It might be considered illegal to open a shop for business on certain days of the year – the effect of this restriction reduces the strength (attenuates) of the private property right.

Greater insights can be gained by viewing property rights as comprising a bundle of rights. For example, a water permit under the Resource Management Act 1991 has a number of strands: (1) water is vested in the Crown; (2) the permit holder may have the freedom to decide when and where to use the permitted quantity; (3) the permit holder may transfer the permit to a subsequent owner of the land; (4) the permit holder may not transfer the permit to another person outside the catchment area; (5) during times of shortage the regional council can impose rationing; and so on.

Continuing with water, the following characteristics give shape to the structure of property rights and in doing so determine their value to water users:

Duration: the length of time a user holds a legal claim against the profit associated with use. Other things being equal, water rights of longer duration are relatively more valuable. Duration is particularly important when asset-specific investments (eg, irrigation infrastructure) are needed to exploit the full economic potential of water.

Exclusivity: refers to the ability of individual users to appropriate the profits associated with their investment and operational decisions. Greater exclusivity more directly aligns profits with costs.

Transferability: rights that are transferable are relatively more valuable. Transferability enables the right to move to its most highly valued use in the market. Moreover, transferability unleashes a dynamic that enables profit-seeking individuals to innovate and develop new and more profitable forms of enterprise.

Transformability: refers to the ability to legally transform the right into a derivative right. Thus a water right of fixed duration – say 30 years – could be leased out to a neighbour on an annual basis. This improves the flexibility of the right – farmer A growing crop Z this year may not require the full water allocation; if transformable into a lease, A could transfer a portion to farmer D who needs additional water to meet the requirements of crop Y.

Quality of title: high quality title is secure and relatively less vulnerable to challenge by other users or government. Higher quality title is relatively more valuable.

For example, in California the market value of a water right held in perpetuity is about 5 times that of an annual lease right (Saliba and Bush, 1987). The price of fishing quota rights in New Zealand varies with quota management area, allowable catch limits and economic variables such as harvesting costs, interest rates and so on (Batstone and Sharp, forthcoming).

In 1934 ranchers in the US were granted rights to forage flows on public lands. Although relatively insignificant in terms of US livestock production grazing is important to rural communities. Competition for rights to forage has increased with the increase in demand for alternative uses – eg, wildlife, retired grazing land – of federal land. In a Coasian world with zero transaction costs and tradable rights, competition would resolve the allocation problem and yield an efficient outcome. For example, conservation groups wanting to exclude cattle from public lands would buy grazing rights from ranchers. External institutions – in this case federal law – do not allow for market transactions of this nature. Egan and Watts (1998) provide an estimate of the risk of appropriation facing ranchers. In 1978 the risk index started at 0.94 and declined steadily through 1994 to 0.23. The real (1992) total loss of grazing value over this period was US\$10.9 m.

3.4 Institutional change

Most institutional change is incremental. Dovers (2001) sees purposeful incrementalism capable of producing profound change. In his opinion, initiatives in Australia have been in the nature of disjointed incrementalism, characterised by ad hocery and amnesia. Of course it is not easy to keep a complex institutional system internally consistent, compatible, and cohesive over time. A proliferation of specific detailed rules is not a sign of good governance. As rules proliferate the system becomes dysfunctional.

3.4.1 Institutional reform

Enhancing the coordinative power of institutions is an important aspect of institutional reform (Epstein, 1995). It is useful to consider institutional reform in first and second-order terms (Sharp, 1996a).

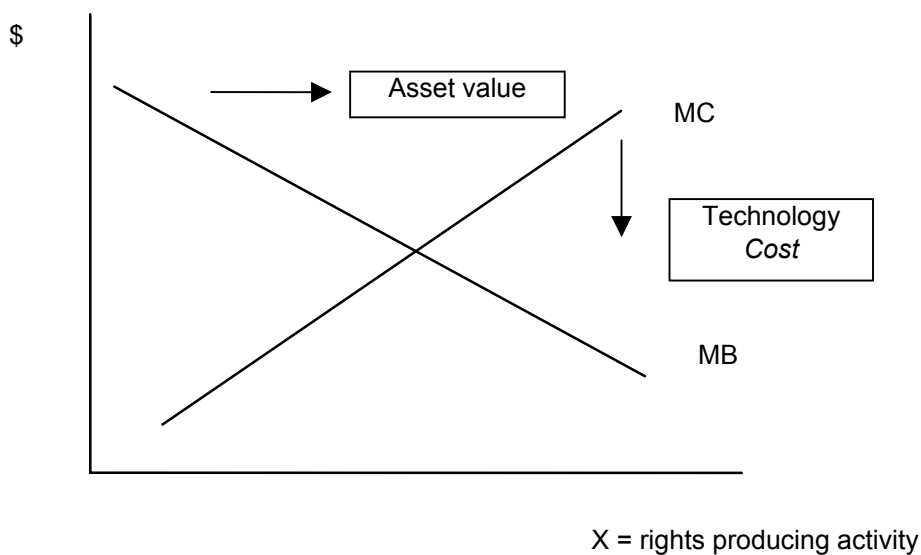
First-order reform refers to getting the basics of institutional structure aligned with policy objectives. For example, two key institutions – tradable rights working within a sustainable harvest – underpin New Zealand's quota management system. Second-order reforms are marginal adjustments occurring within the basic structure. These reforms

might be internal to the industry – as evidenced by the formation of quota owner associations in the fishing industry – or external when the rights to harvest were re-defined from being a tonnage to a percentage of the allowable commercial catch.

3.4.2 Evolution of property rights

A property right is a socially enforced right to selected uses of an economic good or service. Alternative views on how property rights came into being will not be discussed here (Libecap, 1986). The idea is to look at how and why existing institutions change in response to changes in variables such as demand, factor endowments and technology. Establishing and protecting property rights is an economic activity. It is useful however to consider the economic variables that affect property rights (Anderson and Hill, 1975). If we represent activity by X then an increase in X suggests an increase in search activity. Marginal benefit (MB) depends on the asset's value and the degree to which the activity enables value to be captured. As scarcity increases we might expect individuals to attempt to better define rights. The marginal cost (MC) of producing property rights increase because of the opportunity cost of resources used in property rights activity. Anderson and Hill use this model to explain and predict the evolution of property institutions. Exogenous changes, for example increased theft and crime, to the probability of being able to capture the benefits would reduce the benefit function. Similarly, if the asset's value increased because of price increases (for example, the price of timber) would shift the benefit outwards. Changes in technology and a fall in the price of inputs would work to lower the MC curve. For example, advances in surveillance monitoring systems would contribute to lowering the marginal cost of rights based systems of governance.

Figure 11 - Production of private property rights



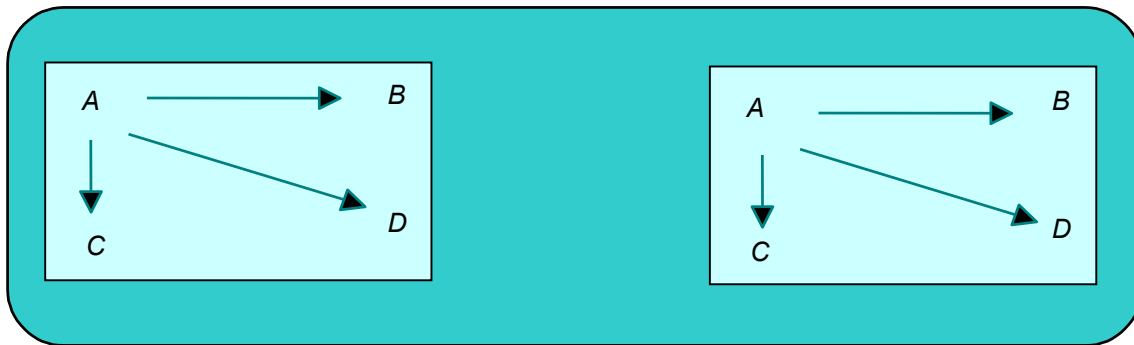
3.4.3 Establishing a basis for endogenous change

One of the most powerful changes that can be made to an external institution is to provide a platform for evolution and economic growth. Endogenous change is possible within an open system but it cannot occur in a closed system. Figure 12 illustrates the idea.

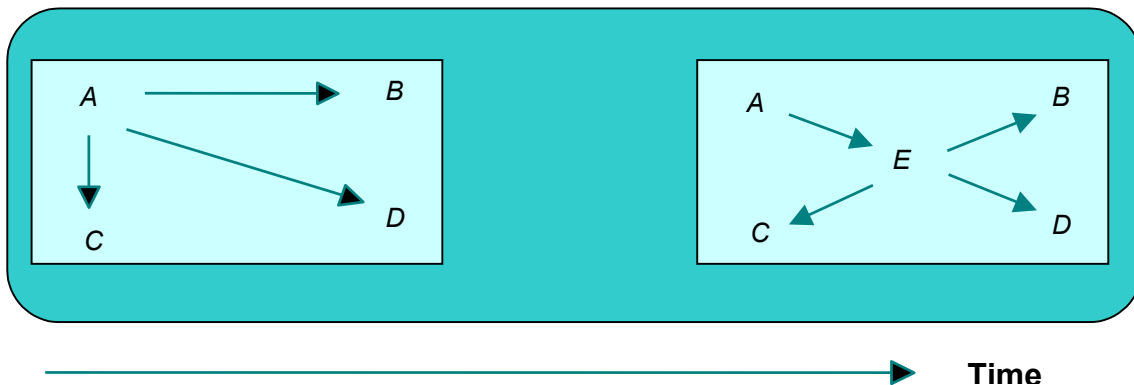
Under a tightly regulated system of governance there is little prospect – other than through the imposition of new external institutional arrangements – for innovation to occur. In contrast, under an open system new entities (shown as E in Figure 12) can emerge according to the forces described in Anderson and Hill (1975). The following two examples show how new organisations can evolve in response to a more open system of governance.

Figure 12 - Closed and open systems of governance

Closed system



Open system



The Southern Scallop Enhancement Company (SCEC) is an organisation based on ownership of rights to scallop quota (Sharp, 2002). Obviously, the SCEC was not a feasible organisation prior to the 1986 Fisheries Amendment Act that shepherded in individual transferable quota (ITQ) rights. Thus the 1986 legislation is an “external institution” or “a first order reform” that enabled SCEC to form. Significant innovations were suddenly made possible from this platform – rights in the scallop fishery were further refined. Examples of these “internal institutions” or “second order changes” include rules governing harvest, sanctions for violating company rules, rules for supporting research, and so on. The point to be made here is that parliament-made rules (external) provide a basis for the evolution of other rules (internal).

In 1974 the Wisconsin state legislature recognised the threat to environmental values and public welfare caused by the deterioration of lakes. The legislature acknowledged that the current state effort was not sufficient and noted that the public will benefit from the protection and rehabilitation of these public lakes. Wisconsin Lake Management Law was enacted in 1974, authorising a joint state-local partnership that permits local property owners to organise a lake management district to manage and improve the lake in their community. This evolution of organisational structures is a process of adjusting the rights, the opportunities, and powers of lake property owners relative to the public. Of particular interest is the opportunity for a local community-state relationship to emerge as an effective partnership in lake management. There are approximately 130 Lake Management Districts, over 300 Voluntary Lake Associations and about 30 Town Sanitary Districts.

