Chapter 13
Environmental Policy Instruments

Gjalt Huppes and Udo E. Simonis

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G. Huppes (✉)
Institute of Environmental Sciences at Leiden University (CML), The Netherlands
e-mail: huppes@cml.leidenuniv.nl

13.1 Introduction

13.1.1 Approaches to Governance

What is the role of environmental policy instruments? In simplified terms, environmental policy instruments can be said to link policy development and decision-making to policy implementation. Starting from policy development, the policy problem is translated into operational goals, the appropriate instruments are chosen, and their implementation achieves the goals. This picture of policy as a linear, stepwise activity is an over-simplification. For instance, the definition of the policy problem is often already based on instrument choice, resulting in a circularity that disrupts the seemingly rational linear picture. Permits for the operation of installations tend to define problems in terms of the effects the installation has on its environment, for instance in terms of noise, stench and eutrophication of a nearby lake. Having defined the problem in this way, the choice of policy instrumentation is then more or less limited to variants of the permit, as emission taxes and liability rules simply do not fit the problem definition. Such more abstract instruments require a more aggregate view of the problem, involving for instance groups of installations or activities (see Huppes 1993).

It is also possible to take a more complex view of the policy process, starting with the social processes involved. Policy implementation presupposes a particular context in which the instruments function, involving public and private organisations and many individuals, each with their own roles, knowledge and ideas. In some countries, installation permits are specified and become legally binding without having much effect on behaviour. Actual behaviour may deviate from the permit regulations because monitoring is

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lacking, officials agree to allow deviations, or sanctions cannot be effectively applied. In such quasi-illegal, seemingly ineffective regulatory situations, however, private organisations may still decide to introduce environmental improvements, on a variety of grounds, and may communicate and coordinate their actions with officials. These may then sanction the actual behaviour, either informally or by ultimately issuing a formal permit befitting this behaviour. Such an informal style of regulation has been dominant in England and the Netherlands, where officials communicate with firms and agree on actual operations without necessarily issuing a permit. As a Dutch environment officer once expressed it: 'As long as there is no permit, I can influence my firms. As soon as the permit is issued officially, my influence is gone.' In such situations, there is no clear distinction between the setting of policy goals, instrument choice and policy implementation, let alone that they occur in this precise sequence. A context in which such officials have all sorts of, preferably broad and unchecked, powers allows them to negotiate. It is these operational practices in society, embedded in culture and institutions, which may largely determine policy development and policy instrumentation. In a more legalistic culture, as in the US, such informal procedures may play a limited role.

These two views of the environmental policy process relate to two basic views on the way society can be influenced, one vertical and the other horizontal. The vertical view links a formal democracy which sets policy goals with a Weberian ideal type of hierarchical bureaucracy implementing these goals (see Weber 1947). The horizontal view is associated with direct democracy and social integration through meso-level bodies, like trade associations. Covenants between all public and private parties involved set environmental goals and leave their implementation to those most directly concerned. Even if one does not specifically opt for one of these views, one still has to deal with these diverging aspects, as ignoring social aspects may well make enacted policy ineffective. In the Netherlands, three decades of formal regulations on the manure problem have been to no avail, as local governments refused to effectively implement the successive laws enacted (see Huppes and Kagan 1989). Pressure by the EU in this field, with heavy penalties being imposed on governments for not meeting quality standards for air quality and eutrophication, seems to create an impulse towards effective policy implementation. The two views also meet at a more strategic level. In formalised bureaucratic societies, like the United States, the rigidity of regulations and their increasing complexity exerts a pressure towards more informal procedures. Conversely, the lack of effective regulation in more informal societies, as England and the Netherlands used to be, has led to pressures towards more formal procedures, as have the formal rules introduced by the EU. The integration of process aspects and instrumentation requires a more abstract approach to the policy development and implementation process. German authors (especially Mayntz 1978; Luhmann 1989) have been highly influential in this respect, also in the US, linking the Weberian bureaucracy theory with political process theory into modern administrative sciences.

