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Chapter 4

Environmental policy instruments and governance

Introduction

The major justification for environmental regulation stems from the public interest theory where environmental policy aims at promoting societal welfare by addressing various sources of market failure. For example, regulatory measures can be used to curb negative externalities like pollution or to control overuse of environmental resources having public goods or open access characteristics (see Chapter 1 for an excellent discussion of these issues). We begin with an overview of the various classes of environmental policy instruments. Next, criteria for choice between these instruments are discussed. The fourth section reviews practical considerations for effective implementation of environmental policies. More specifically, we seek to probe into causes of policy failure which is characteristic of developing countries and therefore a cause of concern for their sustainable development. This part of the discussion takes us to another strand of the economic literature which emanates from the 'public choice' school of thought. In essence, the conflicting interests and rent-seeking behaviour of agents emerge as important constraints of environmental policy-making and implementation. The final section summarises the main issues.

Taxonomy of environmental policy instruments

The existing literature distinguishes between three main classes of regulatory instruments, namely market instruments, 'command and control' and economic instruments (see Box 4.1). In the case of externalities, market instruments can be used where the polluter has a legal right to pollute or, alternatively, the affected parties have a right to no pollution. Let us consider the first instance. If a polluter can legally pollute, then the victims would like to 'compensate' the polluter in order to reduce pollution levels. Negotiations between the two parties would take place to determine the amount of compensation to be paid subject to some 'optimum desired level of pollution' acceptable to both the parties. Coase (1960) predicts that this kind of bargaining process will result in welfare maximising the level of pollution where the marginal benefits to the polluter just equals the marginal cost of the victims. Similarly, if the affected party has a right to no pollution, then firms (or polluters) may like to bribe or compensate the affected party so they can go ahead with production along with associated levels of pollution. Here again, an equilibrium will be achieved where incremental benefits to the polluters just equals marginal cost to the victims. Thus, irrespective of who has the rights, markets will work so as to achieve a socially optimal outcome.

Coase's theorem, however, rests upon a number of restrictive assumptions, such as the small size of groups and near-zero transaction costs. In practice, however, transaction costs are often prohibitive and government has to intervene. Two major approaches to environmental regulation are the use of command and control (CAC) instruments and economic instruments (EI). Command and control methods such as pollution standards and targets are most commonly found in developed countries as well as developing countries (LDCs). Actors who fail to meet the levels specified by the standard are liable to sanctions. This is in contrast to economic instruments which work by modifying markets and the incentives of agents in order to achieve socially desirable levels of pollution.

Box 4.1. Environmental policy tools

Market instruments – By establishing property rights, these instruments enable the use of the legal system.

Economic instruments – Also known as incentive mechanisms. Examples include taxes, subsidies on abatement technologies, pollution permit trading systems and transferable quotas, deposit-refund systems e.g. on bottles and packaging, performance bonds such as afforestation bonds. Examples of environmental taxes, also known as green taxes, include petroleum taxes, selective production and input taxes, tax on international travel based on carbon footprints, and so on.

Command and control – Standards and quotas; prohibition of inputs, processes or products.

Liability rules – Precedents from previous cases create expectations about penalties for future transgressors.

Education, information and communication – Information to polluters, investors and consumers.

Support for R&D to promote cost cutting, environmentally friendly technologies.

Generators of **renewable energy** (wind, solar, etc.) receive a Renewable Energy Credit for each megawatt of electricity generated from renewable energy sources.

Encouragement of voluntary participation or co-operation – at the local, state or global level depending upon the dimension of the environmental or natural resource issue.

Table 4.1 provides a taxonomy of regulatory instruments in terms of specification of goals and methods of implementation. The strictest type of command and control instruments are located in the space where levels of pollution are specified as well as methods on how to achieve these pollution targets. In the USA, for instance, auto-pollution regulation specifies tailpipe emission standards of pollutants like carbon monoxide and nitrogen oxide (the 'what'). Additionally, cars must have catalytic conversion exhaust systems (the 'how'). Other forms of CAC tools may indicate the method only without mention of the target pollution level, for example technology standards. Alternatively, the target level of environmental damage can be specified while leaving the regulated party free to choose the method of pollution control. In contrast to CAC, pure economic instruments neither specify the level of pollution to be achieved nor the means of controlling pollution. These

act upon the incentives of agents to find an optimal and cost-effective means of polluting given their preferences.