3.4.4 Path dependency

In the absence of first-order reforms (Sharp, 1996) the evolution of new institutional arrangements will be determined to varying degrees by the institutional structure *ex ante*. The emergence of quota owner associations provides an example of path dependency. Carey and Sunding (2001) show how the development of water markets is path dependent, varying with the institutional structure emerging from pre-existing property rights and political battles to build consensus and obtain federal money for financing projects. A case study involving two federal government projects – the California Central Valley Project (CVP) and the Colorado-Big Thompson Project (C-BT) illustrates how different market outcomes have emerged from different institutional structures. Most CVP water trades are limited to short-term transactions within the agricultural sector, and are often informal. In contrast C-BT water is transferred in both short and long-term rental markets and permanent sales within and between agricultural and urban sectors. Within the C-BT region there are well-established market prices and water brokers mediate exchange between anonymous users. Four institutional features explain the differences in market activity:

Water district structure: the federal agency negotiates with multiple entities within the CVP whereas it negotiates with only one entity in C-BT.

Water rationing mechanism: a priority system is used to ration water in CVP while a proportional rationing system is used within C-BT.

Acreage limitations: CVP imposes acreage limitations whereas C-BT does not.

Return flow rules: CVP has relatively stricter return flow rules that are designed to protect third parties against adverse effects associated with transfer.

In addition to security of tenure and establishing an initial allocation of rights, the above study highlights the importance of allowing water markets to adapt to long-run changes in water demand. In other words, institutional design should allow for the evolution of new arrangements over time.

3.5 Barriers to implementing market based instruments

One of the key elements of sustainable development involves balancing the environmental damages avoided with the costs of abatement. Section 2 has outlined the necessary conditions for efficiency and it was suggested that instrument choice centres around either a pricing (polluter-pays) or quantity-based (tradable rights) approach. The typical response is to use regulations that have a strong technological content based on BAT. Capture of policy formulation by advocating and adopting technical solutions may give insufficient scope for innovation. One BAT will not satisfy the requirements of heterogeneous firms. Furthermore, burdensome regulations that are not least-cost will emerge if regulators are risk averse. Monitoring and enforcement will increase the cost of CAC. Economic instruments avoid many of these problems.

Why has it proved difficult to introduce MBIs? First, there might be significant income effects associated with environmental charges. Take fuel as an example. A relatively large increase in price (we have noted earlier that it is price inelastic) would be needed to encourage the public to switch to less polluting transport. The tax will have income effects. The political consequences of increasing the fuel tax are immediate while the reduction in pollution is longer term. The second reason is institutional. In the UK, Helm (2000) asserts that institutional structure is responsible for at least two major weaknesses. Targets and standards are set with too little regard to the costs and benefits, and there is

a strong bias towards CAC regulation. The British approach to pollution control is characterised as piecemeal, pragmatic, technically driven and conducted by experts largely out of reach of the courts.

The dichotomy between strong sustainability (SS) and weak sustainability (WS) has created a problem for decision-makers by suggesting a two-tier approach to developing policies for sustainable development. There will be uncertainties which current science is unlikely to be able to resolve creating doubts as to whether policy should target SS or WS, which natural assets are critical and which are not. Policy choice is more complex than the simple WS-SS dichotomy suggests. When confronted with uncertainty it is relatively easy for decision-makers to adopt rules such as the precautionary principle (Morris, 2000; Raffensperger and Tickner, 1999) where conservation is encouraged when there is not full scientific knowledge of the consequences or the safe minimum standard approach (Bishop, 1978) which introduces a conservative benchmark into the cost-benefit framework. Both decision rules focus debate on what constitutes compelling evidence.

Typically the returns to investment in the environment are non-market valued and therefore it is likely that under-investment will occur in environmental assets while over-investing in environmentally damaging activities. For example, over the years the quality of water in Auckland's harbours has deteriorated because investment in storm water infrastructure has not kept pace with urban growth. In other words, environmental capital has been drawn down as a substitute for manufactured capital. The problem is of course not unique to Auckland, nor is it unique to coastal waterways. For this reason, it is important for sustainable development that the values of environmental assets are known at the national, regional and local level.

There is almost unanimous agreement that CAC regulation is an inadequate response to present environmental challenges. Command-and-control instruments are myopic, provide inadequate incentives for innovation, carry higher costs than other approaches and are unlikely to be politically sustainable (Parson, 2000). Markandya (1998) lists the following obstacles to implementing MBIs.

Lack of knowledge. The agency responsible for environmental policy must have the technical knowledge necessary to formulate and implement MBIs. Polluters have the knowledge to respond appropriately. Concerns of elected officials include the distributional implications of using MBIs; implications for output and employment in affected industries and communities; cost of implementation; and impact comparative advantage.

Good governance. The legal structure must define property rights adequately and establish authority to implement and enforce incentive systems.

Competitive markets. If firms are operating under soft budget constraints then they will not respond as effectively to fiscal incentives.

Financial and administrative capacity. The agency must have the capacity to initiate, monitor and enforce programs.

Flexibility of response. Private sector and individuals should have choice in their response.

3.6 Conclusions

Market based instruments provide a basis for shaping sustainable development policy. In Section 2 MBIs were shown to encompass key features of sustainable development *viz.* total economic value and intertemporal resource use. In addition, the instruments can be designed to account for linkages within the environment. Rather than arguing for universal application it was suggested that instrument selection should be based on rational analysis.

This section established an institutional link between MBIs and sustainable development outcomes or indicators. In the case of environmental externalities we know that information on willingness to pay and opportunity cost will not emerge from the market. Government intervention of some kind is necessary. Market based instruments are included within a set of feasible external institutions – they are an object of choice.

The simple dichotomy implied between strong sustainability (SS) and weak sustainability (WS) is of no particular use in institutional design. For example, a legal framework mandating SS – eg, investment in renewable sources of energy should accompany the depletion of fossil fuels – would neglect relative scarcity and expectations summarised in market prices. Investment in renewable sources of energy is likely to produce contemporaneous and intertemporal externalities too. Similarly, rules requiring administrators to adopt rules such as the precautionary principle may encourage excessive conservation at the expense of growth and the welfare of future generations.

Hierarchies of rules are important in institutional structures because they provide a basis for consistent governance. For example, if tradable rights are implemented then external institutions must be established to provide a basis for protecting property rights, contracting and exchange. This is essential for the predictable functioning of the economy over time.

Hierarchies also provide a level at which externalities are resolved. A simple net-benefit maximising model shows the location of control to hinge on the public good nature of the externality and the cost of information. For example, policy initiatives dealing with global climate change and protection of endangered species is probably best dealt with at a national level. In situations where spillovers are minimal then local decision-making is likely to be more efficient. More weight is given to the argument in favour of local decision-making if we recognise information asymmetries in principal-agent relationships and the benefits of learning from variety at the local level of government. Arguments in favour of more central control include situations where spillovers are significant, scale economies (eg, in research) might limit policy initiatives, increased transaction costs and a race for the bottom. These are of course empirical issues.

When the impacts of pollution are purely local, the costs of information not too great, and all relative preferences are reflected in local politics then the local incentives for environmental protection should be sufficient to achieve welfare maximising levels of protection without distorting prices. Locally determined supply might not be optimal if powerful interest groups capture local government. Combining central direction and local implementation may improve welfare.

The environment is extreme in the extent that it is characterised by overlapping and shared authority. Indeed it is highly probable that some aspect of the environment touches every unit of government in New Zealand. Thus it is highly unlikely that we can match the primary scale of the problem with the primary scale of authority to manage the

problem. Decision-making is often simultaneously pulled out toward international management and inward to regional and local management.

Obstacles limiting the use of MBIs will exist in the structure of external institutions. The legal structure must define property rights adequately and establish clear lines of authority to implement and enforce MBIs. Enhancing the coordinative power of institutions and providing a basis for sustainable economic growth is an important aspect of reform. This is about getting the basic building blocks set in place. Path dependency should be recognised. If resources become increasingly scarce users will find ways to protect and enhance the value of their property rights within existing constraints. Empirical studies show that environmental outcomes – water use, fish stock enhancement, water quality – can, in part, be linked to institutional structure.

Policy aimed at introducing specific instruments – such as tradable rights – or providing for the evolution of community initiatives will require adjustments to external institutions. This is necessary but not sufficient. We will see in Section 5 examples where the Resource Management Act provides for the use of economic instruments but administrators have consistently preferred regulation. Thus incentives must exist for administrators to approach instrument choice within a rational framework that is consistent with the goals of sustainable development. This topic is discussed in Section 4.

4 Framework for assessment

The design of environmental policy in a unitary government system is seen as involving two steps, setting policy goals and choosing the set of instruments to be used in achieving the goals (Braden and Proost 1997). In contrast, it is argued, environmental policy in a federal system is more complex because it involves at least three dimensions: across levels of government (federal, state and local); across branches of government (executive, legislative, judicial) and across agencies at the same government level. In reality, the design of environmental policy in New Zealand's unitary system of government has some of the dimensions associated with a federal system: central, regional, local government; executive, legislative, judicial; across agencies at the level of central government. While there are obvious differences to consider, for example New Zealand does not have a written constitution, insights gained from environmental policy in a federal system may provide insights for New Zealand.

4.1 Environmental governance

The structure of governance is of interest because it carries with it implications for patterns of resource use and income distribution, both of which are relevant to sustainable development. More significantly, environmental outcomes are co-determined by the policies, rules and mechanisms fashioned in the public sector to provide incentives for correcting externalities. An economic analysis of environmental governance must account for many layers and the possibility of multiple objectives. To simplify things we can describe a set of sustainable development indicators $Q = \{ q_e, q_w, q_a, \dots, q_n \}$ where q_e = economic growth, q_w = water quality, q_a = air quality, and so on.

The following aspects of governance are worthy of explicit consideration.

4.1.1 Setting policy goals

In contrast to a "one size fits all" approach to regulation, devolution to lower levels of government can result in greater efficiency because of the ability to weigh benefits and costs to be different from place to place. For example, it might be appropriate for legislation to allow for different levels of water quality to be set across the country. A national standard could be set as a "minima" (say, q_w = minimum dissolved oxygen level) and lower levels of government would then target the minima plus any increase in the standard after explicitly assessing the costs and benefits of a higher standard.

4.1.2 Bargaining power

Environmental outcomes (eg, air quality) often display the characteristics of a public good. In Section 2 we discussed the particular problems associated with public goods. Through the political process interest groups can influence both the quantity and "price" of environmental outcomes. Power concentrated at a national level places the regulator in the position of a monopolist. This might prove advantageous in situations where bargaining involves large powerful commercial interests. On the other hand, devolving decision making down to local units of government gives local interest groups relatively more focussed power because of reduced heterogeneity of preferences.

4.1.3 Uncertainty

Uncertainty spans not only scientific knowledge but also the outcomes of environmental policy. Research leading to an improvement in the understanding of environmental processes might have the characteristics of a pure public good and may be best financed by the population as a whole. In contrast, research leading to an improvement of an outcome that is shared by sectors within the community might be better financed by a differentiated contribution from the sectors involved, depending on the ability to monitor and measure those deriving benefit. For example, this principle is used as a basis for cost-recovery in the fishing industry.