How does this chapter deal with such fundamental differences of view when discussing the subject of policy instruments? We have decided to apply both. For some instrument types, this chapter uses the hierarchical vertical model, mitigated by the knowledge that policy development and implementation is a cyclic process and that context, in terms of culture and institutions, is a decisive factor in the functioning of such instruments, especially in situations where horizontal government is the dominant mode. At the other end of the scale, there are policy-making processes in which consultations between those involved create a consensus between them which hardly needs formalising. A covenant, without any sanctions for non-compliance, may be the only externally visible instrument in this situation. In between, there is a range of instruments which guide private choices without ever specifying the behaviour of the actors involved in any detail. Emission taxes and environmental information are examples of situations in which very limited public actions have a far-reaching influence on many decisions. Taxes on petrol in Europe and Japan have led to much lower gasoline consumption and related emissions than in the US, while subsidies on energy in the former communist countries, still not fully being broken down after the collapse of communism, have led to extremely high energy consumption per Euro of national income. Such mechanisms work regardless of the intentions with which the subsidies and taxes were created; it is through anonymous markets that they exert their

influence. The middle European countries now having become members of the EU have adapted to world market prices and Western European taxing systems and are transforming rapidly to the Western European energy consumption levels per Euro of national income.

Furthermore, this chapter covers not only the vertical and horizontal approaches to public policy, but also purely private developments. An example is that of the international standards for environmental performance specified in the ISO 14000 Series. ISO (International Organisation for Standardisation) is a private organisation. These standards, in combination with cultural values and liability rules, are having a profound influence on corporate behaviour in particular. The inclusion of such non-public policy instruments in the analysis results in a broad view on instruments.

Finally, we had to decide which environmental subjects to cover. In principle, this chapter includes all subjects for which policy formation has developed in such a way that clearly specifiable domains of social activities are linked to states of the environment with real or potential undesirable effects, either directly on the environment or through the environment on society. Hence, all environmental problems relating to emissions and a-biotic extractions are extensively covered. To some extent, the chapter also covers biotic extractions, such as fishery rights in common waters and quality control on sustainable forestry. Other areas are not extensively covered in this chapter. Policy development for land-use related subjects has not yet developed much beyond zoning laws. Globalisation has fundamental ecological and evolutionary consequences, for instance through the spreading of species to all ecosystems in our globalising world, from viruses and bacteria to plants, fungi and animals. Its effects on biodiversity will be substantial, while health risks may result from recombination of viruses and bacteria. However, no preventive instruments are available other than border controls, which are steadily diminishing. Similarly, amenity values of landscapes, including aspects of cultural history, cannot yet be broadly and systematically covered by instruments, as building regulations can only partly affect such amenity aspects. Clearly, then, there are domains of environmental policy in which steering has not yet become sufficiently routine and formalised to allow institutionalised instruments to be used.

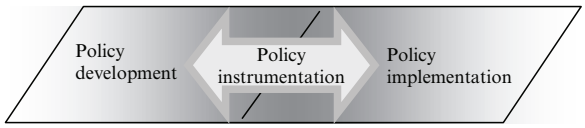

Fig. 13.1 The place of policy instruments in the policy process

It is now widely accepted that human society has to find a sustainable way of dealing with its environment. The basic ethical position taken in sustainability is one of distributive justice within and between generations. The implications for empirical analysis and social action are enormous, and in terms of concrete actions obviously depend on the more detailed ways in which the sustainability concept may be specified. Somehow, society has to incorporate and maintain feedback mechanisms which redirect the actions of many, a process which Luhmann (1989) calls *autopoiesis*. The development of policy instruments is part of the institutional development of society towards the kind of self-steering which is required for long-term human welfare for all, and ultimately even for human survival. See Fig. 13.1 for a main conceptual framework. The institutional development required, often referred to as ecological modernisation, centres around the development of new policy instruments, going from curative to preventive, from centralised to decentralised, and from over-regulated to stimulating (see van Tatenhove and Leroy 2000).

13.1.2 Outline of the Chapter

The chapter moves from the general to the specific, in that it starts with broad societal developments at a global level, then goes into the social contexts of instrument functioning, and finally discusses the detailed specification of instruments, analysing their strengths and weakness. Section 13.2, entitled ‘Policy instruments in a long-term perspective’, investigates the global social context from a long-term strategic perspective. As choices on policy instrumentation bind society for a long period, long-term changes in context have to be taken into account, in terms of structural, cultural, economic and political developments. Major structural developments include globalisation, which changes all organisations in business,

science and technology. Small countries have little decisive influence on technologies which have been developed elsewhere. A major cultural trend is towards individualisation, with intermediate organisations like churches, trade unions and trade organisations loosening their traditional grip on individuals. A key economic characteristic is the continuing growth of income, based on structural developments at a global level like better education, technological progress through ongoing investments in science and technology and increased labour participation not yet offset by shorter working hours. Such fundamental developments are first surveyed, with a view to finding out how instrument choices can take such major contextual developments into account. A number of strategic criteria for instrument design and evaluation emerge from this analysis, which takes for granted certain rough ideas about what policy instruments are and why we need them.