Table 4.1. Taxonomy of regulatory policy instruments

Specification of goal or objectives		
Specification of implementation	Specifying **what** is to be achieved by the regulated party	**Not** specifying what level is to be achieved by the regulated party
METHOD		
Specifying how to control pollution	Input, product or practice ban E.g. US auto-pollution control with equipment requirements and discharge standards	**Technology standards** pollution control equipment fishing gear BMP for agriculture landfill construction rules Liability rules **with** minimum standards of care
NOT specifying how to control pollution	Discharge standard based on • technology • AEQ per cent reduction Limit on fish/game take per fishermen/hunter Limit on logs taken per forest	**Charge per unit of environmental damage** • discharge • fish taken **Provision of information** • to public • to polluters or farmers, technology transfer **Overall limit on damage** • AEQ standard without implementation of effort • Overall fishery limit Liability rules **without** minimum standards of care Product taxes or input taxes

Source: Russell and Powell (1999) BMP: Best management practices, AEQ: Ambient environmental quality, TRI: Toxic Release Inventory

The regulation of incentive is concerned with the design of regulatory schemes that use economic instruments such as prices, taxes, subsidies, bonds, liability, or markets to align individual incentives in favour of environmental quality. There have been several policy experiments with marketable quotas or allowances, including individual transferable quotas (ITQs) used in fisheries management, marketable development rights, and marketable pollution allowances. Tradeable pollution credits are created when an individual pollution source reduces its emissions below some individual source-specific target. A cap-and-trade system sets an **aggregate** rather than an individual cap on emissions, and tradeable allowances take the form of **individual quota shares** to the aggregate emissions cap.

As regards global environmental problems, such as ozone depletion, global warming and the depletion of marine fish stocks, international co-operation is mandatory. Carbon trading is a good example (Box 4.2). The Aral Sea post-decline environmental management, discussed in Chapter 12, is another illustrative case study.

Box 4.2. Greenhouse Gas Emissions Trading

Countries that ratified the Framework Convention on Climate Change established a joint implementation programme in the 1995 Berlin Conference of the Parties. The 1997 Kyoto Protocol allows Annex B countries (countries that have an agreed ceiling on emissions) to meet their ceiling by way of emissions trading with other Annex B countries, and through joint implementation programmes (which may occur in developing countries). In the pilot joint implementation programme, Annex B countries finance projects in other countries that reduce emissions of greenhouse gases, and these emissions reductions are then credited toward meeting the Annex B country's ceiling.

The **Clean Development Mechanism (CDM)** is an arrangement under the Kyoto Protocol that allows industrialised countries with a greenhouse gas reduction commitment (called Annex B countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emissions reductions in their own countries.

Other ways of controlling environmental damage are education and the use of different methods of communication. These may prove to be effective where environmentally unfriendly behaviour results from a lack of information about the consequences of agents' actions. Moreover, government policy to support R&D would help to promote cost-cutting, environmentally friendly technologies. Voluntary compliance and community involvement are also increasingly advocated at the local level in regulating the use of natural resources in LDCs where poor governance structures have witnessed failure of traditional policy instruments, i.e. EI and CAC (see page 63).

Choosing between regulatory instruments

Policy-makers have an array of tools at their disposal to address various kinds of environmental problems. Environmental policy objectives or goals can be broadly categorised as: efficiency, cost-effectiveness, distributional equity, variability reduction and the achievement of certain health parameters (Zilberman, 2005; Goulder and Parry, 2008). Criteria for choice between tools would be guided by the achievement of policy outcomes subject to informational constraints, resource availability (both human and financial) as well as institutional constraints. As regards efficiency, policy outcomes are mainly derived from the impact of environmental instruments on an agent's behaviour. We can distinguish between short-run impacts on existing consumption and production patterns and long-run impacts on the adoption of new 'clean' practices and 'green' technology. Strict regulation on pesticide regulation, for example, may reduce the use of pesticides in the short run and lead firms to invest in alternative methods of pest control, which are less damaging to the environment, or to the development of pest-resistant species.