In the presence of uncertainty, it may be appropriate to allow lower-level regulators to attempt different approaches to common problems. For example, the outcome of alternative policy instruments for controlling non-point sources of water pollution is uncertain and there may be benefit from different units of local government “experimenting” with different approaches. A higher-level government could set broad parameters that limit the scope of experimentation. Of course, realisation of the benefits of experimentation is contingent on monitoring, measuring and sharing information on the outcomes associated with the various approaches.

4.1.4 Transboundary problems

When external impacts spill over into neighbouring jurisdictions the rational unit of government will pay attention only to the local fraction. This behaviour would result in too little environmental protection. For example, consider a river flowing through two jurisdictions (A and B) and jurisdiction A has a concentration of pulp mills on the river. The mechanism adopted by jurisdiction A has obvious implications for the level of external damages visited on the community in jurisdiction B.

4.1.5 Market integration

The potential for economies of scale and comparative advantage should be considered in the design of environmental governance. It would be unrealistic for all coastal communities to equip themselves to cope with major oil spills. Central government can most effectively design monitoring and reporting protocols. Many local governments lack technical expertise to set, monitor and enforce standards. Comparative advantage calls for different levels of government to specialise in different tasks.

4.1.6 Ecological dumping

The pollution haven hypothesis suggests that polluters will move their activities to the most lenient jurisdiction (Markusen, Morey and Olewiler 1993). A second hypothesis is that local units of government will compete for economic development by weakening their environmental standards. However, these effects will be moderated by the cost of relocation, rapid diffusion of technology and increase in the demand for environmental protection. The empirical evidence of pollution havens and ecological dumping is weak (Jaffe, Peterson and Portney, 1995).

4.1.7 Fiscal capacity

Local government might be especially vulnerable to industry threats to relocate and or to free ride on service supply. Segerson, Miceli and Wen (1997) show that central government will over-regulate if it does not pay any cost and local government will fail to minimise costs if it bears no financial exposure. Thus there exists a threshold assignment of costs across levels of government.

4.1.8 Policy innovation

Environmental policy design occurs under uncertainty about the consequences. With central government policy, only one design can be implemented at once. With devolution it would be possible to observe a number of policies attempting to address the same issue. Of course the challenge is to encourage innovation while maintaining or improving environmental outcomes.

4.2 Features of sustainable development

The challenge that sustainable development poses for policy is somewhat different to many other policy problems. In part, differences derive from the multifaceted nature of sustainable development and the emphasis given to the welfare of future generations. Policy that focuses on a single issue – say transportation – has impacts that flow into other domains of policy. If we turn the problem around and consider externalities associated with transportation then instrument choice can potentially spill over into many units of government. Thus a unit of government designed to deal with transport may not be adequately set up to deal with the externalities associated with transport. Differences also follow from the emphasis given to sustainable development as a process of change in which exploitation of resources, the direction of investments, the orientation of technological development and institutional change are made consistent with the future as well as present needs.

Obviously, sustainable development policy should be based on institutions and decision-making structures that lead to sustainable outcomes. Clearly, it is not possible to design an optimal set of instruments if the end-state cannot be specified. More importantly, it is imperative that policy choice be guided by economic efficiency. If we dismiss economic efficiency as a criterion for policy analysis then we run the risk of stifling economic growth and compromising environmental quality. In Section 2 we used the efficiency framework to analyse a range of policy instruments. Where possible empirical evidence was used to establish their relative performance. Table 2 summarises the key concepts of sustainable development.

Table 2 - Key challenges of sustainable development

Concepts	Elements
Spatial scale	Global, national, regional
Linkages	Ecological, organisational, policy
Capital	Manufactured, natural, human, and social
Value	Use values, non-use values, ecological measures
Institutions	Structure, property rights, duties
Participation	Preferences, consultation, democratic process
Equity	Intragenerational, intergenerational
Knowledge	Risk, uncertainty, technology
Time	Horizon, discounting

Source: Sharp, 2001

4.3 Generic framework

Virtually every discussion on sustainability concludes that existing institutions are part of the problem and reform is required. Section 2 provided evidence that traditional CAC approaches lead to unnecessary compliance costs that, in turn, result in lost economic welfare. From the point of view of sustainable development this loss should be of concern because the current generation could achieve the same environmental outcome using fewer scarce resources thereby providing a greater endowment for future generations. Using economic instruments would free up these resources for alternative uses now or in the future.

According to Dovers (2001), too often institutional and policy change does not flow from sound problem definition and consideration of alternative proposals. He extends the “adaptive management” approach that was developed by ecologists to cope with complexities and uncertainties, to include institutions. Five key principles for adaptive institutions are identified:

Persistence: where efforts are maintained over time.

Purposefulness: efforts are supported by stated principles and goals.

Information richness and sensitivity: seek best information and make widely available.

Inclusiveness: full range of stakeholders are involved in policy formulation and in management.

Flexibility: prepared to experiment.

Goodin (1996) proposes five desirable principles of institutional design:

Revisability: learn through experience, and change trajectories and practices as required.

Robustness: respond appropriately to more or less significant pressure.

Sensitivity to motivational complexity: open to a variety of motivations and values.

Publicity: publicly defensible and can gain political and community support.

Variability: learning enhanced through encouraging experiments.

It is not possible to specify an optimal institutional design. At best we can check whether the attributes of institutional structure and decision-making are consistent with the general notions of sustainable development. Table 3 links the attributes of institutions with the challenges of sustainable development shown in Table 2.

Table 3 - Institutions for sustainable development

Attribute	To enable
Legal foundations	Setting sustainable development as a goal, expectation of longer time horizons, ability to experiment and adapt, ability to undertake comparative assessments.
Locus of decision making	Incorporation of differences in economic and environmental conditions and community preferences.
Fiscal capacity	Supply of adequate human capital, financial and information. Economies of scale.
Instruments	Decentralised decision-making, generation of information, incorporate community preferences, long term monitoring and evaluation.
Incentives	Decision-making that economises on transaction costs, compliance costs are low, and results in sustainable outcomes.
Integration	Synthesis and analysis of cross cutting (economic-environment) issues related to research, management and policy.
Coordination	Linked with other institutions and processes, inter-jurisdictional (vertical and horizontal) coordination.
Participatory	Participation that is appropriate to the context.

4.3.1 Locus of decision-making

The distinction between decentralisation and devolution should borne in mind when dealing with policy in New Zealand. Decentralisation involves central government making decisions through branch offices. Devolution involves transferring decision rights to regional/local government. As Guerin (2002) notes the issue of subsidiarity is most obvious when dealing with the roles of the levels of government and the mechanisms for coordinating between and within levels. Central government retains ultimate control and accountability. The ability of local government to tax at all is dictated by parliament and can only be changed by parliament. In the context of sustainable development policy in general and implementing MBIs in particular central government occupies the high ground – it delimits the rights and duties of lower levels of government.

The allocation of rules and accountabilities between levels of government is determined not by constitution but by the processes of central government policy formulation. Thus local government tends to operate, to some extent, as an agent of central government administering or interpreting the rules set centrally (Guerin, 2002). For example, the Resource Management Act:

- prescribes procedures and criteria;
- leaves actual decisions at the regional/local level but provides for central government override;
- local government activities are divided into 3 categories
 - prohibited, policy is set and implemented nationally,
 - mandatory, policy set nationally and implemented locally, and
 - discretionary, policy set and implemented locally.

Transfer of functions between levels of government should be coupled with transfer of accountability. Guerin (2002) offers the following principles for allocation and co-ordination of functions:

- The allocation of powers must be addressed from both the private (individual and firm) and public policy point of view. As noted earlier, external institutions are important to achieving consistent regimes. However, at the same time account should be taken of the diversity in preferences so that the jurisdiction of decision-making is aligned with the jurisdiction of effects.
- Minimising of transaction costs.
- How the policy rules are set for different policy areas is more difficult. For example, the public good nature of global climate change suggests centralised provision.
- Inter-and-intra government co-ordination can take the form of consultation, delegation or joint planning and/or implementation
- Accountability and participation across and between levels of government.
- The ability to “optimally” allocate responsibilities between levels of government requires clear criteria. Kerr, Claridge and Milicich (1998) suggest the following:
 - Where the relevant expertise and knowledge exists.
 - Where effective accountability arrangements exist eg, close to those affected but avoiding small group domination.
 - How best to make trade-offs between achieving the specific needs of one community group and delivering consistency between jurisdictions.
 - Assuring that inter- and intra-national commitments are met.

Bermann (1994) suggests that local governance is valued because it facilitates effective accountability of decision makers to those affected; allows self-determination and political liberty; has the flexibility to take account of local differences; and preserves identities and diversity.

Guerin (2002) concludes by saying that the notion of subsidiarity provides a broad framework but does not provide the answer. In the end, decisions should consider the availability of information; the location of costs and benefits of the decision; the accountability of decision-makers; and cost-efficiency.

4.3.2 Incentives

One way to analyse the issue of subsidiarity and devolution is to focus on the structure of governance, the rights and duties of actors at various nodes within the structure, and principal-agent relationships. Tirole (1994) provides a useful overview of the application of incentive theory to public sector organisations. He begins by discussing the differences between private and public sector organisations and is careful to point out that the differences are in degree and not fundamental in nature.

Government may have a multiplicity of goals. Typically the mandate of government agencies is multi-dimensional. Although multi-dimensionality need not prevent the construction of powerful incentive schemes it does create difficulties. First, some of the dimensions (eg, an indicator of sustainable development) might be hard to measure. A second, and related, difficulty is the relative weights that attach to the multiple goals of the organisation. For example, the RMA requires mitigation of adverse environmental

impacts and instructs administrators to consider the costs and benefits of their policies. Setting an incentive scheme would require putting weights on these two measures.

Many government agencies have a monopoly position that can make relative performance hard to measure. At lower levels of government this may not be too difficult provided information is available. For example, a study comparing the cost of consent processing across regional councils should be feasible.

In contrast to a corporation, the goals of an agency are defined by a political process that changes over time reflecting heterogeneity of owners' tastes. Lack of time consistency may limit commitment possibilities relative to the public sector. For example, bearing in mind the political cycle, what intertemporal commitments are possible if a lower level of government decides to deplete natural capital in expectation that future investment in manufactured capital will occur? Incentives for achieving sustainable development should be related to agency missions.

