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Environmental Policy  
Instruments and Institutions in  
Developing Countries

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## 1. Introduction<sup>1</sup>

Environmental economics in the industrialized countries has developed in the mould of traditional public economics which assumes a policy-maker maximizing a social welfare function, most frequently not assumed to satisfy any properties except the Pareto principle. Analysis was, therefore, particularly in the earlier studies, largely confined to the design of policies to achieve Pareto-efficiency in the presence of market failures. In the last decade or two, when policies have started to be implemented on a large scale, attention has shifted to implementation efficiency, distributional consequences and political economy considerations concerning incentives for compliance, monitoring and enforcement. There is a growing literature on citizen enforcement, the use of liability, labelling and information, design for environment, etc. Even with these new and exciting extensions, most of this body of work tends to presume reasonably well-functioning markets and underlying economic governance systems, which may be problematic for many developing countries. A large share of research has concentrated on applications to industrial pollutants with the polluters assumed to be firms. There are other applications, of course, which have been analysed in a developed country context, for example, vehicular pollution and solid waste management. The practice of environmental policy is generally perceived as having to some extent moved from physical and technological regulation to market based instruments and to more sophisticated instruments such as liability and information disclosure requirements<sup>2</sup>.

In the developing countries, environmental economics, *per se*, is a newer and weaker discipline but its subject matter is clearly central to the concerns of most of these countries. We believe the character and mix of instruments to be chosen is quite a complex design issue that depends crucially on the type of issue and economy we are dealing with. It is not sufficient to characterise instruments as “regulatory”, “legal” or “economic”. All instruments are based on laws and all imply some form of regulation that has economic consequences. We should thus adapt to the particular circumstances at hand as wide a range of policy instruments as is needed. In practice in developing countries, this will include the design or restructuring of a broad set of institutions including property rights, legal systems, accountability and management of the public sector, information provision systems and so forth. This is all the more important since the scope of what constitutes environmental policy is even wider in developing countries than in the developed world. The reason for this is simple: many environmental problems that have been solved in the developed world still loom large in poor countries, (see the chapter by Barbier in this volume). For example, waterborne diseases associated with bacterial contamination of water supplies and lack of sanitation are leading causes of death in poor countries while negligible in rich ones. Another leading cause of mortality in very low income countries is respiratory disease associated with indoor air pollution resulting from the use of solid fuels such as wood for cooking. These two problems (water and sanitation, and indoor air pollution) are high up on the list of causes of mortality in low-income countries, together accounting for 9% of the 833 million disability-adjusted life-years lost in

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<sup>1</sup> Comments from Carl Bauer and Mike Toman are gratefully acknowledged.

<sup>2</sup> The literature is very large but much of it is summarised in the textbooks that have formed successive generations of students in this area: Baumol and Oates (1988), Tietenberg (1992), Hanley, Shogren and White (1997) and Kolstad (2000). Stavins (2001) provides a good overview of the current implementation, in industrialised countries, of market based policy instruments.

high mortality developing countries every year, not far behind the single largest risk factor, being underweight which accounts for 15% (World Health Organisation, 2002)<sup>3</sup>.

Since agriculture, forestry, and fisheries constitute a much larger part of the economy in poor countries and the poor are disproportionately concentrated in these sectors, problems of resource depletion such as groundwater scarcity, inappropriate allocation of surface water, soil erosion and deforestation are all very important. In addition to having environmental problems from industry and transport, developing countries have a larger set of problems related to natural resource management and basic health.

Poor people have virtually no capital except the common property resources of the most immediate ecosystems. These provide fuel, fresh water, collection of food, firewood, construction material, material for handicraft, medicinal plants, fodder etc. and thus represent a much larger proportion of the asset portfolio for a poor person than the corresponding ecosystem resources do for rich people. This has serious implications for policy and it makes enclosure or privatisation very problematic from a distributional and welfare view-point - even in those cases where such enclosure does promote technical efficiency. The large number of very poor people in poor countries implies that distributional issues such as the burden of environmental problems and abatement costs become even more important than in richer countries. The fact that the distribution of costs is decisive for the political feasibility of instruments and that it varies strongly between instruments underlines the importance of careful instrument design. The same is true of risk management: Those who live in poverty are very risk averse and need savings or insurance to meet variations in income or in expenses. However the institutions that provide insurance and savings to the poor are often highly insufficient. This can be an important factor leading to unsustainable behaviour and therefore it is important to help build such institutions as will be discussed in section 2.3.

Note that distributional and efficiency effects cannot be conveniently separated: they are intimately intertwined. One reason for this is an instrument that might have looked "efficient" on the drawing board will not be efficient if its social acceptability and feasibility are low due to unacceptable distributional consequences. If, for instance, a tax implies a burden on powerful firms they are likely to resist it and resort to lobbying against it. If the result is a much lower tax than what would have been optimal then abatement (or resource conservation) will also be modest. Sterner (2003) shows how refunded emission payments may split the industry lobby (since a large share of firms actually gains more from the refunds than they pay in taxes). This may make it possible to implement a considerably higher fee level leading to more abatement than under a (low) tax.

Industrial, vehicular and agricultural pollution, while increasing rapidly with industrialization, and in absolute terms generally far worse in developing than in developed countries, may still be of less importance to the majority of people in poor countries than the problems mentioned above. Over-simplifying in order to classify, it could be said that the resource depletion and allocation problems described are associated with undefined property rights, while biological contamination of water

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<sup>3</sup> See also the Krupnick and Markandya chapters in this volume.

and indoor air pollution are perhaps best seen as public health issues, i.e. the provision of public goods. Other air and water pollution may be analysed as standard issues of environmental regulation although particular attention must be focused on the issues of information and monitoring and the distribution of costs and benefits.

## **2 Analysis of some factors influencing instrument choice in developing countries**

Most developing countries were colonized and many devastated by war and ethnic conflicts that have left geographically, politically, socially and ethnically heterogeneous and often conflicting norms, traditions and legal systems. We know that a given resource, forest, lake, mangrove, coral reef or other, could potentially be managed in a number of different ways as long as these have evolved to suit the ecology and culture. When however multiple principles of management and multiple legal principles are overlaid the result is often that short-sighted rapacious interests get the upper hand over caution and sustainability.

A vital aspect of the inability of public institutions in many developing countries is the lack of a good reliable and functioning public body. This is often discussed in terms of corruption and it may be true that poverty can sometimes be a fertile ground for corruption but we believe the most important aspects are others. One of these is the excessive concentration of power to central government. In many of the countries we have in mind, the power of local municipalities and courts is very small and virtually all power is concentrated in the hands of the state - and in fact of a small number of politicians such as the president and/or prime minister.<sup>4</sup> This excessive centralisation is inefficient, deficient in democracy and conducive of corruption. It usually does not favour sustainable management of ecosystems.

### **2.1 The Provision of Public Goods**

One of the effects of the deficiencies in governance structures that characterise many poor countries is an inability to provide public goods. It is even possible that it is the very difficulty in providing reasonable public goods that is the core element that makes economic development so slow. Without access to reliable electricity, water, roads and other physical infrastructure, production is inevitably hampered. Without good public health and education, many of those born gifted but poor are not given the preconditions to develop their productive skills. Without an impartial and independent judiciary and other institutions that guarantee security and prospects for private property there will be few investments. And, to repeat: most environmental and resource issues are largely "public" which implies that there tends to be insufficient provision.

Consider the issue of domestic water supply. More than a quarter of the population in South and South-east Asia (including China) as well as some South American countries lack access to safe drinking water (Gleick, 1998). In large parts of

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<sup>4</sup> The IMF's Government Finance Statistics show that the size of local government as a proportion of all government, measured in terms of expenditures or revenues increases with income and democracy.

Sub-Saharan Africa and some Asian countries more than three-quarters of the population lacks access. The picture with respect to sanitation is worse.