Policy outcomes that have attracted less attention in the economic literature include

effects on income distribution and any resulting change in resource allocation. For instance, certain policies may transfer benefits to lower income groups. Moreover, a tax on an environmentally intensive activity like agriculture may reduce the land allocated to that activity, which may then be used to provide environmental services. This is an example of natural capital augmentation. Government policies may also result in changes in physical and human capital. Physical capital is essentially the infrastructure while human capital refers to transfer of knowledge or skills. Building dams to reduce variations in water availability is an example of physical capital expansion. An educational effort to improve water use efficiency, on the other hand, is an improvement in human capital.

Table 4.2 considers criteria for choosing between the two most widely used instruments, namely EI and CAC. Overall, EI is found to be superior to CAC. EI gives the 'double dividend' effect of generating government revenue (which may be used to attenuate tax distortionary effects) and inducing, in the long run, cost savings from more efficient production and abatement technologies. This is contrary to CAC where the ratchet effect may prevail. In other words, the fear of more stringent environmental regulations from innovation may discourage research in new ways of abatement. CAC may be preferred for perceived administrative ease in terms of achieving fast results and having less demanding monitoring requirements. These perceptions are, however, not clearly supported by evidence (see Table 4.2). Moreover, information intensity is found to be equally important for EI and CAC in practice. The major constraint behind the implementation of EI versus CAC would appear to be the regulatee burden, that is, opposition by firms due to higher perceived costs. It is important to note that evidence appears to support this view (Keohane et al., 1998; Russell and Vaughan, 2003; Harrington, Morgenstern and Sterner, 2004). Furthermore, CAC has shown flexibility by integrating with economic instruments, such as systems of tradeable permits and quotas. These mixed instruments, which may be classified as impure economic instruments, are increasingly supported by the literature as clubbing together the advantages of EI and CAC.

Environmental policy in practice: Governance and political economy issues

Efficiency-enhancing environmental regulations would appear to have little importance in practice. As observed earlier, CAC instruments are most popular in both developed economies and their less developed counterparts. This may be indicative of a higher perceived administrative ease of CAC and/or the power of polluting firms which work to oppose the implementation of EI. Even mixed instruments, such as transferable quotas or pollution permits, are found to have limited implementation in developed countries and are almost non-existent in LDCs.

Where environmental regulation exists, the success of policies across the world and, in particular, LDCs is questionable. In Mexico, for instance, where there are stringent environmental laws, we also find severe air pollution in the capital city and over-exploitation of forest resources. One possible explanation as noted in Chapter 1 would stem from the public goods nature of various environmental problems and the difficulty in monitoring access to natural resources. For example, bans on over-exploitation of marine fish stocks

Table 4.2. Criteria for choice: EI v. CAC

Criteria for choice	Superiority of EI v. CAC (Theory)	Remarks/Evidence
Static efficiency	EI preferred to CAC.	EI instruments more cost effective than CAC in achieving a given level of emission reduction.
Information requirement	EI requires less information to achieve reductions in emissions in a cost-effective manner.	EI needs aggregate information on marginal damage and marginal abatement costs. CAC needs information required by EI plus individual sources' marginal abatement cost. Evidence, however, shows that all policies turn out to be information intensive.
Dynamic efficiency	EI better than CAC (especially in the long run).	EI provide continuous incentives to reduce emissions permitting flexibility in methods. Thus, EI encourage more efficient production and abatement technology. Direct regulation on technology may discourage research in new abatement methods. Moreover, the ratchet effect may result as new ways of abatement provoke more stringent standards.
Effectiveness	CAC is likely to achieve results faster and with greater certainty then EI.	Evidence supports the contrary, i.e., EI are generally more effective than CAC.
Regulatee burden	Regulated firms are more likely to oppose EI than CAC due to higher perceived costs.	Evidence supports this view.
Administrative burden	Costs under direct regulation probably exceed costs under an emissions fee.	Evidence on this is mixed. There are examples where costs of EI have been found to be higher.
Monitoring requirements	More demanding for EI than for CAC.	EI require credible and quantitative emission estimates. Evidence: Requirements for both EI and CAC are found to be exacting.