Section 13.3, entitled 'Policy instruments: what are they good for', discusses basic analytics, in a bottom-up approach. Why do we need instruments for environmental policy? Could integrated policies, without specific instruments, not cover all problems? As instruments are placed in their administrative setting, while emphasising 'horizontal governance' – in which public and private partners together design solutions to common problems – the question why we need them crops up again. The answer given here is that they are needed for environmental effectiveness, for the simplification of the policy process, and for building into the fabric of society the safeguards for long-term sustainability. After these hurdles have been taken, the analysis is constructed around the theme of the nature of environmental problems and the general mechanisms that cause undesirable environmental consequences. Concepts like 'external effects', 'collective goods' and 'free rider problems' are surveyed, as these constitute the particular context in which instruments should provide solutions. A final introductory theme is that of evaluating alternative instruments for environmental policy. A distinction is made here between first-order criteria like effectiveness and costs; second-order criteria like requirements on administrative capacity and effects on technology development, which are mostly difficult to quantify; and strategic third-order criteria relating to instruments, such as fitting them into overall regulatory and broader institutional developments, which are never quantified.

Finally, Section 13.4, entitled 'Design, analysis and evaluation of policy instruments', specifies the main dimensions for defining instruments. It shows that it is not at all clear how policy instruments can be classified and described. Nor is it clear how a consistent evaluation of policy instruments can be set up. Still, as some ordering is necessary for instrument development and instrument choice, an analytic framework is developed, covering not only the traditional regulator-regulatee relations but also instruments structuring the relations between various governmental organisations, and instruments structuring relations between private actors, both individuals and organisations. Some practical guidelines are given for policy development at a case level.

Before discussing first strategies, then the contextual framework and next the actual instrument analysis, let us first try to visualise this complex subject as a whole, to gain some perspective (see Fig. 13.2). The starting point is some sort of policy goal that is to be achieved. In designing instruments, one first has to decide on the actors involved, like regulators and regulatees, but also the broader groups involved, which together form the stakeholders to the policy. Next, the goal of the policy has to be defined at an operational level, like an emission volume, an immission concentration, an immission load or an allowable health risk. The next element required is something that can be regulated, something that is the object of regulation, like an installation, a product or a behaviour. Finally, something is needed that sets the policy in motion, such as an operational influencing mechanism. Some positive or negative incentive has to be created, like a prohibition, a subsidy or the obligation to display information, to act as the instrument's influencing mechanism. What happens next, empirically speaking, is set in motion, that is, caused, by the instrument.

This then leads on to an empirical part of the analysis, involving all sorts of mechanisms in society which may have direct effects, involving simple causal chains in the short term; indirect effects, taking into account longer effect chains; or secondary effects, involving broader effect mechanisms. The direct effect of an energy tax, for instance, is a change in energy prices and consumption, while its indirect effect is increased spending on non-energy expenditures and a shift towards more energy-efficient products, and its secondary effects may involve adjustments to the goals of research and