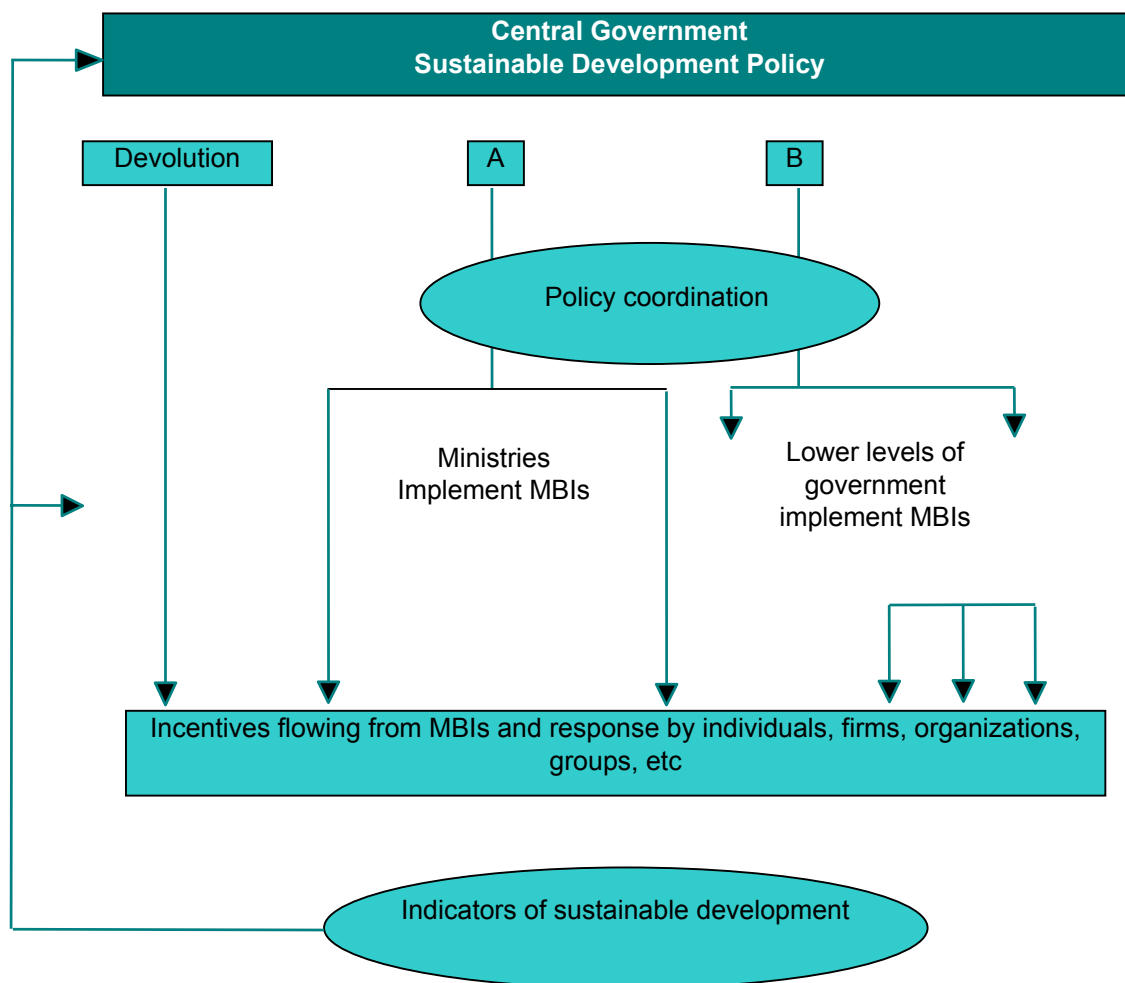
Monetary incentives exist in government agencies. However, incentives are likely to be low powered rather than formal incentives. By low powered Tirole is suggesting that the agent receives only a small fraction of his or her marginal product. To illustrate, a government official might lead a law reform that enables rights-based management of water resources that unleashes regional economic growth. In the private sector this individual might enjoy a share bonus and other benefits. Not so in the public sector. Existence of low-powered incentives is related to the difficulty of measuring marginal product and the existence of multiple objectives.

An agency with a strong mission will give perfunctory attention to tasks that are not central to that mission. If this observation is correct, then a directive to minimise adverse environmental effects without due consideration of compliance costs will bias resources toward activities that promote the former. This of course raises the issue of where missions come from. The example assumed that they are set externally or self-imposed. While we are in the realm of conjecture, we might also ask whether officials would accept the task of implementing MBIs knowing that they do not have the ability (broadly defined) to succeed.

As mentioned earlier, adverse selection and moral hazard models have been applied to the issue of devolution. When it comes to managing externalities and promoting sustainable development it is highly likely that we face the problem of incomplete contracting. When all contingencies cannot be costlessly included in contracts the allocation of rights plays a role in deciding what to do in unforeseen circumstances. It is more realistic to view government in terms of the distribution of control rights over various kinds of decisions (Tirole, 1994).

Continuing with the idea of control rights we can consider these within the architecture of governance. In New Zealand the architecture of governance is an external institution where control is determined by parliament. Figure 13 provides a stylised view of two alternative architectures for sustainable development. Sustainable development is shown as an overarching goal. Numerous configurations are possible but let us look at the following two possibilities. Sustainable development requires both vertical and horizontal coordination. Alternative A shows central government ministries implementing MBIs that may or may not be differentiated across regions. Alternative B shows the responsibility for introducing MBIs devolved to regional/local units of government. Issues of efficient governance and incentives *vis-à-vis* achieving sustainable development can be assessed empirically within this architecture.

Figure 13 - Architecture of governance for sustainability



4.3.3 Strengthening decision-making

Meeting the challenge of sustainable development requires clear processes for identifying and integrating economic, social and environmental goals and efficiently implementing the goals at all levels of responsibility. It was argued above that it is not possible to provide an optimisation plan for achieving the goals of sustainable development. Policies are typically crosscutting where the particular issue will span the domain of several ministries and yet no one ministry is responsible for the policy in its entirety. Section 5 uses air pollution to illustrate this problem. Problems relating to the vertical dimension of policy need to be recognised also.

Policy integration. The Danish experience shows that it is easier to focus on the economic efficiency of environmental policies rather than to make economic policies more environmentally sensitive (OECD, 2001).

Sectoral policy integration. Institutional arrangements in many OECD countries tend to be organised along sectoral lines. Specific policies as they relate to agriculture, transport and energy have the potential to spill-over into areas relevant to sustainable development.

Policy integration between levels of government. As noted earlier, devolution of decision-making to lower units of government may result in more efficient and effective decision-making. The need for coherence between levels of government is particularly important when approaching national policy issues, such as climate change.

Strengthening the machinery of government. Given the crosscutting nature of sustainable development there is a broader need for integrated policy advice and decisions. Government in the UK has committed itself to a sustainable development strategy that provides a framework for annual policy reviews against indicators (OECD, 2001). However, in order to operate effectively and efficiently, the machinery of government requires a consistent (and theoretically robust) definition of sustainable development in order to properly locate indicators for the purpose of informing policy makers Pearce and Barbier (2000).

Accountability. *Ex post* monitoring provides valuable feedback on progress towards goals and facilitates policy adjustments. Accountability relies on good information, analysis and transparency in reporting results.

Transparency and participation. Consultation and participation are important because non-public entities are becoming increasingly involved in policy implementation. Transparency promotes trust – an internal institution - that underpins institutional stability. This was shown above to be particularly important when designing/modifying property rights.

Although optimal institutional design, especially within the context of sustainable development, is beyond the reach of economic theory it is possible to list characteristics of good policy interventions:

Policy should add value to the economy. The primary test for all interventions (eg, MBIs, CAC) should be whether they could be expected to result in net benefits to the community.

Policy should not be too prescriptive. Policy instruments should lay foundations that recognise heterogeneity, provide scope for individuals to adjust according to their circumstances and flexible enough to incorporate dynamic adjustments.

Policy should be performance based, implementation should be transparent and agencies accountable.

Policy should be clear and concise.

Policy should result in low compliance costs.

Policy should be enforceable and offer low probability of regulatory capture.

The following steps are suggested if reforms are necessary for the introduction of MBIs.

A careful analysis of the impacts versus alternative methods of regulation should be carried out. The affected parties should be identified and the relative merits of short term compensating measures examined. Once a policy has been agreed on in broad terms it is important to improve public awareness and incorporate public input. Legal instruments must be firmly in place for the instrument to be enacted and enforced.

The agency should have adequate resources to carry out its functions. All agency functions must be financed some how or other. If a local agency is too small to finance an activity then cooperative arrangements could be used to make service supply feasible. Who should pay for service supply is a related issue. In principle, those contributed to the “need” for service supply should finance the activity. For example, commercial fishers contribute to the need for research and management – they pay an annual levy that covers a large percentage of research and management costs.

4.3.4 Property rights

Property rights are a primary institution for facilitating economic growth and we should look for the following desirable characteristics:

1. Sustainability should be explicitly incorporated into mechanism design.
2. The mechanism should unleash a dynamic that enables parties to exploit commercial opportunities for mutual gain.
3. Users should be confronted with the real (and dynamic) opportunity cost of use.
4. The allocation mechanism should have the flexibility to adapt to changes in the profile of opportunity costs over time.
5. The mechanism should make anticipation and strategic planning feasible for users.

What tends to be neglected in most arguments for and against market-based reforms is the fact that all instruments generate effects. The inescapable conclusion is that economic instruments provide a least-cost option for achieving an environmental target because they provide flexibility in the firm's response, whether through investment, changing input mixes, changing production, and so on. Furthermore, transparency tends to be greater with market-based instruments relative to the less-visible costs associated with regulations.

The adverse effects of reform can be reduced in a number of ways.

International coordination can assist reform. Governments, particularly trading partners, can participate, share experiences and discuss possible coordination.

Unilateral implementation of market-based instruments could be coupled with social welfare to reduce the burden on those affected.

Time phased implementation can help firms adjust. A credible timetable may allow firms to make short-run adjustments in anticipation of implementation

Public acceptance of the instrument can be enhanced by better use of revenues generated and re-cycling revenue to particular sectors.

Regulatory reform can lower compliance costs and increase economic efficiency. However attention must be paid to the net effect of reform. In other words, regulatory reform should be a value enhancing exercise. Regulatory reform may lower the economic cost of existing regulations and may increase the effectiveness of market-based instruments by increasing competition in related markets. However if prices – eg, water, energy – do not fully capture opportunity costs then regulatory reform may increase demand and associated emissions. Furthermore, the relative price of substitute sources may increase, lowering their appeal to consumers.

4.4 Conclusions

The challenge that sustainable development poses for policy is somewhat different to many other policy problems. Governance is important to achieving the outcomes of sustainable development because it provides both structure and incentives. Section 3 provided a framework for linking institutions with spatial and intertemporal patterns of resource use, economic growth, and the maintenance of natural capital. Virtually every

discussion on sustainability concludes that existing institutions are part of the problem and reform is required.

Meeting the challenge of sustainable development requires clear processes for identifying and integrating economic and environmental goals and efficiently implementing the goals at all levels of responsibility. This is consistent with the focus that sustainable development has on intertemporal welfare. It was argued above that it is not possible to provide an optimisation plan for achieving the goals of sustainable development. Policies are typically crosscutting where the particular issue will span the domain of several ministries and yet no one ministry is responsible for sustainable development.

Deciding whether to locate specific instrument choice at central or regional/local levels is an empirical issue. In some situations central control might be appropriate, in other cases control might be better located at the local level. In general, unless the externality is truly national (eg, global climate change) then a “one size fits all” is highly unlikely to be consistent with the principles of sustainable development. Efficiency gains can accrue from devolution that enables instrument choice to explicitly take into account heterogeneity in community preferences and ecosystems. In some situations, there may be benefits in having regulatory power concentrated at the central level of government when there are powerful commercial interests. On the other hand, devolving decision making down to local units of government gives local interest groups relatively more focussed power because of reduced heterogeneity of preferences. In the presence of uncertainty, it may be appropriate to allow lower-level regulators to attempt different approaches to common problems. A higher-level government could set broad parameters that limit the scope of experimentation. The potential for economies of scale and comparative advantage should be considered in the design of environmental governance. Comparative advantage calls for different levels of government to specialise in different tasks.