Tax interaction effects	Adverse effects for both; but larger for EI as compared to CAC for same level of emission reduction.	In general, EI aggravate distortionary effects of existing taxes. However, revenue from EI may be used to partly offset the distortionary price impacts of the regulation.
Altruism	Not clear.	Context CAC: pollute less than what regulation allows. With EI: marginal abatement cost is higher than the emissions fee or permit price.
Adaptability	EI can be changed more readily in response to changing economic conditions than CAC.	CAC policies primarily show adaptability by adopting economic instruments e.g. systems of tradeable permits and quotas.
Cost revelation	Easier with EI v. CAC.	According to theory, a firm's marginal cost is equal to the rate of an emissions fee, or to the permit price under a tradeable permits system. Under CAC system, marginal cost is not directly observable. Firm has to reduce emissions by a prescribed quantity.

Source: Based on Harrington, Morgenstern and Sterner (2004) and Russell and Vaughan (2003)

are generally not effective due to high (if not prohibitive) costs of exclusion. FAO's concern over declining world fishery stocks is justified since illegal fishing activities can thrive. Moreover, even if international treaties for the protection of the environment exist, countries may not want to adhere to those agreements if costs of regulation would hamper their economic growth.

Even where exclusion is possible, regulatory policies are rarely effective. Bad governance is often found to be at the root of these policy failures. Politicians may not work to promote welfare; they pursue their own self-interests. It is evident that big industrialists are promoted who are also polluting firms. Corruption, poor design and implementation of environmental laws, as well as ineffective enforcement due to lack of adequate funds or lack of will of the policy-makers, contribute to the problem. Misspecification of the appropriate level of management may also compound the problem. For instance, certain problems of a more

widespread nature may require centralised control while other problems such as water pollution may be better addressed at the local or state level.

Table 4.3 illustrates the relationship between institutional quality and effectiveness of environmental regulation and management. Measures of the effectiveness of environmental governance include stringency of regulations and perceived degree of enforcement of regulations. Indicators of institutional quality are government effectiveness and transparency.

Table 4.3. Standardised average scores on institutional quality and environmental regulation

Group of countries	Government effectiveness (2007)	Transparency (2006)	Stringency of environmental regulation (2007)	Enforcement of environmental regulation (2007)
High income OECD (23)	1.35	1.40	1.45	1.35
High income non-OECD (16)	0.70	0.70	0.31	0.43
Upper middle-income (26)	–0.05	–0.23	–0.19	–0.26
Lower middle-income (35)	–0.63	–0.61	–0.61	–0.62
Low income (25)	+0.98	–0.85	–0.72	–0.60

Source: Author's computation from data compiled by Kaufmann et al. (2008) for Government Effectiveness scores; Transparency International (2006) for Transparency index; and from World Economic Forum (2008) for data on environmental stringency and enforcement.
Figures in ( ) parentheses show the number of countries in each group.

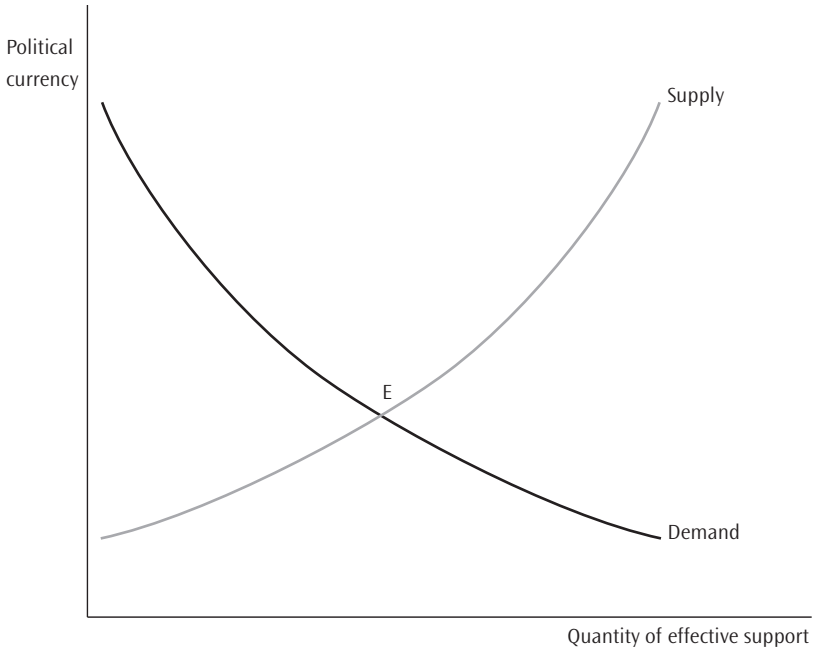
Government effectiveness captures the efficiency and impartiality of the civil service, the quality of public infrastructure and the bureaucratic framework. The index increases with higher levels of good governance. An increase in the transparency indicator, on the other hand, indicates decreasing levels of corruption. The scores have been standardised to reduce deviations and for ease of comparison. Findings from the table tend to support the hypothesis that good governance and effective environmental management go hand in hand. More specifically, we observe that higher income countries with better quality institutions are characterised by more stringent environmental regulations and are also able to successfully enforce these regulations. Environmental problems would appear to be significantly more acute in lower middle-income and low-income countries. These countries also have very poor governance structures and high levels of corruption (well above the mean for the whole sample). It may be conjectured that government failure due to low institutional quality and political will would give rise to more regulation. Moreover, in all likelihood, the legislative supply of regulation will be guided by self-interest and partisan motives.