One might suspect that inadequate domestic water supplies may be in part due to small total water supplies. In fact, this is generally not the case. In most developing countries, agricultural use is at least four times domestic and industrial use combined, so that relatively small additional transfers for domestic consumption would have little impact on agriculture (Rosegrant and Binswanger, 1994). In addition, most of the water withdrawn for domestic consumption is returned to rivers (except in coastal cities) and available for agricultural use.<sup>5</sup>

Another questionable hypothesis is that since the poor simply do not have the willingness-to-pay for clean water and sanitation, they do not get it. While low willingness-to-pay is part of the reason for the lack of provision, it is often misleading. The poor sometimes pay exorbitant prices for the water they buy from private vendors (Lee 1994). This strongly suggests that municipal authorities have simply failed to provide piped safe water despite existing demand for it. This is a serious failure of governance.

Municipal water provision in the worst-affected countries is poor even for those who get it and efficiency is low. For example, 24-hour piped water from the municipality is virtually unknown in India. Pipes leak leading to large water losses and the loss of pressure when water is not present makes contamination by sewage possible. Attempts to augment supplies by pumping more water may not result in any more reaching consumers unless pipes are monitored and repaired (Lee, 1994). The number of municipal water employees per thousand connections may be an order of magnitude higher than in countries that provide reliable safe piped water.<sup>6</sup>

In this area a number of different policies and policy instruments are required: On the one hand, the systems for local supply and distribution of water are classical public goods<sup>7</sup>. On the other hand, as suggested above, redefining property rights in agricultural and industrial water may be important to elicit increased supply for domestic water supplies by encouraging efficiency in other sectors and enabling water transfers from them. Taking the second point first, several countries have in recent years enacted new water laws that may be fundamental in facilitating these developments. The new South African water law from 1998 focuses on providing access to the basic levels of service required to ensure health for all South Africans. At the same time it also seeks to implement an ecosystem approach to water management: It guarantees in-stream flow necessities (minimum flow levels) and includes a campaign against invasive tree species. One of the instruments is a licensing process to limit the planting of trees.

One factor that is very important in urban water supply is the appropriate design of water tariffs. In some countries, increasing block tariffs have been used to “guarantee” that the poor get access to affordable water. Often the tariffs for the higher blocks, and the definitions of the blocks, are such that the authority is left with

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<sup>5</sup> For the US, the figures are 83% for domestic withdrawals and 84% for industrial withdrawals (Briscoe, 1997).

<sup>6</sup> Personal communication from Vivek Srivastava, UN Water and Sanitation Program-South Asia.

<sup>7</sup> See also the chapter by Dinar in this volume concerning the economics of water issues.

too little revenue to provide connections to everybody. In such situations it is invariably the poor who are left out. As already mentioned the poor often pay many times the official price of water when they have to buy it from vendors because they are still waiting for connections to the public system. Thus rhetorically “pro-poor” policies actually end up hurting the poor. For example, Foster, Pattanayak and Prokopy (2003) find that 75% of the water subsidy completely fails to reach the poor in two South Asian cities, Bangalore and Kathmandu. In principle it may be possible to design a lifeline tariff large enough to cover marginal costs of service and partly pay for connection cost and combine this with an explicit government subsidy of connection versus consumption, in a way that improves public service and welfare without such adverse impacts on welfare or pervasive distributional consequences, see

Box 1 Water provision for the poor with efficient tariffs

Chile is, as mentioned, country that has followed neo-liberal policies quite strictly. Water is partly privatized partly run by autonomous public bodies. When new more efficient tariff structures were enacted in the early 1990s, the rate increase was dramatic for small consumers, who previously had heavily subsidized rates. To address this, a system of subsidies was created for consumers unable to pay. To achieve transparency in public affairs, this subsidy is not an automatic “lifeline” tariff but a direct subsidy. To receive the subsidy, consumers must file a written application to the municipality proving their incapacity to pay. One condition is that the cost of 20 m<sup>3</sup> is more than 5% of the household’s income. In 1995, just over 15% of customers received subsidies. This system might be efficient and sensitive to poverty concerns while preserving transparency in the public use of money. However, the system obviously incurs administrative costs and may be humiliating for those who are forced to apply for the subsidy.

box for one, probably rather rare example where this has been at least partly successful.

Higher tariffs for at least some customers are clearly needed to generate the necessary revenues to cover costs in order to improve the situation. The political difficulty is that consumers (usually also voters) used to poor service are unwilling to pay higher charges unless service improves. Contingent valuation studies of

willingness-to-pay have shown that it is highly sensitive to reliability of service (World Bank Water Demand Research Team, 1993). Ways to provide an assurance of good service are politically necessary if tariffs are to be raised.

Professionalization of the water authority and appropriate incentives for management are needed to check theft and improve efficiency. Privatization is one way of achieving this, but unless credible mechanisms for monitoring quality of service, and accountability are put in place, it is risky and the public is unlikely to favour it.<sup>8</sup> There is a considerable risk of creating private monopolies which have no incentive to act responsibly. This requires a credible and independent regulator and the gradual build-up of institutions and even of culture for compliance and impartial civil service, see for instance Fischbeck and Farrow (2001) for a review of regulatory issues, Raymond (2003) on using private rights for the management of public resources and Makhaya (2001) or Ariyo & Jerome (1999) for reviews of issues concerning regulation and

<sup>8</sup> McKenzie and Ray (2004) provide a brief review of studies evaluating the experience with privatization of urban water supply in several developing countries. Privatization improved access of the poor in all cases but raised water tariffs in some cases. Apart from one (spectacular) failure, the welfare of the poor appears to have improved in all cases.

private/public rights in developing countries. Given the large up-front costs in repairing systems it is not clear that private investment will always be forthcoming, even if invited. Whether reform is carried out within the public sector or not, it is clear that improvements in accountability to consumers and transparency are needed.. The literature on utility management, pricing, public-private partnerships, privatization, and so forth is too voluminous to be referenced here, but Savas (2000) gives a first overview.

## 2.2 Property Rights Structures

Property rights are not cast in stone but continuously evolving: They started with land and have gradually been extended to more complicated assets such as water, minerals, and various natural resources and are today being extended to environmental resources such as radio frequencies, fish, genetic information, biodiversity and clean air. The development of rights over time is often perceived as a more or less linear progression from public or common property to private property. This process is often referred to as “enclosure of the commons”. As shown by Cole (2002), this may be quite misleading. Even in the USA, various forms of public ownership account for 42% of all land. Cole cites authors who show that when it comes to US water laws, the direction of transfer is rather in the opposite direction, from private to common property.

It is striking to see how big the variations between countries are, in the various bundles of rights applicable to land property. One example is provided by rights to water and subterranean resources: Mexico follows Spanish legal traditions and such rights are retained by the state while in the US, government has less power vis-à-vis the individual landowners<sup>9</sup> and mining rights are normally part of land rights, creating greater incentives for mining. Access to land is another example: In the US, trespassing is highly illegal and asocial, whereas in Sweden it is a right not only to walk but even to camp and pick berries on other people’s forest lands. In many developing countries, harvested fields are similarly used as a common property resource for grazing to the benefit of the poorer segments who have no private land.

The countries that have been colonized often have layers of incompatible legal systems with different perceptions and definitions of property rights<sup>10</sup>. In many developing countries, common or communal property (with or without private user rights) is particularly important. In northern Ethiopia, the *rist* tenure system has predominated. Traditionally, everyone in a village had a right to land to support his or her family. Those who left the village would temporarily lose their rights but could reclaim them. Even distant descendants who can prove their lineage to village elders can return to claim land. Because of this and because of variations in family size making the average holding per person uneven, there is a tradition of periodic *land*

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<sup>9</sup> Furthermore the US appears to place somewhat greater emphasis on “prior appropriation” rights – that is the right of the first (productive) user: “First come first served”.

<sup>10</sup> For instance, many countries in Africa have gone straight from a pre-feudal collective ownership to various forms of foreign dominance and state ownership.



*reallocation*. Such reallocations appear to be fairly common in many African countries and they do solve the problem of combining equity with hereditary rights as perceived. However they are completely alien to the modern notion of individual property rights and will generally not provide incentives for productive investments.