Adverse selection and moral hazard should be considered when assessing the relative merits of devolution. When it comes to managing externalities and promoting sustainable development we cannot assume complete contracts. In part, this is because the current government is not typically bound by the decisions of earlier government. It also arises because of myopia and the likelihood of temporally inconsistent patterns of resource use. In this situation the allocation of rights - vertically and horizontally - within the architecture of governance is probably a more realistic view of government.

Thus, the issue is who has the rights – if at all - to implement MBIs. Sustainable development is characterised by crosscutting issues – the economy-environment linkage is obvious. This of course raises the issue of policy integration and coordination. Coordination horizontally and vertically degrades incentive intensity and adds to bureaucratic costs. One case study in Section 5 will highlight this difficulty.

Incentives for achieving sustainable development should be related to agency missions. As noted in my earlier report, sustainable development policy may have multiple goals that may make it difficult to appropriately incentivise administrators (Sharp, 2001). Difficulties with measuring the productivity of agents may result in low powered incentives to efficiently achieve sustainable development outcomes.

Optimal institutional design, especially within the context of sustainable development, is beyond the reach of economic theory. As a rough guideline, policy should add value to the economy, policy should not be too prescriptive and policy instruments should lay foundations that recognise heterogeneity, provide scope for individuals to adjust

according to their circumstances and flexible enough to incorporate dynamic adjustments. Policy should be performance based, implementation transparent and agencies accountable. Policy should be clear, concise, enforceable, offer low probability of regulatory capture and result in low compliance costs.

5 Applications to New Zealand

In this section we look for evidence of MBIs being used in New Zealand. Discussions were held with the Auckland Regional Council, Environment Canterbury, and the Otago Regional Council. The issues facing each Council are different. The Councils also differ in terms of the expertise and resources available to them. Although coverage is limited the cases do point to fundamental problems with governance if indeed sustainable development is a goal.

5.1 Policy integration

If government wants to promote sustainable development then it is imperative that policy is integrated at the central level of government. A very cursory look at the listed functions of two ministries finds evidence of activities that directly relate to sustainable development. Because of the cross cutting nature of sustainable development it will span a number of government agencies. For example, setting fuel specifications would touch on The Treasury, Ministry of Transport, Ministry of Economic Development, Ministry of Health and Ministry for the Environment.

Sustainable development appears as an outcome in the Ministry of Economic Development's (MED) statement of intent. It recognises the importance of the micro-economic foundations for growth and the Ministry's prime role is to ensure that these foundations evolve to facilitate economic development. Economic policies are seen to contribute both to a higher rate of economic development and to sustainable social and environmental outcomes. Two intermediate outcomes underpin the over-arching outcome. The first is that regulation of economic activity is effective and low cost and the second that regional development, business growth and innovation are actively facilitated and encouraged.

The Ministry for the Environment (MfE) reports on the state of the New Zealand environment and the way that environmental laws and policies work in practice, and advises Government on action necessary to improve environmental management. Significant areas of policy are resource management; land, air and water quality; waste, hazardous substances and contaminated sites; protection of the ozone layer; and climate change. The Ministry notes that most of the responsibility for day-to-day environmental management rests with local government, particularly the regional councils and that an integrated approach to environmental management provides a sound framework for developing policy and providing advice. The Ministry also offers advice on the environmental implications of other Government policies, such as Treaty of Waitangi settlements; and contributes to interdepartmental work on biological diversity, marine environmental issues, energy and transport. The Ministry consults with local government, resource users, resource managers, and others likely to be affected by changes in policy or legislation, and provides information and advice to assist them.

Clearly these two ministries are responsible for policy advice as it relates to sustainable development. Both offer advice on national policy issues such as climate change. Interestingly, the MfE reports on the state of the environment and advises government on action necessary to improve environmental management. The MED is quite explicit in its mission regarding the compliance costs of regulation. Who should lower levels of government, or business, approach when seeking action? The increased need for

horizontal co-ordination reduces incentive intensity at this level of governance and adds to co-ordination costs. The cost to lower units of government will increase with the number of supra units of government that need to be convinced that (national-level) intervention is necessary to achieve sustainable development. The emergence of units in central government ministries undertaking environmental analysis is reminiscent of the “green dots” that reforms in the 1980s sought to amalgamate.

5.2 Achieving clarity of purpose

Skelton and Memon (2002) provide a review of section 5 of the RMA and reflect on the experience of adopting and applying the concept of sustainability as the basis for an environmental statute designed to help resolve conflicts over allocation and resource management. Although section 5 uses “sustainable management” the definition encapsulates in their minds the concept of SD as laid out in the Brundtland report (WCED, 1974). During the policy development phase of the Act, the biophysical perspective – “environmental bottom line” was promoted by government and officials. One of the difficulties associated with section 5 is that practitioners and elected councillors have taken a view that differs from that accepted by the courts. Even if parliament thought it was moving away from an anthropocentric view to prescribing environmental bottom lines, this was not to be. The courts have taken the view of an “over all judgement” approach. Judgements “... allow for a comparison of conflicting considerations in the scale or degree of them, and their relative significance or proportion in the final outcome.” (Skelton and Memon, 2002:8). This suggests a weight be given to the various elements of sustainable management in the context of a particular case. Furthermore, Skelton and Memon (2002) suggest that it is inappropriate to single out in advance any particular elements of the meaning of sustainable management and give it some kind of primacy over others. Thus it puts the onus on decision-makers to take into account the diverse values that groups place on the environment as a basis for decision-making.

The above analysis has implications for sustainable development. First, the notion of environmental bottom lines approximates an operational meaning of strong sustainability. It would appear that the courts are interpreting the statute as requiring an overall judgement to be made. This suggests trade-offs – spatial and intertemporal – and provides an opportunity for the use of total economic value within the decision-making process. Furthermore, the above interpretation suggests an anthropocentric as opposed to ecocentric approach to value. The Courts’ interpretation of section 5 of the RMA does not prevent the implementation of MBIs. In recognising the need for a balance the Courts’ have provided an outer-envelope for the use of MBIs. However, we will see that the potential to use MBIs is severely limited.

5.3 Market based instruments

There is no doubt that there is significant scope to use MBIs to underpin sustainable development. Furthermore, there is ample evidence that MBIs can offer the same environmental outcome at lower cost. We now briefly turn to an examination of current practice. Once again coverage is limited, the aim is to highlight outcomes under contemporary decision-making structures rather than present definitive results. We have seen in the MfE’s statement that a great deal of the responsibility of environmental management rests with regional councils.

5.3.1 Legal framework

As McGee (1994) points out, polluter pays charges may only be imposed under the authority of an Act of Parliament. This of course limits the methods and level of government at which pollution taxes can be applied. Options for the use of polluter pays charges are further limited by the powers central government confers on lower levels of government (Bullen, Jacobsen, Palmer and Scrimgeour 2000). Therefore policies to promote sustainable development must fit within the legal framework prescribed by central government, acting outside the legal framework is *ultra vires*. Lower levels of government cannot apply polluter pays charges as an instrument of environmental policy if there is no parliamentary authority.

In the context of instrument choice it is important to recognise that local government has only the powers authorised in legislation. As Bullen *et al* (2000) note, local government is a creature of central government. Thus the relevant statutes *viz* Resource Management Act and Local Government Act limit the decision-making structures of regional/local government *vis-à-vis* sustainable development. Section 24 of the RMA requires the Minister for the Environment to consider the use of economic instruments to achieve the purposes of the Act. At the regional/local level, section 32 requires administrators when adopting any objective, policy, rule or method in relation to administration of the Act to have regard to alternatives including the provision of information, services or incentives and the levying of charges (including rates). This particular section is cast within the context of an assessment of *viz* an evaluation – appropriate to the circumstances - of the likely benefits and costs of each alternative. It would appear that the RMA provides a basis for using MBIs and indeed asks administrators to assess the relative merits of alternative instruments, including CAC and MBIs. Let us look at common approaches to water allocation and air pollution⁴.

5.3.2 Water consumption

Section 136 of the RMA makes provision for the transfer of water permits, to take and use water (eg, irrigation) which may in some circumstances be transferred to another firm or another site provided both sites are in the same catchment. Tradable water rights are feasible. Water is becoming an increasingly scarce resource in Canterbury and Otago. Economic development in both regions is being fuelled by water using industry *viz*. dairying, horticulture and other intensive farming systems.

Both regional councils allocate water on a first-come first served basis according to the requirements of land use. River flows and aquifer levels are often modelled and use monitored. Total abstraction levels are limited by minimum flows in rivers or water levels in aquifers. Restrictions are imposed during shortages. Typically, transfers are not feasible beyond transferring the permit to a new owner of the enterprise. During water restrictions there is limited scope for transfer. Permit duration is adequate for investment. Water use is not measured. Farmers are suspicious of measuring water use because they see it as a precursor to charging.

Although water allocation in both Canterbury and Otago makes allowances for “in-stream uses” administrators have not used the total economic value framework. Whether the balance referred to by Skelton and Memon (2002) is being achieved will be an ongoing debate. In parts of Canterbury and Otago the allocation of water between productive uses

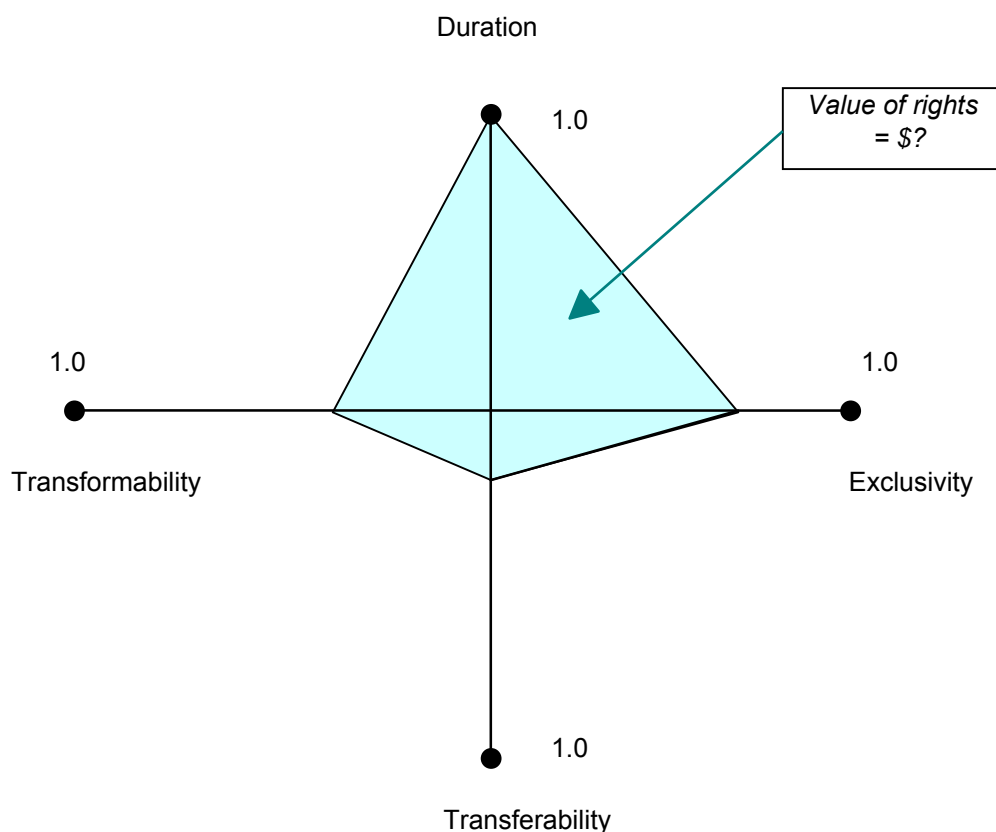
⁴ I have drawn extensively on the report prepared by Bullen *et al* (2000) prepared for the Auckland Regional Council and a legal opinion provided to Environment Canterbury.

and in-stream uses is being contested in the Environment Court. There can be little doubt that water is valuable in production – but administrators do not know the relative value and there is no mechanism (other than land acquisition) that guides water to its most productive use. The inefficiencies of CAC highlighted in Section 2 apply. Furthermore, if water is not being used efficiently then there might be a greater risk of adverse environmental impacts in the future. The contest for water – not only between productive users and environmental groups but also within the community of productive users - can be expected to increase over time.