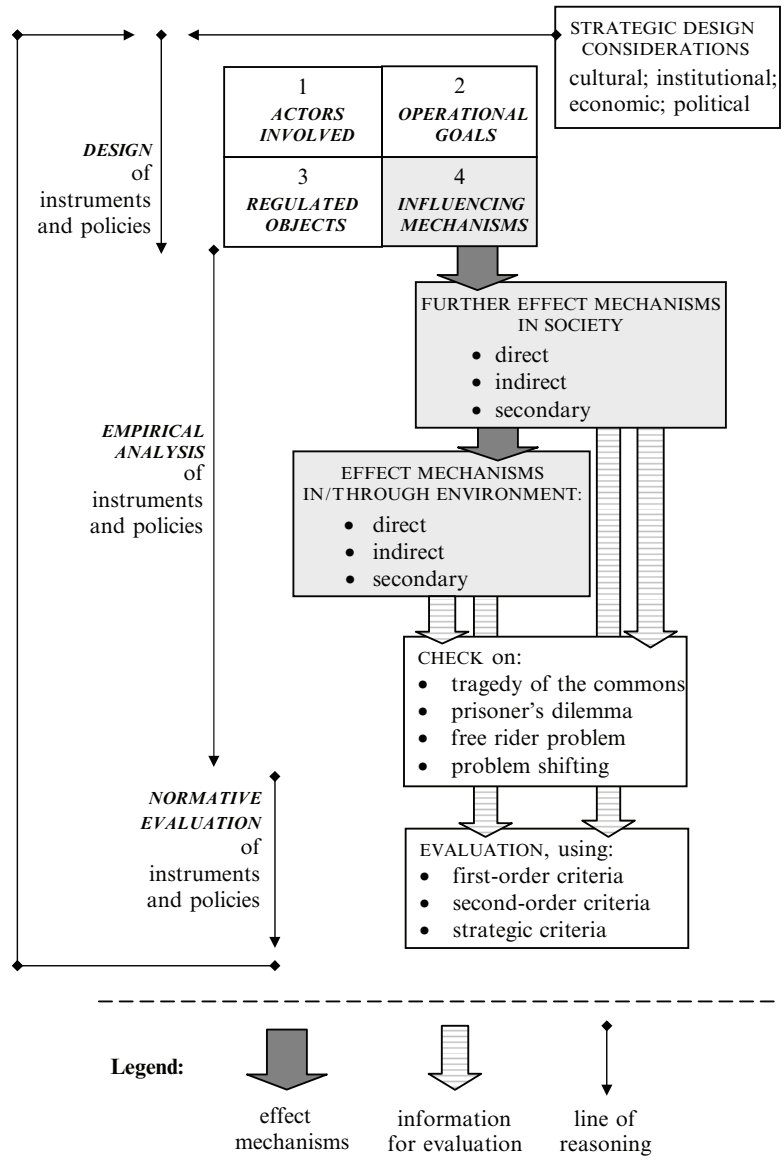

Fig. 13.2 Design, empirical analysis and evaluation of policy instruments

development in large sections of society. This empirical analysis of instrument application in society is then followed by an empirical analysis of the resulting environmental effects, with feedback to society.

A third element in the analysis is evaluative: is it worthwhile to use the instrument, reckoning with its implementation costs and effects? This question is related on the one hand to the empirical functioning of the instrument, involving evaluation criteria like environmental effectiveness, cost and regulatory effort. On the other hand, an important set of evaluation criteria is of a more abstract nature. How do subsidies for not polluting relate to liability law, where it is an accepted principle that those who cause damage have to pay for it? The highest level of strategic considerations takes into account the expected developments in our world, relating to trends like globalisation. In a world where international trade becomes more pervasive, national regulations increasingly lead to loss of competitiveness. Instruments differ in this respect, with emission taxes having major effects and consumption changes minor ones, and instruments may be designed in such a way as to prevent this unintended consequence. The empirical and normative analyses feed back to instrument choice and policy design. The empirical analysis is of course not based on actual empirical

performance, which is not yet there, but on expected consequences. This completes the policy instrumentation cycle (see the arrow on the left in Fig. 13.2).

13.2 Policy Instruments in a Long-Term Perspective

13.2.1 The Future Context of Instruments

Policy instruments tend to bind society for a long period of time, as changing them often requires complex administrative procedures and a decision to adopt a particular instrument in one context influences instrument application in other contexts. Given this long-term character of instrument choices, the context of their functioning is not the situation in which they are being introduced but more that of the future. Although the future is hard to predict and also shaped by deliberate choices, some general developments may be specified, such as structural trends. Such structural changes, both in society and the environment, lead to shifting conditions, resulting in a different functioning of existing instruments and emerging options for new instruments. At the core of an instrument, there may be simple social mechanisms which were rightly taken for granted when the instrument was introduced, but are not self-evident in the long run. For instance, the workhorse of environmental policy in England and the Netherlands is the permit for individual installations. It was assumed that decisions on how to operate these could be discussed with those responsible before the installations were designed and built, and long before a permit was due. The firm's planning was geared to that of the permitting procedure, with quite some procedural flexibility. In many sectors, the periods for planning and implementation technologies have now been reduced to months rather than years, and involve integrated decisions on technologies implemented worldwide. Discussions with the local environmental authority will only relate to some of the details, but not to the technology itself. Nor are consultations allowed to address factors involving real cost shifts, as expected costs have already been incorporated in the decision-making process in the network of firms involved in the technology. Thus, the role of local authorities in the strategic and tactical aspects of technology development has been reduced to virtually zero in most permitting situations. Only additional instruments like large subsidies can exert some influence in exceptional cases. For instance, highly efficient and environmentally benign coal gasification plants for power generation are only built with huge subsidies now, and no more than a few dozens of such installations have been built in the world so far. Therefore, developing the instruments for environmental policy, as an operational set, requires such long-term developments in society to be taken into account, not only in the local firms but also in the broader societal settings.