It may be a surprise to some but African systems of land tenure with reallocation do not necessarily have a negative influence on productivity – at least not in traditional societies (Place and Hazell 1993; Migot-Adholla et al. 1991). In a modern context, frequent reallocations do however clearly create a lack of tenure security. Now that technology and investments have become so important in financing modern agriculture and increasing productivity, the absence of tenure security and thus of investment incentives has had a significant effect on economic growth (Alemu 1999). Peasant associations are ensnared in a seemingly impossible trap because they are responsible for conflicting tasks: managing the common pool resources of the village and allocating “individual” land lots. Difficulties are compounded by increasing population and demobilized soldiers returning so the village association often uses common pool resources, which thus effectively become privatized (Kebede 2001).

The enclosure of the commons was a political struggle that lasted for centuries in England and was sometimes a fierce process. Today, similar struggles still take place all over the world—especially in poor countries—and the distribution of land between kinds of property has significant importance not only for the ecosystems as such but also for the distribution of wealth and welfare in society. A study of 75 villages in India found that 30–50% of common pool resource areas had been lost between 1950 and 1982 (Jodha 1992).

Although a general trend toward enclosure seems to be apparent, common property is not necessarily an inferior kind of property. In some respects, a well-designed, well-functioning common pool resource is like private property (Ostrom and Schlager 1996; Murty 1994). Notably, it does build on the exclusion of outsiders thereby at least creating some of the necessary preconditions to avoid “overgrazing”. In some ecological and social contexts (when the costs of protecting private property are high or when the yields are low and very variable), a common pool resource may simply have lower transaction and other costs and thus be more efficient than private property. If well-adjusted and flexible mechanisms to deal with resource allocation decisions continue to be developed, then common pool resources may continue to play an important role in the future.

When concepts of property rights clash—particularly when modern codified concepts take over from the more informal, culturally rooted, usufruct systems—the result can be an uncertainty that leads to a wasteful abuse of resources and, in many cases, to solutions that are perceived as unfair by the original users. For example, in the traditional island society of Mafia (close to Zanzibar), ownership rights are defined not to land (the so-called “coral rag,” because it has low productivity) but to fishing sites and to coconut trees, which are valuable and belong to whomever planted them. When hotels want to buy “land”, this implicitly includes a whole package of rights which covers exclusive rights to the land (including the beach down to the seafront) as well as water rights, vegetation and so forth. This builds on a generic international concept of property that is taken for granted by the international investor but poorly

understood by locals. Negotiations tend to be uneven; hotel owners often have been successful in securing “titles” that local residents do not understand or respect.

Although government must play a vital role as an ultimate guarantee of property rights per se, it has often failed abysmally when acting as a direct owner and manager of natural resources. This can be explained by many factors: As discussed in the previous section, the state is often rather inadequate at providing even the public goods for which it really does have a central role. When it comes to natural resources such as oil, minerals or forests, the arguments for state provision are not, in general, strong since these are activities that very well can be provided by the private sector and the role of the state is generally to control and regulate. The policy maker and civil servants will generally not have the right incentives to manage the resources in a “welfare maximizing” fashion. In fact one might say that it would be naïve to expect them to behave in such a way. The problems are compounded by poverty, poor training and other factors. In practice matters are made much worse by the fact that many nationalizations, for instance, of forests, have been swift, affected enormous areas and failed to respect local customary rights. They were usually carried out with very limited budgets and administrative capacity to manage the resources taken over. The consequences usually are harsh, as in the central hills of Nepal, where nationalizing the forests in 1957 quickly led to deforestation because villagers no longer perceived themselves as the owners or beneficiaries of the forests.

One problem with state involvement is that the feedback mechanisms by which the people affected by poor management can influence their governments have often proved to be inadequate at national and regional scales. This suggests that decentralization of resource management to the appropriate scales may help. We discuss two examples below.

### 2.2.1. Surface Irrigation

It is difficult to empirically identify the impact of decentralization since there are usually many confounding correlates. For example, Wade (1995) has argued that the superior performance of East versus South Asian irrigation systems could be due to the fact that South Asian topography favoured large-scale centralized systems while ecological conditions favoured decentralization in Taiwan, Korea and Japan.

Even in large South Asian systems, however, management of the smaller field channels is left to the farmers. Because of seepage losses, farmers close to the head of a canal in a water-scarce region will often have a lower marginal value for water than those near the tail because they get more water. Monitoring and policing costs may deter farmers in such situations from actually making investments to reduce losses so that they can trade in surface water. The state can play a facilitating role in such situations by passing enabling legislation allowing water users’ associations to be formed that define tradable water rights and monitor and enforce them. It is important to ensure that the legislation makes the formation and functioning of the associations consensual as far as possible, otherwise, it could lead to expropriation of de facto rights, with adverse effects on political feasibility, legitimacy, equity and transactions costs.

In Chile, legislation passed in 1981 made water rights strictly private and separate from land rights. An important factor in making the Chilean program acceptable was that rights were based on past use, thus avoiding expropriation of de facto rights. In those parts of the country where water is scarce, there has been considerable trading (Thobani, 1997; Easter, Rosegrant, and Dinar 1999). The Chilean case with its extreme focus on neo-liberal principles has been hotly debated across the World as a model and several other countries have passed or considered similar legislation. For instance, the Mexican water law introduced more limited tradable water rights in 1992. According to Bauer (2004), the Chilean model has been very successful in some respects: the legal security of private rights has led to considerable private investment in water use both in agriculture and other sectors and there has been a certain amount of reallocation in water use from less to more productive sectors. On the other hand, the model has failed to incorporate broader environmental and social aspects in an overall river basin management. It has also failed to give advantages to the poorer segments of farmers and other users.

Market creation at the lowest level of canal irrigation systems may lead to demand for further property right definitions in canal systems, since the formation of associations can lead to trade between associations, with larger and larger federations and more trade occurring over time. The resulting rise in the value of water can act as a spur to investment, resulting in reduced losses from seepage, waterlogging, and salinisation.

A bottom-up consensual approach is needed to ensure that no one is expropriated. This makes for political feasibility and makes it less likely that newly created monopoly power will worsen the allocation. In addition, efficient allocation at lower levels makes it much easier to re-allocate water at higher levels, since valuations of agents at the lower levels have been equalised. This is very important for equity. If water trades between groups are permitted before trades or other mechanisms have equalised valuations within groups, then users with less water and high valuations within a group may lose as more powerful users within their group sell water to other groups.<sup>11</sup>

In larger canal systems, such as those of South Asia, management has typically been bureaucratic, with a portion of the rents being seized by state politicians and bureaucrats (Wade, 1984). Enabling legislation and success at the lowest (field channel) level could create demand for reform at higher levels. It is important to note that saleability is important for reasons above and beyond the usual efficiency arguments. Lack of saleability provides additional incentives to lobby to re-define property rights in one's favor. This seems to happen frequently in water disputes, the changes in water allocation on the Indus river in the 1990's between the provinces of Punjab and Sindh in Pakistan being a case in point. Institutionalising mechanisms for involving the different claimants in the formation of legislation that defines property rights appears to be the due process that most likely ensures that the resulting rights will be implemented successfully without non-compliance and lobbying for redefinition generating uncertainty that leads to continued rent dissipation. Most developing country governments' activities are

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<sup>11</sup> Marketability of water and forest resources is frequently opposed by advocates for the poor or the environment since the impetus for it often comes from powerful well-endowed groups interested in defining new rights in their favour and capturing the gains from the rise in asset values that follows. If the rights of the poor were protected, they could gain from making the resource saleable.

conspicuously lacking in transparency and the drafting of legislation is no exception. While the processes suggested above may be welfare-improving for most farmers, they may eventually cut into the rents of government officials. Foreign aid can be used to induce governments to overcome resistance from within themselves, if such aid is appropriately tied. This process is clearly already at work. However, donors are often not sufficiently sensitive to the need for public consultations in the drafting of reform legislation. Typically, conditionality is applied to the content of legislation, and imperfectly so. Bureaucracies have been quite effective at undermining devolution (Lele, 2000). It would be less politically sensitive to tie it (that is, aid) to the *process* and probably more effective if there were an insistence on public consultation and incorporation of the consensus view among stakeholders.