The operative water allocation plan for the Oroua Catchment (Manawatu-Wanganui Regional Council) established a basis for the first tradable permit system in New Zealand (Sharp, 1996). Ten year permits were granted according to existing entitlements within constraints of the plan. New users had to obtain all or part of their requirements from existing irrigators. Although permits are transferable the right to transfer is attenuated. The whole or part of an interest in a water permit may be transferred during periods of water restriction only, provided the end use is irrigation, both sites are within the catchment and the Council is informed in advance of the transfer.

Figure 14 scores the Manawatu-Wanganui tradable rights scheme using the dimensions provided in Section 3. Duration scores highly, exclusivity lower because the users entitlement can be reduced, both transferability and transformability are attenuated and score relatively low. The area of the “star” suggests the value attaching to the right. The value of these rights would exceed the value of rights in an identical catchment where water is allocated using CAC.

Figure 14 - The quality of water permits



5.3.3 Air pollution

Controlling discharges to air is unambiguously assigned to regional councils. To an economist at least, the intent of section 32 is that regional councils should use a cost-benefit framework to consider alternative instruments. The total cost of the health effects of motor vehicle air pollution in New Zealand has been estimated to be around \$700 m per annum (Fisher, 2000).

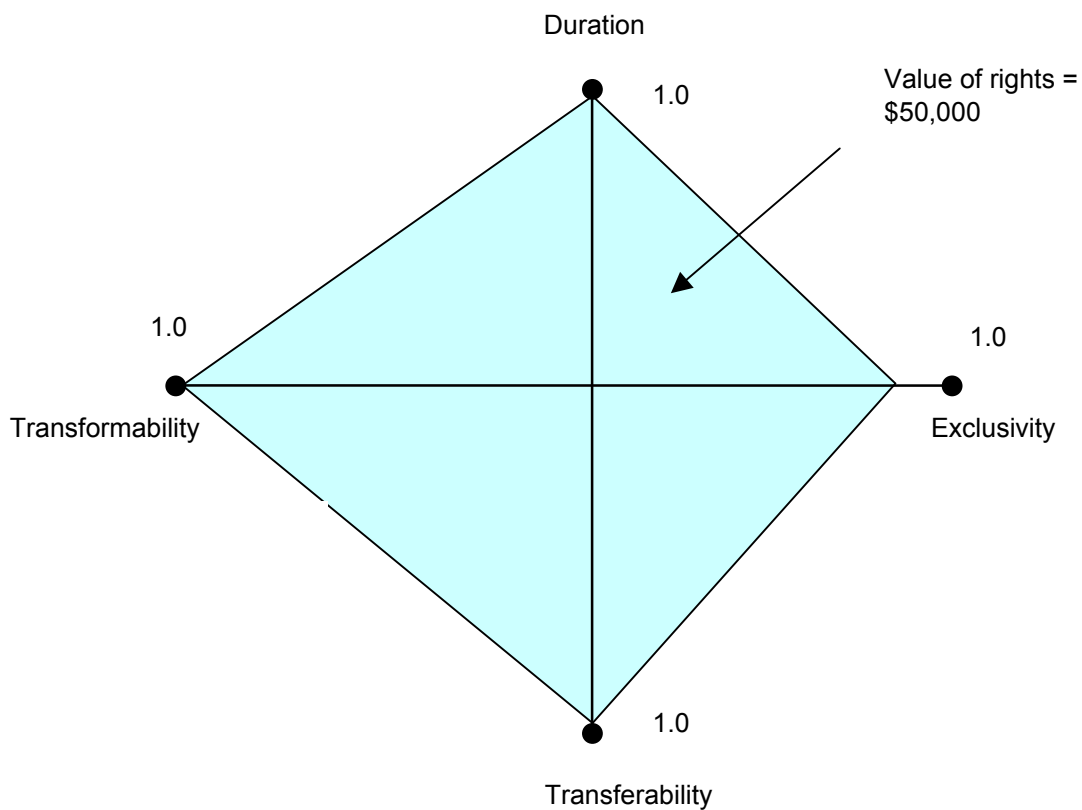
Site specific discharge permits regulate point sources of air pollution. Section 137 of the Act prohibits the transfer of a discharge permit or the interest in such a permit, except where the transfer is to the owner or occupier of the site. If a firm has a permit to discharge into the atmosphere and the firm is sold then the permit accompanies the firm. Legislation prevents the permit from moving independently of the firm. In contrast to setting minimum water flows and water quality standards, there is no mechanism for setting minimum air quality levels or maximum air pollution loadings.

There is no provision in legislation for setting quotas, allocating quotas or requiring firms to participate in a tradable permit scheme. Indeed there is a total absence of an allocation mechanism other than a requirement that councils process applications on a first-come first served basis. According to Bullen at al (2000) there is no legal authority for regional councils or district councils to implement economic instruments to deal with air pollution.

5.3.4 Fisheries

Development of New Zealand’s fisheries over the period 1963-83 occurred within an institutional framework that encouraged growth. By the end of this period economic rent in the fishery was low and important commercial stocks were depleted – that is, development was unsustainable (Sharp, 1997). In 1986 a quota management system (QMS) based on transferable rights, operating within the constraints of sustainability, was implemented. As noted in Section 2, the QMS is structured around individual transferable quota rights and a total allowable catch. The former institution provides the basis for allocating rights across commercial interests. The latter institution is based on scientific information and stakeholder consultation (Batstone and Sharp, 1999). The QMS easily out-performs its predecessor.

Figure 15 - The quality of fishing rights



Positive rents and sustainable harvest are distinguishing features of New Zealand’s fishing industry. Figure 15 shows the size of the “star” reflecting the quality of rights. In contrast to water use in irrigation, we know that economic rents are positive (the market value for ITQ > 0) and this information can be incorporated into the Ministry of Fisheries’ stock adjustment process. Fishers know the cost of harvest and they will form expectations in the market over stock abundance, market conditions, and so on. Thus managers have some additional information to base the allowable catch recommendations on. Furthermore, the Ministry can examine the impact of regulations in terms of value (Batstone and Sharp, forthcoming). It was pointed out in Section 2 that commercial fishers pay a significant share of the costs of management and research. Taxpayers finance the “public good” component of management and research activity.

5.3.5 Discussion

The RMA uses the term “economic instruments” and asks administrators to undertake an evaluation – appropriate to the case - of the costs and benefits of alternative courses of action. However the Act is silent on whether regional councils are authorised to use economic instruments (Bullen *et al* 2000). More significantly, the Act precludes the use of tradable instruments in point sources of air and water pollution. Two regional councils have seriously looked at MBIs as a possible solution to air pollution only to be thwarted by infeasibility in law.

In the case of water allocation, tradable permits are feasible, yet only one regional council has implemented a scheme. Adoption of tradable permits in the Oroua Catchment was prompted by submissions (from the Ministry for the Environment and Ministry of Agriculture) to hearings on the water plan. Water use in some areas is not even monitored. Users view monitoring as a precursor to charging and strongly oppose its use. This state of affairs stands in stark contrast to successful tradable rights system underpinning commercial fisheries in New Zealand.

What differences might have led to this outcome? First, fisheries policy has always been the function of a central unit of government. In contrast, since 1991 water resource management has been the primary responsibility of regional government. Thus we could follow the path dependency line of argument and conclude that reforms are somehow linked to the status quo. Second, we might look for reasons in the technical complexity of fisheries management *vis-à-vis* water resource management. Given that water resource managers must base their allocations on scientific information the issue is really one of relative cost. On the surface, the science of water hydrology would not appear to be any more complex than fisheries science. Third, the bio-economic state of New Zealand’s fisheries prior to reform required action. It might be that the state of water management has not reached a similar point. Maybe the looming contest between abstractive users and other non-abstractive interests will lead to market based instruments. Time will tell. Ownership is not an obvious issue – fish *in situ* are not owned, what is owned is a right to harvest. The same can easily apply to water. Finally, reluctance to embrace MBIs might be traceable back to pre-RMA days and the prevailing regulatory culture in regional government. Even the Section 32 requirement to assess the costs and benefits of alternative approaches is not sufficient to incentivise serious consideration of MBIs.

5.4 Conclusions

The above examples highlight shortcomings in the current institutional structure. First, the environment court has imposed its interpretation of the overarching aims of the RMA. Its interpretation is now at variance with the political view at the time. The contemporary view is one of “balance”, as opposed to securing “environmental bottom lines”. More significantly the courts interpretation of requiring an overall judgement sits well alongside the key concepts of sustainable development. This may not be a surprise because language of the RMA is remarkably similar to the Brundland definition.

One of the most striking observations has to do with MBIs. The use of MBIs is severely constrained by legislation and by the CAC culture that exists in regional government. For all intents and purposes MBIs are not feasible for controlling environmental externalities – *viz* pollution. Where scope does exist for their use – eg, water allocation - administrators invariably shy away from their application. Command and control is the favoured instrument and BAT is often selected without economic analysis. Administrators are not

able to report on the cost of compliance. In short, we currently have no idea of the true costs and benefits of policies related to sustainable development.

6 Conclusions and recommendations

6.1 Conclusions

Correcting externalities and pricing access to natural resources both occupy centre stage in sustainable development. Externalities and excess resource depletion are rooted in market failure. The economics literature on externalities and the merits of MBIs relative to CAC is well understood. Empirical evidence shows CAC to exceed least cost alternatives. In terms of sustainable development, regulation can be expected to result in excessive resource use in the present that might work to reduce the welfare of future generations. The weight of evidence shows MBIs to score relatively highly in terms of sustainable development.

As a criterion, economic efficiency can be applied to both the spatial and temporal aspects of sustainable development. In principle, the economic model can incorporate the latest scientific knowledge on ecosystems the notion of total economic value. Market based instruments are consistent with sustainable development. The choice of a market-based instrument should be based on analysis of the particular externality, while the choice between taxes and quotas as instruments of sustainable development control should be sensitive to the nature of the uncertainties involved.