A number of these developments are addressed below, with some indications of their potential significance for the instrumentation of environmental policy. Relevant and significant developments are taking place in the overall structure of society, in general cultural developments, in developments in the economy and specifically in industrial relations, in the changing role of government and, last but not least, in the changing nature of environmental problems. We will also discuss in some more detail the consequences of globalisation. The next aspect to be addressed is that of the prospects for various policy instruments in a changing world. These prospects do not automatically lead to clear indications as to which instrument is to be used, when and how. In this respect, policy instrumentation as a societal process is itself also partly developing through causal mechanisms of a social nature, and is partly based on explicit strategic considerations and decisions. Some major strategic choices in policy instrumentation are identified in the final section of the chapter, which approaches the arena of political discussion.

13.2.2 General Tendencies in Society

The social structure of Western countries is showing a trend towards a decreasing role of intermediate organisations like churches, trade unions, parties and clubs. Institutional integration is weakened and its indirect control over individuals is reduced. This structural development reflects a double cultural development. As early as the 1950s, Riesman (1950) described a change from *inner directed* to *other directed* control of people's behaviour. This means that it is not internalised norms and values that guide specific choices, but

the notions of others about this subject as determining his choices. Moral precepts are replaced by self-centred considerations of expediency, based on how others view an action and react to it. General considerations on what is right and wrong lose their place in guiding actions. The second tendency, stated even longer ago by Tönnies (1887), relates to the question who these others may be. The reference group for one's norms and values is shifting from a closely knit small group of partners for life, one's 'Gemeinschaft', to larger groups of more shifting acquaintances, the 'Gesellschaft'. These basic developments provide opportunities for new forms of integration. The differences between national cultures are diminishing, as a global culture is developing through shared TV programmes, advertisements, books and movies, through the nearly universal marketing of products and through internationalisation of contacts via tourism and the Internet. Although some debate is possible on new modes of small group integration, the tendencies specified above all lead in the same direction, in which normative control on individuals in their roles as consumers and producers is decreasing. The legitimacy of measures founded in morality has been reduced in the process, and no longer plays its invisible (quasi-automatic) role the way it used to. Therefore, the assumption that rules will be followed more or less automatically may increasingly come to be questioned. Although cultural controls on behaviour are shifting to higher-level collectivities, the subjective view at a global level is ultimately that of increasing individualism, with people deciding on ever more subjects for themselves, arguing from their individual views of the world. This theme of individualisation has been extensively discussed by Beck and is summarised in Beck and Beck-Gernsheim (2002). In a world dominated by relatively superficial types of information, the reference for individual decision-making may be quite poor and simple, relating to individual experiences with simple generalisations. This de-socialising tendency (with integration levels becoming less binding and content-poor, compare Durkheims *anomie*) may be countered by other structural mechanisms, like the globalisation of science and literature. It is difficult, however, to link these global activities to new types of normative and broader cultural integration.