#### Box 2 Property rights and compensation in Watershed Management

Watershed management is very important both for biodiversity conservation and poverty alleviation. The city of Chandigarh 15 km downstream from a village Sukhomajri in Haryana, N India suffered siltation of a lake on which it depended and wanted to get villagers to reforest in order to protect the hillsides. In return the town financed the building of a series of small water retention dams which were useful for irrigation, particularly for the closest farmers. These farmers were prepared to collaborate by keeping their grazing animals off the hillside slopes. But other farmers gained little or nothing and were thus not prepared to forego fodder on the hillsides. Instead they demanded some share in benefits of the dams and thus pipes were laid to all the other farms. This however did nothing for the landless and to entice them to cooperate a sharing mechanism was devised. First all citizens were given tradable vouchers for their share in water. However the amount of water was unknown at the beginning of the year and hence the exact value of each share was unknown which complicated transactions considerably. A revision of the instrument led to a price type system: All irrigators had to pay for the water they withdraw and the proceeds are shared equally in the village which is an example of a Refunded Emission Payment, a market-based instrument that harnesses the efficiency of the market and still addresses the distribution of costs and assets, see further Sterner (2002).

### 2.2.2 Forest management

As mentioned earlier, nationalisation of forests in Nepal (and elsewhere) led to drastic deforestation. During the past couple of decades, forest management has reverted back to village communities, and reforestation has been fairly rapid. It is natural to ascribe this entirely to the change in regime. Disentangling the consequences of decentralization from those of other variables is, however, difficult. Somanathan, Prabhakar and Mehta's (2004) study of the Van Panchayat (Forest Council) system for community management of village forests in the Indian central Himalayas uses geographic data to do this. They compare its performance relative to state management of neighboring forests. They find that while the village council forests had the same or higher crown cover (an indicator for forest stocks) they cost less than one-sixth as much to administer as the state forests. This suggests that while decentralized management may not improve the condition of forests, it can lead to substantial savings. It needs to be kept in mind that the system has many drawbacks. The rules do create some disincentives for villagers to invest in their forests. If these were removed, conservation might improve. It is also possible that even though village forests have crown cover that is not much higher than state forests, they might

be contributing more by way of forest products like fuel and fodder due to more efficient and coordinated extraction.

## 2,3 Public Information and Monitoring

In the last decade, the provision and handling of public information has become a new and very powerful factor that has led to a whole new wave of policy instruments (information disclosure, labelling, certification, voluntary agreements etc). The main common driving force behind these is the dramatic fall in the price of information gathering, processing, dissemination and even interpretation. It is reasonable to say that this process has not gotten as far in the poorer countries where wide segments of the population lack electricity not to mention computers and Internet. However, it seems that this is only a small delay and that information is indeed finding new ways to reach even less privileged recipients.

Access to appropriate information is a vital issue for the successful implementation of all policies. This includes technical and market information for local agents in the economy and, for both agents and regulators, it is important to have adequate monitoring of technology and transactions in the market. It is often asserted that costs of monitoring will be prohibitive in a developing country but we believe this argument needs to be dissected carefully: It is not acceptable to conjure up a picture of the vastness of pollution issues in say India and then say that the Pollution Control Boards are so weak and that one underpaid inspector has to deal with many hundreds of polluting firms. The reason is that if pollution problems are vast – so is the manpower supply that would potentially act as inspectors. Poverty might certainly be an aspect but then salaries are also low so poverty cannot be an explanation for the failure to supply inspection labour – rather we are speaking of the general failure to supply public goods that was the subject of the previous section. There might however, also, be a lack of sophisticated monitoring equipment, technology and skilled manpower.

It is also important to see that there is a feedback from knowledge to preferences and consequently public demands for action on environmental issues. This leads to more environmental monitoring, that generates more environmental data and further raises public awareness of environmental issues. These feedbacks clearly operate but it is, of course, very difficult to measure them. It would be unwise, in policy formulation, to ignore them for this reason.

A very important problem for which the issue of information transmission is crucial is indoor air pollution. Such pollution is rather special because the affected are at least partly, themselves responsible for the pollution. Therefore, it is closer to a public health problem akin to cigarette smoking than one of externalities, the traditional domain of environmental economics. This is not to say that externalities are absent. In a recent study in rural India, concentrations of respirable particulate matter in households were high, (Mehta & Smith 2002)<sup>12</sup>. Even those who cook with *gas*, (and

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<sup>12</sup> The results for Kenya and other African countries are similar, see for instance Ezzati and Kammen (2002) who show that there are large knowledge gaps in this field despite its large significance for the health of almost half the global population.

hence produce no PM themselves) had approximately double the mean outdoor level for US cities, for example. This suggests that the external effects of neighbors' cooking with solid fuels are not negligible. Secondly, there are intra-household externalities. Women and small children are more exposed than others in the household since they spend more time close to the cooking fire so that the costs of cooking with solid fuels are not uniformly distributed within the household while its benefits are. Historically, indoor air pollution disappeared as populations grew richer and were able to afford better stoves or fuels. These shifts were due to the desire to avoid the nuisance of smoke rather than to any awareness of the potentially lethal effects of emissions. Now that these effects are established, it is clear that households are making the decision to shift (or not) to more expensive cleaner fuels with inadequate information. Public education is clearly a possible tool that may be cost-effective. Similarly, research in improved stove designs has higher benefits than were thought before the results of the epidemiological studies were available.

The importance of public education and access to information reappears in the domain of drinking water and sanitation. In their study of urban India, Jalan, Somanathan and Chaudhuri (2003) find that raising the level of schooling of the most educated woman in a household from 0 to 10 years roughly doubles willingness to pay for improved drinking water quality which is the same as the effect of raising the household's wealth level from the first to the third wealth quartile.

Very often, this applies to other pollution problems as well. There is insufficient information available to the public about the extent, consequences and causes of various pollutants. Without such information, the demand for pollution control will be too low, relative to a hypothetical full-information situation. This suggests that government monitoring programs should be accompanied by publication of the data. In the US, for example, water providers are required by law to inform the public if tap water fails federal standards. Such disclosure requirements are uncommon in developing countries. In India, water quality information is rarely made public (McKenzie and Ray, 2004). In practice, the requirement to publish data may lead to lobbying to ensure that it is not collected to begin with. It is, therefore, good policy to promote capacity outside government to conduct environmental monitoring. This is best done by academic institutions.

The effect of public information programs on the incentive for polluters to clean up has been clearly seen in the case of the US Toxic Release Inventory data, where the annual publication of the data leads to stock price declines for the most polluting firms and subsequent emission reduction by the firms penalized most by the capital market (Hamilton, 1995; Konar and Cohen, 1997, Arora and Cason 1994)<sup>13</sup>. The stock price effect of public disclosure has now been seen in a developing country as well (Gupta and Goldar 2003). In developing countries, the rating and labelling of industries known as PROPER in Indonesia deserves special attention.

Indonesia was long ruled by an authoritarian government in which the family and other associates of the president during the Suharto period, wielded considerable power and influence in not only politics but business and administration as well.

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<sup>13</sup> See also Karl and Orwat (1999) or OECD (1997) for more analysis of labelling schemes in industrialised countries.

Policy making and implementation was far from transparent. Many of the owners of polluting industries were powerful and the local EPA, BAPEDAL, a relatively small and weak organisation. Inevitably an EPA in this situation would be asking for trouble if they set up badly paid and ill prepared inspectors against the most well-connected and powerful business leaders, who, if need be, could employ the best lawyers. The risks of ineffective monitoring, weak enforcement and even corruption were obvious. BAPEDAL had already tried conventional regulations with little success. They were also wary of a system of environmental charges and one of the reasons for this was that charges create a negotiation situation between the polluter and individual officers of the agency in which the latter can be tempted into corruption. They chose instead a rating or labelling system, PROPER, the Program for Pollution Control Evaluation and Rating.