Public policy should be based on the rational use of market incentives. This is particularly true in the context of sustainable development. In New Zealand today the potential for economic analysis to contribute to environmental policy is great and yet to be fully realised.

Historically, central and local governments have relied primarily on regulations to meet their environmental goals. From the outset we must note that both CAC and polluter pays require a standard. Governments usually set standards after considering scientific evidence and stakeholder preferences. Thus the issue for sustainable development is using a policy instrument that achieves the standard at least-cost. To do otherwise unnecessarily increases expenditures in the present. Regulations that impose a technology on industry will not adequately account for the heterogeneity of firms nor will the technology adopted necessarily be cost minimising. Regulation will not produce the desired outcome at least-cost. Empirical evidence supports this conclusion.

Polluter pays provides an opportunity cost to the polluter that acts as an on-going incentive to implement less costly abatement technology. Defining tradable rights to the standard provides similar incentives. Economic instruments produce a richer response on both sides of the market. There is no blueprint or algorithm to follow when considering whether to regulate or turn to market-based instruments. Good economic reasons might exist for adopting regulations. Devolving rights to communities, empowering them to “manage” the local resource, providing technical (and possibly financial) assistance, is a powerful instrument. There are good working examples of how devolution to non-government organisations produced significant environmental gains.

Market based instruments score relatively highly in terms of sustainable development. Concepts such as total economic value and concern for future generations can be directly addressed and incorporated. Within the generic set of options laid out above, there exists a huge range of potential applications. Discovering the most appropriate instrument

should result from careful economic analysis. Ill-conceived proposals to use of MBIs will not gain the acceptance needed for implementation.

In New Zealand today the potential for economic analysis to contribute to environmental policy is great and yet to be fully realised. At a more general level, current practice of not pricing access to scarce environmental resources will, eventually compromise sustainable development. Reliance on regulation offers a political advantage in that its impact on producers and consumers is mostly implicit.

Often there are difficulties to overcome with economic instruments. For example, there might be powerful income effects to deal with that work against the political acceptability of economic instruments. Lack of practical understanding of the instruments can limit application. Too often they are crudely modelled and fail to take into account important transition steps. While it is important to get the principles right, it is also important to get the transition sorted.

A simple net-benefit maximising model shows the location of control to hinge on the public good nature of the externality and the cost of information. In situations where spillovers are minimal then local decision-making is likely to be more efficient. More weight is given to the argument in favour of local decision-making if we recognise information asymmetries in principal-agent relationships and the benefits of learning from variety at the local level of government. Arguments in favour of more central control include situations where spillovers are important, scale economies (eg, in research) might limit policy initiatives, there is increased transaction costs and a race for the bottom. These are of course empirical issues.

The structure of governance is important to sustainable development because it works to determine spatial and intertemporal patterns of resource use, economic growth and the maintenance of natural capital. Virtually every discussion on sustainability concludes that existing institutions are part of the problem and reform is required.

Devolving rights to communities, empowering them to “manage” the local resource, providing technical (and possibly financial) assistance, is a powerful instrument. There are good working examples of how devolution to non-government organisations produced significant environmental gains.

However, MBIs must be legally feasible if they are to become an object of choice. Furthermore, administrators should be appropriately incentivised to adopt policies that are conducive to economic growth within the context of sustainable development.

Enhancing the coordinative power of units of government – horizontally and vertically - is necessary for achieving sustainable development. This is about getting the basic building blocks set in place. Sustainable development outcomes are inextricably linked to decision making structures and procedures. Path dependency should be recognised. If resources become increasingly scarce users will find ways to protect and enhance the value of their property rights within existing constraints. Empirical studies show that environmental outcomes – water use, stock enhancement, water quality – can, in part, be linked to institutional structure.

It is important to seriously consider the allocation of rights - vertically and horizontally - within the architecture of governance. The issue is who has the rights – if at all - to implement MBIs. Incentives for achieving sustainable development should be clearly related to agency missions. As noted in my earlier report, sustainable development policy may have multiple goals that may make it difficult to appropriately incentivise

administrators. Difficulties with measuring the productivity of agents may result in low powered incentives to efficiently achieve sustainable development outcomes.

Implementing sustainable development policy will require a transparent linkage between indicators and policy delivery mechanisms. Policies are typically crosscutting and a particular issue will usually span the domain of several ministries.

Optimal institutional design, especially within the context of sustainable development, is beyond the reach of economic theory. As a rough guideline, policy should add value to the economy and society, policy should not be too prescriptive and policy instruments should lay foundations that recognise heterogeneity, provide scope for individuals to adjust according to their circumstances and flexible enough to incorporate dynamic adjustments. Policy should be performance based, implementation transparent and agencies accountable. Policy should be clear and concise. Policy should result in low compliance costs. Policy should be enforceable and offer low probability of regulatory capture.

Several shortcomings of existing institutional and decision-making structures were highlighted. First, it is clear that the political intent of section 5 of the Resource Management Act (RMA) has not endured and we have witnessed the Environment Court developing its own interpretation. The Courts' interpretation sits well alongside the key concepts of sustainable development. This may not be a surprise because language of the RMA is remarkably similar to the Brundtland definition. Second, the use of MBIs is severely constrained by legislation. For all intents and purposes they are not feasible. Third, where scope does exist for using MBIs administrators invariably shy away from their application. Command and control is the favoured instrument and BAT is often selected without economic analysis. In short, we have no idea of the costs and benefits of policies related to sustainable development.

Setting aside legal infeasibility, administrator preference for CAC might stem from three sources. First, interest groups might be able to exert influence on policy and mechanism design. Second, it might be argued that lower levels of government do not have the scientific knowledge necessary for using MBIs. Third, lower levels of government may not have the expertise to analyse and propose operational alternatives to CAC. If this characterisation is correct, then the last two problems can quite easily be addressed. We must recognise that CAC requires scientific knowledge therefore the issue has to do with the additional cost of knowledge and human capital necessary for implementing MBIs. Regulatory capture – if it exists - may prove more difficult to control. For example, legislation could be made more prescriptive or the locus of decisions could be raised to central government. Whether this makes economic sense is an empirical issue because of the costs and benefits involved with each alternative.

The environment is extreme in the extent that it is characterised by overlapping and shared authority. Indeed it is highly probable that some aspect of the environment touches every unit of government in New Zealand. Thus it is highly unlikely that we can match the primary scale of the problem with the primary scale of authority to manage the problem. Decision-making is often simultaneously pulled out toward international management and inward to regional and local management.

Meeting the challenge of sustainable development requires clear processes for identifying and integrating economic and environmental goals and efficiently implementing the goals at all levels of responsibility. Implementing sustainable development policy will require a transparent linkage between indicators and policy delivery mechanisms. It was argued

above that it is not possible to provide an optimisation plan for achieving the goals of sustainable development. Policies are typically cross-cutting where the particular issue will span the domain of several ministries and yet no one ministry is responsible for the policy

6.2 Recommendations for future research

This report builds on earlier work that focussed on developing an integrated framework for sustainable development. The set of instruments available to policy makers is relatively well understood. A brief survey of contemporary practice reveals that either the application of MBIs is infeasible in law, or in cases where it is feasible, administrators are reluctant to implement MBIs. The former can be corrected by law reform if government considers this necessary to achieving sustainable outcomes. Important externality problems can be addressed by law reform *viz.* the Resource Management Act. However, while reform may be necessary it is unlikely to be sufficient. This report illustrated situations where the use of MBIs is feasible yet administrators are reluctant to implement them.

There appears to be a significant skill gap vis-à-vis economic instruments at lower levels of government. Short courses and education programs might effectively plug this gap.

Part of the reason why CAC endures may well be the fact that we simply don't know how much CAC costs the economy. Empirical estimates of these costs might prove useful to policy makers who can highlight the real cost of CAC. This can be achieved in two ways. Primary data could be gathered from a sample of firms to estimate compliance costs. There may be an existing database – for example, the Annual Business Enterprise Survey run by Statistics NZ – that could give an indication of compliance costs.

A second area of future work relates to sustainable development indicators. This was suggested in my first report. Internationally, there is some debate about whether to use micro-level or macro-level indicators. This topic could be further explored with the view of providing indicators for *ex post* assessment of progress and *ex ante* indicators for policy analysis.

References

- Anderson, T.L. and P.J. Hill 1975. The Evolution of Property Rights: A Study of the American West, *Journal of Law and Economics*, 18: 163-79.
- Arrow, K. 1969. The Organisation of Economic Activity: Issues Pertinent to the Choice of Market versus Nonmarket Allocation, In *The Analysis and Evaluation of Public Expenditure: The PPB System*, Vol 1., US Joint Economic Committee, 91st Congress, 1st session, Washington, DC, US Government printing Office, pp. 59-73.
- Atkinson, G. 2000. Sustainable Development and Policy, in *Objectives, Instruments and Policies, Environmental Policy*, (ed) D. Helm, Oxford University Press, Oxford, pp29-47.
- Atkinson, S E. and D.H. Lewis. 1974. A Cost-Effective Analysis of Alternative Air Quality Control Strategies, *Journal of Environmental Economics and Management*, 1, 237-250.
- Batstone, C.J. and B.M.H. Sharp. 1999. New Zealand's Quota Management System: The First Ten Years, *Marine Policy*, 23(2):177-190.
- Batstone, C.J. and B.M.H. Sharp. Minimum Information Management Systems and ITQ Fisheries Management, *Journal of Environmental Economics and Management* (forthcoming).
- Bishop, R.C. 1978. Economics of Endangered Species, *American Journal of Agricultural Economics*, 60: 10-18.
- Bourgeon, J.M., P.A. Jayet and P. Picard. 1995. An Incentive Approach to Land Set-Aside Programs, *European Economic Review*, 39(8): 1487-1509.
- Braden, J.B. and S. Proost. 1997. *The Economic Theory of Environmental Policy in a Federal System*, Edward Elgar Publishing Inc., Lyme.
- Bromley, D.W. (ed). 1995. *The Handbook of Environmental Economics*, Blackwell, Oxford.
- Brozovic, N., J.M. Carey, and D.L. Sunding. Trading Activity in an Informal Agricultural Water Market: an Example from California, *Water Resources Update*, (in Press).
- Bullen, S., V. Jacobsen, G. Palmer and F. Scrimgeour. 2000. The Use of Economic Instruments for the Control of Air Quality in Auckland: A Scoping Study, Prepared for the Auckland Regional Council, Arthur Anderson Chen & Palmer.
- Caillaud, B., B. Jullien and P. Picard. 1996. National vs European Incentive Policies: Bargaining, Information and Coordination, *European Economic Review*, 40, 91-111.
- Carey, J.M. and D.L. Sunding. 2001. Emerging Markets in Water: A Comparative Institutional Analysis of the Central Valley and Colorado-Big Thompson Projects, *Natural Resources Journal*, 41:283-328.
- Coase, R. 1960. The Problem of Social Cost, *Journal of Law and Economics*, 3: 1-44.