Political economy of environmental policy

The political economy school justifies regulatory policy as an outcome of the political process reflecting various economic forces at play. The political economy of regulation

takes two major views. One explains the existing level of regulatory control using a market framework of demand and supply for regulation (Stigler, 1971; Keohane et al., 1998). Demand for any regulatory measure derives from various interest groups served by the regulation such as firms, consumer groups and environmentalists. Firms may organise themselves as trade groups and lobby for regulations which reduce their production costs, provide subsidies, constrain substitutes or erect barriers to entry. Environmentalist groups would demand regulations that protect or restore the environment, while consumers may organise themselves as groups to obtain quality assurance or reductions in process. The supply of regulations is provided by politicians who may be motivated by the opportunity cost of effort to shepherd the legislation, psychological costs and the probability of re-election. In Figure 4.1, political currency represents political gains (revenues, rents, votes, etc.). As the quantity of political gains increases, supply of regulation increases. On the other hand, decline in political currency will increase the demand for regulation. The equilibrium E corresponds to the observed level of regulation, which is the outcome of bargaining forces between the various agents.

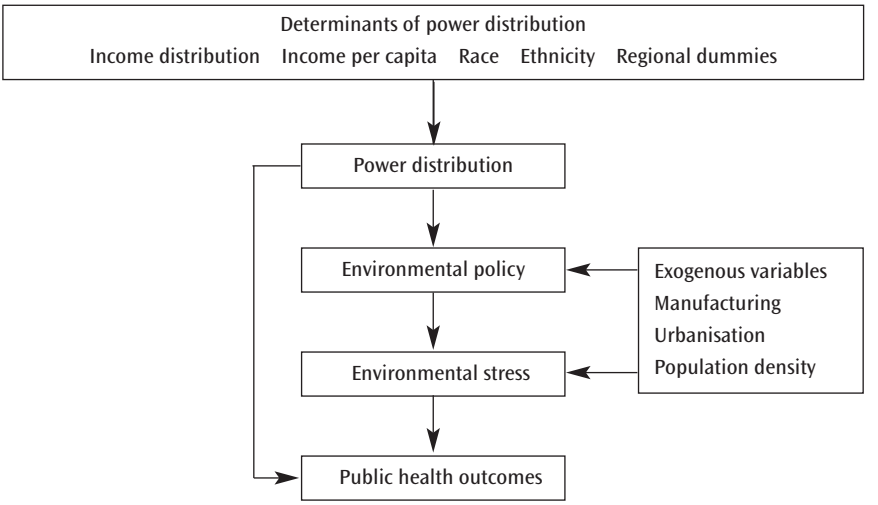
Figure 4.1. The political market for regulation



The capture theory – a formalisation within this framework – shows the power of an interest group to influence policies as rising with the amount of resources available to that group and inversely related to the size of group (Stigler, 1971; Peltzman, 1976; Becker, 1983). This is because small groups are better organised and can reach agreements faster than larger groups. In the above framework, firms have typically more resources than consumer groups and environmental NGOs. Further, the size of trade groups is likely to be small compared to that of consumers. Thus, the above model predicts the prevalence of producer protection over consumer interests. The limited success of environmentalists can also be explained within this framework.