The PROPER scheme was prepared very carefully and is actually more than just a labelling scheme. It is fundamentally a system for emissions reporting, for evaluation and control of the reports, for assistance, advice and in addition to this, there is grading of each industry based on the reports. A good deal of thought has been spent on designing the number of parameters to be reported and selecting these. The purpose was to have an appropriate set of parameters: not too many as to make reporting burdensome and alienate the firms but not so few parameters that they are easy to falsify. By experience certain problems such as stoppages cause excess release of certain – though not necessarily all pollutants. At the same time such stoppages are related to other items the firms report, production, electricity use, raw material consumption, water etc. The PROPER team collected a large number of indicators and developed small but sophisticated programs for checking the correlation between the various data collected. This was in turn used to award labels, see box 3.

Box 3 Colour coding used by PROPER

The choice of labels was made with great care in order to be simple, clear and understandable to citizens with little or no prior knowledge or understanding of technical and pollution issues. For simplicity a colour coding was chosen but for coherence and credibility the colours have to have fairly precise meanings. The starting point for all of them which gives the whole system its formal legitimacy is the fact that it builds on earlier regulation. Those firms which simply comply with regulations are “blue”. For firms that are “proactive” and significantly exceed the legal requirements in environmental standards can be awarded a “green” status while the “World Class” status is gold (yet to be achieved by any firm in Indonesia). Firms that fail to meet minimum standards are “Red” – or in the really bad cases of significant environmental damage and no effort at abatement: Black.

Thus the PROPER scheme provided both technical and market information. It turned out that the power of reputation (particularly the fear of bad publicity) was stronger than expected and a rather large number of firms managed in a short time to improve their ratings. The most important sign of progress was the fact that, in the first 18 months, overall effluents from the 187 first firms was reduced by 43%, see for instance Afsah et al, (2000).

A somewhat neglected point is that information flows even within governments may be inadequate. Tax policies are made in Finance Ministries and it may be the case that

environmental implications are ignored in their making. This problem is quite acute in developing countries although it has a low-cost solution. Procedure could simply require that the environmental agency's comments on each change in the tax code be solicited before the change is made.

Another area in which information problems are of paramount importance is the regulation of run-off from farms in industrialized economies. These are referred to as "non-point source pollution" since it is not possible to monitor emissions as easily as it is from a factory that has a limited number of effluent pipes and stacks. To overcome the difficulties of monitoring a number of special instruments have been developed for the non-point source pollution case. These usually hinge on utilising the monitoring of peers or on "information-revealing" mechanisms of various sorts. Recently it has become apparent that these mechanisms may be usefully extended also to other contexts where monitoring is difficult or expensive. Examples include small-scale industry, agriculture and vehicles. Even quite significant industries may, for instance in many Asian countries, be comprised mainly of very small industries that have many of the characteristics mentioned here. In some cases these industries are organized into industrial estates which may facilitate the use of certain special policies and policy instruments that can be designed for such estates. These include joint technology transfer, waste management infrastructure and educational efforts that may be channeled through the estates. These may be partly subsidized. Alternatively the estate may be made collectively responsible for some parameters related to the ambient environmental quality (such as water quality in a river or stream that flows through the estate). This creates a two-tier pollution management issue and may help resolve the issue of incentives for monitoring. It puts the estate in the position where it has incentives to encourage its members to monitor each other. As is well known from the literature on common property it is frequently the peers who are best placed to overcome the cost barriers to monitoring. This is an advantage and yet another advantage may be the technical collaboration (assistance) that larger firms can supply to smaller ones. Inevitably however this asymmetric interaction also implies implementation risks since the larger firms can dominate the smaller. In the case of the Ankleshwar estate in Gujarat, Kathuria and Sterner (2003) report that one of the complaints by smaller firms was that the fees for effluent treatment and waste handling were unfair towards smaller plants since they were only partly based on actual waste volumes.

The ecosystem resources used by the poor for agriculture, fishing, grazing or other collection are often marginal and their output low and variable due to climatic conditions such as uncertain rainfall. This variability is unacceptable for these poor who are very risk avert and thus have a demand for savings or insurance to guarantee survival in lean years. Due to asymmetric information and monitoring problems, there are however problems of adverse selection and moral hazard so that savings and insurance schemes are generally in short supply. This is a market failure that can be the cause of very unsustainable behaviour. Those who cannot open bank accounts may put their savings into the only available form, which may be cattle which in turn frequently leads to overgrazing and land degradation. Similarly risk aversion may lead to the over-application of pesticides since pests, although unlikely, are an unacceptable risk in a world without crop insurance. In these cases it is of fundamental importance to correctly judge the various underlying market failures. It is probably the case that capital market distortions (and distortions in other markets such



as the labour market too) can spill over and create problems in the environmental and resource area. This is particularly a concern for developing countries where such distortions are most common. A superficial understanding might lead one to recommend taxes on cattle or pesticides when the appropriate long run policies for sustainability might instead be the gradual build-up of small scale insuring or banking services such as the Grameen Bank of Bangladesh. This bank is one of the pioneers in providing banking and other financial services to the rural poor. They do not look or behave like a conventional bank but they have had very large-scale success in starting savings among the poor and of extending credit for small businesses and housing etc. There are similar schemes in a number of countries but it is clear that their success has not been easy to replicate as there are many specific cultural and social details that must be properly understood and dealt with, see <http://www.gdrc.org/icm/grameen-info.html>.

## **2.4 Incentive-Based Policies and the Costs of Pollution Control**

Incentive-based policies, notably pollution charges and various types of tradable pollution permits, have turned out to be successful in many applications in the developed world not only in reducing aggregate costs, but also in increasing the acceptability of policies. It is natural therefore that the question should arise as to the conditions under which these instruments can be used effectively in developing countries. Some are enthusiastic at this prospect saying that cost efficiency is all the more important in a context of poverty. There are already a number of examples, particularly of environmental taxes or fees (sometimes paid into earmarked funds) in which they are used quite extensively in developing economies and they may well have an important role to play in some contexts.

Examples of specific pollution taxes include the fee schemes for industrial water pollution in China and Colombia and combinations of fee and regulation for management of water pollution from palm oil plants in Malaysia<sup>14</sup>. Other examples that are interesting in this context are the developing country experiences of taxation of goods such as fuel, energy or tobacco. These taxes may not necessarily have been instituted primarily for environmental reasons. Their operation is, however, largely independent of the original motivation and they do obviously have considerable environmental effects illustrating that environmental taxes can very well operate across a broad range of countries.

Others suggest that incentive-based policies often are not suitable for developing countries since they require special conditions to ensure compliance and effectiveness. Bell & Russell (2002) for example point to the fact that such rights are subject to all the normal hazards of commercial transactions. Sellers can default, buyers can go bankrupt and either party may try to cheat. Thus proper, reliable,

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<sup>14</sup> Descriptions of these and other developing country instruments may be found in Blackman and Harrington (2000), Sterner (2002), Anderson (2002) and at the World Bank website "New Initiatives on Pollution Regulation" at <http://www.worldbank.org/nipr/commun.htm>. These sources also describe interesting applications of other instruments, legal or information based in developing countries. See also the paper by Krupnick in this volume.

transparent monitoring and accounting must exist. Furthermore it is absolutely necessary to have some form of solid legal basis for deciding conflicts – be it a court or a public body such as an environmental protection agency. The authors further point to the fact that the participants in a pollution market need experience with market behaviour. At the very least they need to be able to ascertain their own abatement costs – which is the kind of knowledge that is best acquired after some years in a functioning regulatory system where rules really are enforced. The act of compliance is part of a whole culture of collaboration, communication, cooperation and law abidance and it may be necessary to understand this whole complex in order to understand its politics.<sup>15</sup>

We believe these viewpoints are important. It is definitely not possible to simply and mindlessly transfer an instrument from one type of country to another. Market based instruments are neither universally applicable to all situations nor are they necessarily simple or automatically efficient.

On the other hand, it is important to recognize that it is the very weakness of regulation in developing countries that has led to much greater heterogeneity among polluters than in developed countries where minimum standards cut off a considerable part of the distribution. This is compounded by the higher cost of capital, which results in older equipment remaining in use, and typically, polluting more. Greater heterogeneity among polluters increases the scope for cleaning up by targeting only the worse polluters. This, in turn, means that a fraction, perhaps a majority, of polluters could gain from a scheme that recycles pollution charges, whether these are implemented as permits or taxes.