The global economy is going through an extensive structural change, based on new technologies and new forms of communication. The amount of specialised knowledge embodied in any given product is expanding and the technological complexity in or behind most products is increasing. The innovative capacity of firms is increasingly based on functionally differentiated, more or less independent innovation generating organisations. At the same time, the organisation of successful firms is more open to external innovation options. A large firm like Shell has incorporated its main research capacity in an independent organisation, called Global Solutions, which has Shell as its main client, but operates on the world market. The market for innovations in industrial production has increasingly gone global, including and relying on the information and service industries. It is here that future technologies with their specific environmental consequences are born and start to diffuse throughout the world. Technological innovation, viewed by Schumpeter (1942/1976) half a century ago as the capacity of owners of firms to innovate their own activities, has now become a more or less independent capacity at the service of all other firms. It is an open question whether 'Schumpeterian dynamics' and the Rio imperative of sustainability can be made compatible, based on the development of *zero emission* or *Factor Ten* technologies which will not arise spontaneously. If firms want to invest in new installations, they will often be faced by a stark choice: here and now, or not here at all. Delays due to environmental permitting procedures are becoming increasingly unacceptable to a firm which may just have acquired new and superior technology from the specialised technology developers abroad, with only a few weeks or months of head start on its competitors. In this new situation, traditional regulatory controls on technologies clearly have to be redefined, as they can no longer be based on insights by the regulators into the firms they are regulating.

Another structural change in the economy is the shift *from product to service*. This development also affects traditional hardware, such as cars that are not bought but increasingly being leased. In addition, it is embodied in the emerging information and communication technologies, whose hardware is mainly owned by providers, while clients pay for services only. This development is taken one step further when firms do not provide services but act as service-providing organisations, leaving the actual physical activities related to service provision to smaller units. Franchising is one example that has been in existence for some time, but in industrial

production, designers and marketers now externalise production to a much higher degree than they used to. A fast growing firm like Nokia is an example, in which suppliers of all major parts of mobile phones and physical networks are being chosen flexibly every few months. The actual service provision is by competitive network operators, which ensure that the phones function for the consumers who are paying them. And if services are not externalised outside the firm, larger organisations set up business units, which in many respects function as independent firms. They sell and deliver their goods and services to other business units in the organisation but also to the outside markets, while other business units are not obliged to buy their inputs from business units within the same firm. No doubt, this downsizing of organisations, combined with increased international competition for more or less standardised activities, makes environmental control on such standardised mass production activities very hard for individual countries. The non-standardised, creative and strategic aspects of the innovation process may hardly have discernable environmental effects, and are not influenced by binding instruments or market instruments, leaving the scene to 'softer' informational instruments and to structural instruments with a limited environmental scope.

A shift in a similar direction is the changing nature of coordination in the economy. There is a marked shift from hierarchical control to coordination by contracts and markets, quite in line with the tendency towards individualisation. Contracts and markets are not fully anonymous but involve flexible relations, increasingly based on global communication networks. Anything can be bought anywhere in the world at short notice. The main fixed points are the locations of consumers and most employees and some bulk resources, while most of the other aspects of the physical economic activities are variable in terms of location, due also to decreasing transport costs. Formerly the domain of large multinationals, now small and medium sized enterprises are also turning to international trade, integrating in international networks. As a consequence of these developments, traditional national regulators must feel their powers vanishing.

Will there be an end to the increase in global production and consumption, easing the pressure on the environment? Long-term developments in this respect are pointing in the opposite direction. Economic growth is fairly constant in the long run, with real growth in the last decade being of the order of 3% per year, doubling consumption every 23 years, while international trade is increasing by 7% per year. The implied growth in labour productivity is not matched by a proportional decrease in total labour time. On the contrary, there are pressures towards longer working hours per worker. This means that total production will rise, as will the physical activities related to negative environmental effects. The shifting nature and composition of consumption do not indicate an automatic solution to environmental problems. For instance, services may seem attractive in that they are free of matter. However, the system activities required for growing services like mobile phoning and international holidays are highly energy-intensive and require substantial material inputs of a very specialised nature.

Tendencies in government reflect these broader developments in structure, culture and economy. The ideal of planning the future is dead. Although it is still reflected in names like the Central Planning Bureau in the Netherlands, planning, even the sort of indicative planning that existed in France, has disappeared both from government and from business. (Mintzberg, the 'guru' of strategic planning in the firm, has named one of his books 'The end of strategic planning', Mintzberg 1994). Of course, targets are still being set, such as the reduction targets for greenhouse gas emissions in the Kyoto protocol, and the targets in national policy plans. However, these targets are not part of a broad vision on societal development, and the link between the quantitative goal and implementation activities is decidedly weak. In fact, global implementation mechanisms in the form of policy instruments are largely lacking. Although some of the vocabulary is thus still there, integrated strategic planning and control are fading. In particular, the strong control that used to be provided by the informal modes of regulation in England and the Netherlands has first lost its glamour and then its effectiveness. Ultimately, the informal flexibility used to be backed up by the power of officials to implement what they liked, even if it was unreasonable. Negotiating 'in the shadow of the law' is increasingly difficult and the nature of the instruments involved has changed. It seems such countries are all shifting towards the American, more formalised and litigative procedures,

which is not very helpful in the new situation of global competition for technologies and products.