- Dasgupta, P.S. and G.M. Heal. 1979. *Economic Theory and Exhaustible Resources*, Cambridge University Press, Cambridge.
- Davis, L.E. and D.C. North. 1971. *Institutional Change and American Economic Growth*, Cambridge University press, Cambridge.
- Dovers, S. 2001. Institutions for Sustainability, Centre for Resource and Environmental Studies, The Australian National University, Issue 7.
- Easter, K. W., M.W. Rosegrant and A. Dinar. 1999. Formal and Informal Markets for Water: Institutions, Performance, and Constraints, *The World Bank Research Observer*, 14(1), 99-116.
- Egan, L.M. and M.J. Watts. 1998. Some Costs of Incomplete Property Rights With Regard to Federal Grazing Permits, *Land Economics*, 74(2): 171-186
- Epstein, R. 1995 *Simple Rules for a Complex World*, Harvard University Press, Cambridge MA.
- Field, B.C. and M.K. Field 2002. *Environmental Economics: An Introduction* (3rd Edition), McGraw-Hill, New York.
- Fisher, G.W. 2002. Health Effects Due to Motor Vehicle Pollution in New Zealand, A Report to the Ministry of Transport, Wellington.
- Freeman, A.M. 1993. The Measurement of Environmental and Resource Values: Theory and Methods, *Resources for the Future*, Washington D.C.
- Gilbert, G. and P. Picard. 1996. Incentives and optimal size of local jurisdictions, *European Economic Review*, 40, 19-41.
- Goodin, R.E. 1996. Institutions and Their Design, In *The Theory of Institutional Design*, (ed) R.E. Goodin Cambridge University Press, Cambridge.
- Grossman, S. and O. and Hart .1983. An Analysis of the Principal-Agent Problem, *Econometrica* 51, 7-45.
- Guerin, K. 2001. Subsidiarity – Implications for New Zealand, Treasury, Wellington, Working Paper 02/03.
- Hahn, R.W. and R.G. Noll. 1982. Designing a Market for Tradable Emission Permits, *Reform of Environmental Regulation*, Balinger, Cambridge.
- Hammond, P.J. and G.D. Myles (eds). 2000. *Incentives, Organisation, and Public Economics*, Oxford, Oxford University Press.
- Hansmann, Henry B. 1980. The Role of Nonprofit Enterprise, *Yale Law Journal*, 89(5): 835-902.
- Hartwick, J.M. 1990. Natural Resources, National Accounting and Economic Depreciation, *Journal of Public Economics*, 43: 291-304.
- Helm, D. 2000 Objectives, Instruments and Policies, in *Environmental Policy, Objectives Instruments and Implementation*, (ed) D. Helm Ed. Oxford University Press, Oxford, pp. 1-28.

- Hughes, W.R. 1980. Petrol Consumption in New Zealand 1969-79: Fixed and Time Varying Parameter results, *New Zealand Economic Papers*, 14: 28-42.
- Itaya, J., D. de Meza and G.D. Myles. 2000. Who Should Provide Public Goods? in *Incentives, Organisation, and Public Economics*, (eds) P.J. Hammond and G.D. Myles, Oxford University Press, Oxford, pp123-147.
- Jaffe, A., S. Peterson, and P. Portney. 1995. Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us? *Journal of Economic Literature*, 33: 132-163.
- Kasper, W. and M.E. Streit. 1998. *Institutional Economics, Social Order and Public Policy*, Edward Elgar, Cheltenham.
- Kerr, S., M. Claridge and D. Millich. 1998. Devolution and the New Zealand Resource Management Act, Wellington, Treasury, Working Paper 98/7.
- Krupnick, A.J. 1983. Costs of Alternative Policies for the Control of NO₂ in the Baltimore Region, *Journal of Environmental Economics and Management*, 13, 189-197.
- Liebecap, G. 1986. Property Rights in Economic History: Implications for Research, *Explorations in Economic History*, 23: 227-252.
- Leibenstein, H. 1966. Allocative Efficiency vs. "X-Efficiency", *American Economic Review*, 56(3): 392-415.
- Maloney, M.T. and B. Yandle. 1984. Estimation of the Cost of Air Pollution Control Regulations, *Journal of Environmental Economics and Management*, 11, 244-263.
- Markandya, A. 1998. The Costs of Environmental Regulation in Asia: Command and Control Versus Market-Based Instruments, *Asian Development Review*, 16(1): 1-30.
- Markusen, J., E. Morey and N. Olewiler. 1993. Environmental Policy When Market Structure and Plant Locations are Endogenous, *Journal of Environmental Economics and Management*, 24: 69-86.
- McClelland J.D. and J.K. Horowitz. 1999. The Costs of Water Pollution in the Pulp and Paper Industry, *Land Economics*, 75(2): 220-40.
- McGartland, A.M. 1984. Marketable Permit Systems for Air Pollution Control: An Empirical Study, Ph.D. dissertation, University of Maryland.
- McGee, D. 1994. *Parliamentary Practice in New Zealand* (2nd Edition), GP Publications, Wellington.
- Morris, J. 2000. *Rethinking the Precautionary Principle*, Butterworth Heinemann, Oxford.
- Nicholson, W. 2000. *Intermediate Microeconomics* (8th Edition), Harcourt, Orlando.
- North, D.C. 1990. *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, Cambridge and New York.
- OECD. 1972. Acts of OECD's Council Relating to the Environment, Guiding Principles Concerning International Economic Aspects of Environmental Policies, Recommendation adopted 26th May, 1972, C(72)128.

- OECD. 2001. Sustainable Development: Policies to Enhance Sustainable Development, General Secretariat, 27th April 2001.
- OECD. 2002. Environmental Policies and Instruments, [http://www.oecd.org.oecd, 3380, EN-Document-471-14-no-1-3016-OFF.htm](http://www.oecd.org.oecd,3380,EN-Document-471-14-no-1-3016-OFF.htm).
- O'Neil, W., M. David, C. Moore and E. Joeres. 1983. Transferable Discharge Permits and Economic Efficiency: The Fox River, *Journal of Environmental Economics and Management*, 10: 346-355.
- Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action, Cambridge University Press, Cambridge and New York.
- Panayotou, T. 1996. Matrix of Policy Options and Financial Instruments, Paper prepared for the Third Expert Group Meeting on Financial Issues of Agenda 21, Manila, Philippines.
- Parson, E.A. 2000. Environmental Trends and Environmental Governance in Canada, *Canadian Public Policy*, 26, 2, 126-143.
- Pearce, D. 2000. Technology-Based Environmental Standards, in Environmental Policy, Objectives Instruments and Implementation, (ed) D. Helm Ed. Oxford University Press, Oxford, pp75-90.
- Pearce, D. and E.B. Barbier. 2000. Blueprint for a Sustainable Economy, Earthscan Publications Ltd., London.
- Raffensperger, C. and J. Tickner. 1999. Protecting Public Health and the Environment: Implementing the Precautionary Principle, Island Press, Washington D.C..
- Roach, F. C. Kolstad, A.V. Kneese, R. Tobin and W. Williams. 1981. Alternative Air Quality Policy Options in the Four Corners Region, *Southwest Review*, 1, 29-58.
- Saliba, B.C. and D.B. Bush. 1987. Water Markets in Theory and Practice, Market Transfers, Water Values and Public Policy, Westview Press, Boulder.
- Sandmo, A. 2000. The Public Economics of the Environment, Oxford University Press, Oxford.
- Schmalensee, R., P.L. Joskow, A.D. Ellerman, J.P. Montero and E.M. Bailey (1998). An Interim Evaluation of Sulfur Dioxide Emissions Trading, *The Journal of Economic Perspectives*, 12(3), 53-68.
- Scott, A.D. 1996. The ITQ as a Property Right, in *Property Rights and Fishery Management on the Atlantic Coast*, (ed) B.L. Crowley, Atlantic Institute for Market Studies, Halifax, pp31-98.
- Segerson, K., T.J. Miceli and L. Wen. 1997. Intergovernmental Transfers in a Federal System, *The Economic Theory of Environmental Policy in a Federal System*, (eds) J.B. Braden and S. Proost, Edward Elgar Publishing Inc., Lyme, pp.43-65.
- Seskin, E.P., R.J. Anderson and R.O. Reid. 1983. An Empirical Analysis of Economic Strategies for Controlling Air Pollution, *Journal of Environmental Economics and Management*, 10, 112-124.

- Sharp, B.M.H. 1996a. Natural Resource Management in B. Silverstone, A. Bollard and R. Lattimore (eds.) *A Study of Economic Reform: The Case of New Zealand*, 425-449, Elsevier Science, Amsterdam.
- Sharp, B.M.H. 1996b. Progress Towards Tradable Water Permits in New Zealand, in Ed J.J. Pigram *Security and Sustainability in a Mature Water Economy: A Global Perspective*, Proceedings of an International Workshop, University of Melbourne, February 1996. pp.141-153.
- Sharp, B.M.H. 1997. From Regulated Access to Transferable Harvesting Rights: Policy Insights from New Zealand, *Marine Policy*, 21(6): 501-517.
- Sharp, B.M.H. 2001. Sustainable Development: Environment and Economic Framework Integration, Wellington, The Treasury, Working Paper 01/27.
- Sharp, B.M.H. 2002. A Step Closer With Individual Transferable Quotas, Paper Presented to PERC's Thirteenth Political Economy Forum, Evolving Property Rights in Marine Fisheries, Lone Mountain Ranch, Montana, March 21-24.
- Skelton, P. and A. Memon. 2002. Adopting Sustainability as an Overarching Environmental Policy, *Resource Management Journal*, 10,1, 1-10.
- Spofford, W.O. 1984. Efficiency of Alternative Source Control Policies for Meeting Ambient Air Quality Standards: An Empirical Application to the Lower Delaware Valley, unpublished Resources for the Future, Inc. discussion paper D-1189, Washington D.C..
- Stavins, R.N. (ed) 2000. *Economics of the Environment*, 4th Edition, W.W. Norton & Company, New York.
- Tiebout, C. 1956. A Pure Theory of Local Expenditures, *Journal of Political Economy*, 64: 416-24.
- Tietenberg, T. 1996. Environmental and Natural resource Economics, 4th Edition, Glenview, Scott Foresman and Company.
- Tirole, J. 1994. The Internal Organisation of Government, *Oxford Economic Papers*, 46(1): 1-29.
- Van den Bergh, R. 1996. Economic Criteria for Applying the Subsidiarity Principle in the European Community: The Case of Competition Policy, *International Review of Law and Economics*, 16, 363-383.
- Weisbrod, B. A. 1975. Toward a Theory of the Voluntary Non-Profit Sector in a Three-Sector Economy, in *Altruism, Morality, and Economic Theory*, ed. Edmund S. Phelps pp.171-95. Russell Sage Foundation.
- Weitzman, M.L. 1974. Prices vs. Quantities, *Review of Economic Studies*, 41(4): 477-91.
- Williamson, O.E. 1991. Strategizing, Economising and Economic Organisation, *Strategic Management Journal*, 12(Special issue), 75-94.
- Williamson, O.E. 1996. *The Mechanisms of Governance*, Oxford University Press New York.

World Commission on Environment and Development (WCED). 1987. *Our Common Future*, Oxford University Press, Oxford.

Young, M., D. H. MacDonald, R. Stringer, and H. Bjornlund. 2000. *Inter-State Water Trading: A Two Year Review*, Policy and Economic Research Unit, CSIRO Land and Water, Australia.