Under these circumstances, the *distribution* of costs is just as important as their overall level for the political feasibility of any particular policy instrument. Physical regulation such as standards have a tendency of becoming manipulated by industries who will secure acceptance of special rules in favour of already existing plants. Pollution taxes would be an efficient instrument forcing heavy polluters to compensate society at the same time as they provide incentives for clean-up but such taxes impose a burden on all polluters thus uniting them in their lobby efforts against the EPA. We are thus often pointed in the direction of earmarked charges, refunded emission or user charges and environmental funds rather than standards or general Pigouvian taxes. If the charges are related to polluting inputs (such as fuels) or outputs, the administrative costs of monitoring may be reduced making this type of instrument more feasible even in economies with limited administrative capacity.

As shown in Sterner (2003), policy instruments, be they price type or quantity-based can be configured to fit into different conceptions of property rights to the environment and thus different burden of payment. Starting with the quantity based instruments: the permits may be either auctioned or “grandfathered” free of charge in proportion to earlier pollution if the polluters are considered to have ownership rights. Such a distribution may either reflect “prior-appropriation” rights or simply be a pragmatic recognition of the polluters’ power – either way it implies that the polluting firms get the scarcity “rent” rather than letting society get it as with auctioned permits.

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<sup>15</sup> See also Russell and Vaughan (2003). One might however also say that the argument runs both ways. The same factors that will imply difficulties for market based instruments will also cause conventional regulatory approaches to falter.

Similarly for price-type mechanisms: the tax gives property rights to the state and places costs on the firms while subsidies do exactly the opposite – and refunded emission payments or tax-subsidy schemes are intermediate in this respect. It is not sufficient to say that a tax is superior to subsidy or intermediate instruments because of the excess burden of taxes. Although this argument is true<sup>16</sup>, it may have limited relevance if a subsidy of x \$/ton is feasible while a corresponding tax of x \$/ton is not. If the EPA insists on using a tax it may find that the level actually implemented after lobbying is only a fraction of the appropriate level x \$/ton! We are thus faced with a trade-off between the importance of the allocation, output and revenue effects of a given instrument. If the technical substitution effect is the most important then sometimes a subsidy may be preferable because it is effective and meets no resistance. On the other hand, with problems that have no easy technical solution but require large, long-run changes in behaviour, the output substitution and revenue recycling effects will be more important and subsidies may well be expensive and inefficient and taxes thus clearly preferable.

Practical experience does show that there is scope for judicious use of a wide spectrum of instruments, and for use that can expand and evolve over time as laws, regulations, and market institutions and actors co-evolve. In China the system of pollution charges provides an interesting example<sup>17</sup>. The 1979 environmental law stated, “in cases where the discharge of pollutants exceeds the limit set by the state, a compensation fee shall be charged according to the quantities and concentration of the pollutants released” (Article 18). Today several hundreds of thousands of factories are monitored and potentially subject to this fee. Already in 1994, more than 19 billion Yuan (more than US\$2 billion) had been collected from environmental levies (NEPA 1994). These fees are not textbook taxes: they are very low and they are put into funds accessible to industry for the finance of abatement investments. However these departures from the Pigouvian principle are features that enhance political acceptability. The funds allay the fear that this is yet another trick from central fiscal authorities to squeeze out more money and show that the authorities actually take the environment seriously. The collaboration in the funds around the financing of abatement investments actually provides very good opportunities for the spread of information on abatement technology. The experiences from the fees paid into funds are similar in a range of other cases from the environmental charges for water pollution in the Rio Negro (and other water sheds) in Columbia to the systems for industrial pollution charges in Poland and various formerly planned economies of Eastern Europe. In all these cases the local recycling of funds for abatement appears to have helped considerably in overcoming resistance among polluters and in legitimizing the fees.

Other cases that show how useful a market based approach can be in developing countries include the taxation of polluting inputs such as fuels and tobacco as well as the introduction of sensible tariffs for electricity, water and similar services. Many

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<sup>16</sup> It is difficult to raise taxes but the state has many urgent needs (public goods) that are badly needed and thus each dollar of tax has an extra cost to the economy (related to the cost of collection and distortions caused). This implies that if a Pigouvian tax and a subsidy have the same effect on technology choice then the tax is likely to be superior from a welfare viewpoint since it also happens to contribute to the treasury whereas the subsidy in contrast requires more money from the treasury and thus more collection of conventional taxes thus further increasing the excess burden of taxation.

<sup>17</sup> The examples discussed here are given in greater detail in Sterner (2003).

countries are actually quite heavily dependent on fuel taxes for revenues and although the ease of collection may have been their original motivation, they clearly also reduce pollution. Also trading schemes for irrigation water can, as discussed above, be an important mechanism for equalising marginal costs and creating incentives for efficient use. In protecting ecosystems, the market based approaches include various mechanisms entailing payments for eco-system services from say urban centres to rural areas that protect water catchments: examples range from New York to small towns in Costa Rica and elsewhere.

Note that the water payments scheme in Sukhomajri described in box 2 above hinges very crucially on being sensitive to the distributional implications of a scheme – or to property rights. It implies equal allocation per *person*, not per unit of land or cattle, nor grandfathering in relation to historical patterns of use. The scheme was deemed very successful: Siltation was reduced by 95%, saving \$200,000 in annual dredging costs. Tree and grass density increased by a factor of 100 on slopes so that managed harvests far exceed open access levels attained earlier. Livestock, crops, housing and many other indicators developed positively. However experience has also shown that replication is not easy. It appears that the initial contribution from Chandigarh was important and that sharing issues often turn out to be very complex. Sukhomajri had an unusually high degree of social equality (less than 10% landless) and thus arrived more easily at the equal distribution allocation.

When international competitiveness is an important issue, as it tends to be in small open economies, the selection of policy instruments needs to take particular care not to add unnecessary costs to the polluters. This is often used as a strong argument against auctioned permits and taxes. Strictly speaking this need not be the case since these instruments do not affect profitability at the margin but should mainly be seen as a windfall loss to shareholders that does not affect profitability. However whether these income effects matter depends on how capital markets react and the political economy aspects may be quite important particularly in developing countries where the politicians hesitate to alienate powerful shareholders. If the regulator is very weak compared to commercial interests, it may start with some basic regulation and informational instruments. Also refunded payments, free permits, subsidies or regulation may be viable options. In industries with monopoly (or at least significant market power) taxes again have some undesirable side effects since they may aggravate the tendency of monopolists to over-price and under-produce. Two advantages of dealing with large multinational firms are that they often do have the requisite technology and that they are sensitive to publicity. This speaks in favour of information based instruments such as information disclosure, labelling and voluntary agreements.

A category of environmental problems that we have not yet discussed very much are the so-called “brown issues” that are the mainstay of environmental work in OECD countries. They include industrial pollution: air and water as well as waste issues (including hazardous wastes). They also include vehicular pollution and one could include certain types of agricultural runoff. In these areas developing countries have a number of characteristics that make their situation distinct from that of countries in which industrialization and environmental management have a somewhat longer history. One of the differences is that there may be an advantage of being a second-mover: There is less uncertainty about the technical feasibility of abatement since

decision makers can observe and point to abatement technology in industrialized countries. They can economize on the work needed to develop such technologies and in some cases copy standards (perhaps with some time lag). In some areas, the opportunity for “leap-frogging” may be valuable: countries may sometimes go straight into the clean technologies and short cut the polluting paths that led to them in the countries where they were developed.

In other respects, the developing countries face a number of disadvantages: Frequently their environmental protection agencies are weak in relation to the industries they are set to regulate. The regulators are often poorly funded and understaffed –partly a consequence of poverty and partly an aspect of the general failure to provide public goods that we discussed above (see also the chapter by Lopez in this volume).