Boyce et al. (2002) develop a model to explore the political economy dimensions of environmental policy in various states in the USA (see Figure 4.2). They construct a measure of power distribution using four variables: voter participation, tax fairness, Medicaid accessibility and educational participation. Voter participation and Medicaid accessibility are assumed to reflect the influence of power distribution on the revenue and expenditure sides of state fiscal policies, respectively. Power inequality would be higher where (i) voters/consumer groups are heterogeneous and conflict-prone due to high income inequality and (ii) levels of education attainment are low. Their findings show that environmental policies tend to be weaker where there is more power inequality. Weak policies in turn lead to higher environmental stress. Moreover, power inequality and environmental stress are shown to have adverse impacts on public health.

Figure 4.2. Power – environment – health model



Source: Adapted from Boyce et al. (2002)

The second view in the political economy literature emanates from the public choice school, which is concerned with collective decision-making in a democratic system of self governance (see Hackett, 2006, for an interesting discussion). This strand of the literature develops the link between voting rule systems (institutional attributes) and the characteristics of user groups to predict whether policies will be incentive compatible or whether they will generate conflicts and thereby fail. This approach has been used together with insights from game theoretic literature to study the conditions for the effective local or community management of natural resources by voluntary organisations. Box 4.3 summarises the major factors affecting local organisations.

The degree of co-operation within the community would be influenced positively by:

- Small size and homogeneity of a group
- High degree of communication between players
- Long time horizon – which may facilitate detection of defaulters
- High degree of trust and mutual expectations

- Willingness to try co-operation
- Catalysts to start co-operation
- Stability of group – which allows continuous interacting over a long time horizon
- Non-anonymous relationship between members
- Social norms of fairness

Box 4.3. Physical and technical characteristics of the resource

Degree of excludability of the resource; Degree of rivalry; Size of the resource system; Availability of substitutes; Technology (for harvest or exclusion)

Characteristics of user groups

Users' demand for, or dependence on, the resource; Number of users; Size of group; Degree of homogeneity of group; Proximity to other users; Culture; Openness and stability of the community

Institutional arrangements

- Operational rules – member access rules, appropriation rules, monitoring mechanisms, penalty rules, conflict resolution mechanisms
- Collective choice rules (the decision-making process) – guidelines for formulating, changing and enforcing operational rules
- Governance structure
- External arrangements – Includes any public regulation of relevance, e.g., property rights, delegation of management at the local level, economic conditions; legal and political environment

Source: Adapted from Rasmussen and Meinzen-Dick (1995)

Given the 'right' environment, self-governed organisations can minimise free-riding behaviour and provide effective solutions for natural resource management. However, the above conditions are rarely met and there is an important role for policy initiatives at the government level and at the international level to facilitate the operation of these local organisations.

Concluding remarks

Command and control and economic instruments are the most widely used environmental policy instruments. Theory indicates the superiority of EI – which are incentive-based instruments – over CAC in terms of efficiency and achieving the 'double dividend' effect. The latter refers to immediate benefits conferred in terms of revenue generation to the government plus the added advantage of cost reduction in the long term due to incentives for firms to embark on R&D in an attempt to reduce environmental damage. Despite its superiority, EI is less popular than CAC in both developed countries and LDCs. One explanation may be due to the higher monitoring burden of EI as opposed to CAC. Equally, if not more important, is the influence that firms have on policy-makers in the choice of instruments. Firms would tend to oppose EI in favour of CAC due to higher perceived costs. They can form groups and mobilise resources in order to influence politicians to

favour their interests. From political economy models, we find that the efficacy of company pressure groups stems from their small size. Evidence further demonstrates that firms may have more leverage on the success of environmental policies where the quality of governance is low and corruption is high. This is more significant in lower income countries. Moreover, political economy models also demonstrate that higher income inequality and lower educational levels may give more leverage to politicians to support firms' interests.

Environmental stress would result from weakly implemented policies. We would conjecture that economic development of the low-income countries is environmentally intensive and environment may be more of an input in the production process. The design of appropriate environmental policy instruments is absolutely essential for these countries. The importance of involving community and voluntary participation in environmental management is highlighted. NGOs would have a big role in bringing groups together and government policies would act as important support mechanisms. International cooperation in tackling global environmental stress has been emphasised in recent years because developed countries are found to be contributing proportionately much more to atmospheric degradation. This alternative method of controlling environmental and natural resource damage, namely community and voluntary participation and cooperation, is increasingly supported by the literature, in the light of the poor performance of traditional methods of regulation and the way incentives have gained more significance in both local and global contexts.

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