The polluters tend to fall in one of two distinct categories both of which imply problems for the regulator although in very different ways. To be simplistic one might say they are either very large or very small:

**The large polluters** are very powerful compared to the environmental policy makers and this is not least the case with foreign (multinational) firms on which we will focus here. The overriding concern of most developing countries is to attract foreign investment and multinational companies quite naturally will consider all factors (including the environmental and other bureaucratic) barriers in their choice of localization. Thus there is the risk of a “race to the bottom” in terms of standards in order to avoid the risk of deterring investment. It is also more common for the industries in (at least smaller) Third World countries to have considerable market power. As a corollary to this, the asymmetry in information, assets and power will be particularly large when regulators meet polluters. Even in the US, the large firms will have better paid staff than the Environmental Protection Agency. In a poor country with large disparities in income and training, the asymmetry of resources becomes so significant as to be a major impediment to the local regulator that may even be completely deterred from trying to regulate. This is one of the factors that make implementation difficult – particularly for some instruments that put the regulator and the firm into adversarial roles or into relationships involving the discretion over large financial transfers. Instruments such as labeling, earmarked fees, information disclosure and twotier regulation can be designed to reduce these problems.

At the other end of the scale we have the **small polluters**. These will typically, in developing countries, be small but very numerous and poorer in both financial and other resources than their counterparts in industrialized countries. They are sometimes referred to as the “informal” sector and, as the name suggests, may have very simplified or nonexistent routines for administration. The problem for the regulator here is not that the polluter is too powerful but that they are too many. They may in some cases be (de jure or de facto) exempt from tax payments and other regulation. It is in the nature of such polluters that they are hard to regulate by several of the conventional instruments used for bigger industries in wealthier countries. They are too poor to tax and even too poor to afford any significant abatement expense. They

also lack knowledge and organizational skills and are in fact difficult simply to locate and reach even for informational instruments<sup>18</sup>.

Vehicles have many of the non-point source characteristics of small polluters but income sensitivity may be particularly high since they have individual owners. Furthermore, the distribution of emission coefficients is typically skewed so that the most polluting decile of the vehicle accounts for a high fraction of urban ambient pollution. An efficient policy would be to target these vehicles (at least from urban circulation) but this is politically difficult since the worst vehicles will often belong to interests (such as truckers or taxis) that, although poor in a general sense, still have sufficient resources that they can organize and turn into rather powerful lobbies. One way around this problem, which, to the best of our knowledge, has never been tried, would be to refund payments collected from charges (or fines from random checks) within classes of vehicles. If the cutoffs are set sufficiently low, most vehicle owners within each class would end up getting a small check from the regulator, while a significant fraction of pollution would be cleaned up. Setting class-specific cutoffs reduces the scope for cleaning up but makes what cleaning up there is more politically feasible and the impact less regressive.

### 3 Conclusions concerning the building of institutions and the design of instruments

We have in this paper highlighted four groups of factors that are essential for the design and success of environmental policy making in developing countries: property rights, governance, information and cost distribution issues.

The absence of well-defined *property rights* and the resulting non-transferability of assets inhibits investment that would lead to more efficient natural resource utilization. For example, in water-scarce areas lack of clear ownership of surface and ground water makes it difficult for urban governments to contract with rural ones to supply water for domestic and industrial use even though the value of water in such use is much higher than in agriculture. This problem also applies to water transfers from one agricultural region to another. It leads to under-investment in water conservation and groundwater recharge measures. Investment in forest stocks suffers from a similar problem. The definition of property right is thus a fundamental instrument on its own. Furthermore the structure of rights in a society will also condition the kinds of instruments that are applicable. In a society with a strong tradition of private, prior appropriation rights, auctioning of permits and taxation may for instance be politically harder to achieve.

A significant aspect of the inability of *public institutions* in many developing countries is the lack of a good reliable and functioning public body that can provide public goods that are the important prerequisites for economic development. These include the very institutions of property, market allocation rules, legal system and the provision of many other public goods such as the rule of law and the independence of

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<sup>18</sup> There is a large literature on this as on several other topics we have touched on, see for instance Blackman and Bannister (1998), Wang and Wheeler (1996), Dasgupta, Hettige and Wheeler (2000), Hettige et al (1996). More references are available in Sterner (2000) or Wheeler et al (2000)

the judiciary, basic health and education. This is often discussed in terms of poverty and corruption but we would like to emphasize the excessive centralization of information flows and formal decision making.

One of the most important of the public goods that is relevant here is *information*. By ‘information’ we mean here the whole chain from research on the states of nature to technical information on environmental issues and on technology. Other important information concerns market data and the monitoring and enforcement of peers. The *technical* prerequisites for cheap collection, processing and transmission of information have never been better. Unfortunately however many regimes feel instinctively that information should be guarded as a secret and they may well be unaware of just how damaging this can be not only to the environment but to economic growth in general.

Related to the issues of poor governance, lack of public goods and poor enforcement of property rights is the fact that the distribution of income and wealth is frequently uneven. With large number of people who live on the verge of absolute poverty, risk aversion plays an important role in the determination of allocation and distribution decisions. Polluters and resource users tend to fall in one of two classes: big and very powerful or small and so numerous as to acquire non-point characteristics. Under these circumstances the distribution of costs and benefits is very important and the design of instruments must take this into account otherwise the instruments will end up with severe implementation problems – if in fact they at all get implemented! Heterogeneity among polluters implies that there is a greater scope for cleaning up at lower cost by targeting only the worst polluters and, naturally, poor economies are the last that can afford to pass up cost savings. This implies that instruments that recycle revenues to polluters have a better chance of succeeding and, therefore, are to be preferred to harsher instruments such as standards that may provide better incentives to abate by inducing substitution out of a polluting activity in addition to inducing less pollution-intensive operation of the activity. Like all generalizations, this one will have its exceptions. It bears repeating that consultation and transparency in conception and implementation of any scheme is desirable.

It follows that in spite of the considerable difficulties concerning property rights, legal systems monitoring, enforcement and other issues raised here, we believe that market based instruments can and should play an important role in developing countries. In some areas and in some ways they may even be more suitable there than in the industrialized economies. We have already cited heterogeneity in abatement costs as one reason for this. A second reason is that low-income countries often have poor systems for income taxation: they frequently rely heavily on excise taxes already – and these can be quite distorting: except of course for the environmental taxes which instead are both corrective of externalities and revenue generating. This should not be taken to imply that the introduction of such instruments will be easy or their efficiency properties come automatically, quite to the contrary: very careful design will be needed for whatever instruments are chosen (irrespective of how heavily regulatory or market-based they are). Among the issues we have highlighted as particularly important are issues of distribution, information and risk management. We also may note that there are actually more interesting applications of environmental policy instruments – including market based ones - in developing countries than is perhaps generally known (Sterner 2003). Frequently they have

somewhat different design to the solutions chosen in OECD countries. It is not uncommon to find that several instruments are combined, that fees, if they are used, are quite low (and sometimes staggered) and that there is considerable interest in the use of the proceeds, which are quite frequently used to address informational and distributional issues as well as to finance monitoring and even abatement or clean-up.



## References

- Afsah, S., A. Blackman and D. Ratunanda (2000), 'How do Public Disclosure Pollution Control Programs Work? Evidence from Indonesia', Resources for the Future, Discussion Paper 00-44, October 2000, Washington, D.C.
- Anderson, R., (2002), "Incentive-Based Policies for Environmental Management in Developing Countries", *RFF Policy Briefs* 2002-07
- Ariyo A. & A. Jerome, (1999) Privatisation in Africa: an appraisal, *World Development*, 27(1), pp 201-213.
- Arora, S., and T. N. Cason (1994), *A Voluntary Approach to Environmental Regulation: The 33/50 Program*, Resources for the Future, summer 1994.
- Bauer, C J (2004), *Siren Songs*, Chilean Water Law as a Model for International Reform, RFF Press, Washington.
- Baumol, W. J. and W.E. Oates (1988), *The Theory of Environmental Policy*, Cambridge: Cambridge University Press.
- Bell, RG, (2003), "Choosing Environmental Policy Instruments in the Real World", paper prepared for the OECD Global Forum on Sustainable Development", OECD CCNM/GF/SD/ENV(2003)10, March 17-18.
- Bell, RG, and C S Russell, (2002), "Environmental Policy for Developing Countries", *Issues in Science and Technology*", Spring.
- Bell, RG, and C S Russell, (2003), "Ill Considered Experiments: The Environmental Consensus and the Developing World", *Harvard International Review*, Winter.
- Blackman, A., and W. Harrington (2000), 'The Use of Economic Incentives in Developing Countries: Lessons from International Experience with Industrial Air Pollution', *Journal of Environment and Development*, 9(1), pp. 5—44.
- Blackman, A. and G. J. Bannister (1998), 'Community Pressure and Clean Technology in the Informal Sector: An Econometric Analysis of the Adoption of Propane by Traditional Mexican Brickmakers', *Journal of Environmental Economics and Management* 35, pp. 1—21.
- Briscoe, J. (1997). "Managing Water as an Economic Good." *Water Supply*, 15(4): 153-72, reprinted in R. Maria Saleth (ed.) *Water Resources and Economic Development*, Edward Elgar, Cheltenham, 2002.
- Dasgupta, S., H. Hettige and D. Wheeler (2000), 'What Improves Environmental Compliance? Evidence from Mexican Industry', *Journal of Environmental Economics and Management*, 39(1), pp. 39—66.

- Easter, K. W., M.W. Rosegrant and A. Dinar (1999). "Formal and informal markets for water: Institutions, performance, and constraints." *World Bank Research Observer*, 14(1): 99-116.
- Ezzati, M and D Kammen (2002), "The Health Impacts of Exposure to Indoor Air Pollution from Solid Fuels in Developing Countries: Knowledge, gaps and data needs", RFF Discussion Paper 2002:24, August.
- Fischbeck, P S, and R S Farrow, eds. (2001), *Improving Regulation, Cases in Environment, Health and Safety*, RFF Press, Washington.
- Foster, Vivien, Subhrendu Pattanayak and Linda Stalker Prokopy (2003). "Do current water subsidies reach the poor?" Water Tariffs and Subsidies in South Asia Paper 4, UN Water and Sanitation Program, South Asia.
- Gleick, Peter H. (1998). "Water and Human Health" in Peter H. Gleick (ed.) *The World's Water 1998-1999: The Biennial Report on Freshwater Resources*, Washington DC: Island Press.
- Grossman, Sanford J., and Oliver D. Hart. 1986. "The costs and benefits of ownership: A theory of vertical and lateral integration." *Journal of Political Economy*, 94, 691-719.
- Gupta, Shreekanth, and Bishwanath Goldar (2003). "Do Stock Markets Penalise Environment-Unfriendly Behaviour? Evidence from India." Working Paper # 116, Centre for Development Economics, Delhi.
- Hamilton, J.T. (1995). "Pollution as News: Media and Stock Market Reactions to the Toxics Release Inventory Data." *Journal of Environmental Economics and Management*, 28: 98-113.
- Hanley, N., J.F. Shogren and B. White (1997), *Environmental Economics In Theory and in Practice*, London: McMillan Press.
- Hettige M., M. Huq, S. Pargal and D. Wheeler (1996) 'Determinants of Pollution Abatement in Developing Countries: Evidence from South and Southeast Asia', *World Development* v. 24, iss. 12, pp. 1891-1904
- Jalan, Jyotsna, E. Somanathan, and Saraswata Chaudhuri (2003). "Awareness and the Demand for Environmental Quality: Drinking Water in Urban India", Economics Discussion Paper # 03-05, Indian Statistical Institute, Delhi.
- Karl, H. and C. Orwat (1999), 'Environmental Labelling in Europe: European and National Tasks', *European Environment* 9, pp 212—220.
- Kolstad, C.D. (2000), *Environmental Economics*, New York: Oxford University Press.

Konar, Shameek, and Mark A. Cohen (1997). "Information as Regulation: The Effect of Community Right-to-Know Laws on Toxic Emissions." *Journal of Environmental Economics and Management*, 32(1): 109-124.

Lee, Yok-Shiu F. (1997). "Urban Water Supply and Sanitation in Developing Countries." In R. Maria Saleth (ed.) *Water Resources and Economic Development*, Edward Elgar, Cheltenham, 2002, pp. 215-231.

Lele, Sharachchandra (2000). "Godsend, sleight of hand, or just muddling through: joint water and forest management in India." *Natural Resource Perspectives*, #53.

Makhaya, G; (2001), "Privatisation, Economic Development and the Role of the State in Developing Countries: Review Article"; *International Review of Applied Economics*, October 2001, v. 15, iss. 4, pp. 460-65

McKenzie, D and Isha Ray, (2004). "Household Water Delivery Options in Urban and Rural India," *mimeo* Stanford University,.

Mehta, S and K Smith, (2002), Paper Presented at the Workshop on Household Energy, Air Pollution and Health – Exposure Assessment, New Delhi, January 15.

N.S. Jodha (1990). "Rural Common Property Resources: Contributions and Crisis." *Economic and Political Weekly*, June 30.

OECD (1997) *Eco-labelling: Actual Effects of Selected Programmes*, OECD/GD(97)105

Raymond, L., (2003), *Private Rights in Public Resources*, RFF Press, Washington.

Rosegrant, Mark W. and Hans P. Binswanger (1994). "Markets in Tradable Water Rights: Potential for Efficiency Gains in Developing Country Water Resource Allocation." *World Development*, 22(11): 1613-25, reprinted in R. Maria Saleth (ed.) *Water Resources and Economic Development*, Edward Elgar, Cheltenham, 2002.

Rosegrant, Mark W. and Mark Svendsen (1993). "Asian Food Production in the 1990's: Irrigation Investment and Management Policy." *Food Policy* 18(1): 13-32, reprinted in R. Maria Saleth (ed.) *Water Resources and Economic Development*, Edward Elgar, Cheltenham, 2002.

Russell, C S. and W J Vaughan, (2003), "The Choice of Pollution Control Policy Instruments in Developing Countries: Arguments, Evidence and Suggestions", *International Yearbook of Environmental and Resource Economics*, Vol VII, Edward Elgar, UK.

Saleth, R. Maria, (1996). *Water Institutions in India: Economics, Law, and Policy*, Commonwealth Publishers, New Delhi.

Savas, E.S. (2000), *Privatization and Public Private Partnerships* (New York: Seven Bridges Press.

Somanathan, E., R. Prabhakar and B.S. Mehta. 2004. "Identifying the Effects of Property Regimes: Forest Conservation in the Himalayas." Mimeo, Indian Statistical Institute, Delhi.

Stavins, R.N. (2001), 'Experience with Market-based Environmental Policy Instruments', in Mäler K-G. and J. Vincent (2001), eds., *The Handbook of Environmental Economics*, Amsterdam: North-Holland/Elsevier Science.

Sterner, T. (2003) *Policy Instruments for Environmental and Natural Resource Management*, RFF Press, Washington DC, November.

Thobani, Mateen (1997). "Formal Water Markets: Why, When, and How to Introduce Tradeable Water Rights." *World Bank Research Observer*, 12(2): 161-179.

Tietenberg, T.H. (1992), *Environmental and Natural Resource Economics*, HarperCollins Publishers Inc.

Vaidyanathan, A. (1999). *Water Resource Management: Institutions and Irrigation Development in India*, Oxford University Press.

Wade, Robert (1982). "The System of Administrative and Political Corruption: Canal Irrigation in South India." *Journal of Development Studies*, 18 (3): 287-328.

Wade, Robert (1995). "The Ecological Basis of Irrigation Institutions: East and South Asia." *World Development*, 23(12): 2041-2049, reprinted in R. Maria Saleth (ed.) *Water Resources and Economic Development*, Edward Elgar, Cheltenham, 2002.

Wang, H. and D. Wheeler (1996), *Pricing Industrial Pollution in China*, World Bank Policy Research Working Paper 1644.

Wheeler, D. et al (2000), *Greening Industry: New Roles for Communities, Markets and Governments*, World Bank Policy Research Report, New York: Oxford University Press.

World Bank Water Demand Research Team (1993). "The Demand for Water in Rural Areas: Determinants and Policy Implications." *World Bank Research Observer* 8: 47-70.

World Health Organisation 2002. *World Health Report*, Geneva.