New developments also include avoiding the complexities and costs of formalised regulation by concentrating on consensus building. Consensual processes are major vehicles for change, often with horizontal government as a guiding principle. Building on available integration in society, the domain of application of this approach will tend to become more local. In local affairs, those involved know each other already, and horizontal government is not so much of a change. For higher level problems, as environmental problems increasingly are, this is a change relative to existing practice. It is a tendency that builds on corporate government ideas of involving all major parties involved in a negotiating procedure, in which win-win situations are created, to the advantage of all. In corporate government, it was the top echelons of the socio-economic institutions which made the deals; now it is 'those involved' in general, that is, the stakeholders, who together decide on some problem or action. On the one hand, this tendency reflects the decreasing power of national governments. On the other hand, horizontal government is also an impetus for less active and less binding types of regulation. The consequence for environmental policy could be that for most problems, the old habit of setting standards more stringently than those involved think reasonable is no longer an option; only information, stimulation and financial incentives may remain available if this tendency continues.

13.2.3 Globalisation Tendencies

One recurring element in the above survey of tendencies was globalisation. Environmental problems are increasingly becoming transboundary or global; economic production processes integrate at a global level for a global consumer market; and a global culture is emerging, at least in consumption. International political integration in blocks is losing momentum in favour of, as yet limited, integration at the global level. Examples of the latter are the strength of the World Trade Organisation (WTO) and the vehemence of the political discussion on its further expansion vis-à-vis social and environmental interests. Together, these developments pose severe problems for national environmental policy formation and instrumentation.

The consequence in terms of instruments is that binding instruments based on command and control at a technological level are becoming harder to apply. Any instrument with real effectiveness leads to costs. The idea that economic-environmental win-win situations will emerge spontaneously is attractive but highly improbable, as the structural causes of environmental problems remain and environmental pressures increase because of population growth and economic growth. It seems that win-win situations are related to weak sustainability, in which innovations are attractive, environmentally and economically, per unit of product. Since, at the same time, economic growth is implied, the overall effects at the macro level will usually be detrimental to environmental quality. We therefore assume that, for the foreseeable future, environmental policy will not be expendable at all. Quite the opposite, in fact. Its nature, however, will have to change.

Therefore, effective national policies in the global context require international co-ordination. This co-ordination should not only be effected at the level of setting aims, as is now increasingly the case, but to a certain extent, the design of instrumentation also has to be agreed upon internationally, if nationally effective policies are to be achieved. Some early steps have been taken in climate policy and biodiversity policy, where international instruments between countries have been worked out for joint implementation, in the form of a political-administrative instrument for emission trading and a clean development mechanism. For instance, countries may now trade their emission reduction obligations on a bilateral basis to improve overall efficiency in emission reduction. European countries are investing in new technologies in the former communist countries to reduce emissions there relative to the assumed autonomous growth of emissions in these countries. However, any simple trading system based on future emissions of a substantially fictitious nature may easily erode collective efforts and cannot easily be brought into line with the systematic development of regulatory instruments. Imagine that a country can claim credit for helping to close down an old power plant or helping to plant a forest in another country. This is now possible under joint implementation. The net influence of these supporting activities may become

negligible if these developments would have taken place anyway. There is then no actual result, only a clear result on paper. Political deals with some financial gains to the main parties involved, may then become more important than real efforts for emission reduction.

Tradable emission permits might also be implemented as a regulatory instrument. The question is then who would receive the emission rights being traded and what the initial distribution between countries would be. Whatever the initial distribution, after some time real emitters would have to have the emission rights corresponding to their emission volumes. While such a system would be more transparent, it would have serious implications in the normative set-up of instrumentation. Achieving global efficiency in climate policy would mean that the trade in private emission rights would have to be preferred, on the same efficiency grounds now used to defend joint implementation. Broader ethical considerations embodied in the normative-legal structure of most countries would favour instruments that are in line with the polluter-pays principle (see OECD 1995). In this case, emission taxes are to be preferred. In the case of carbon dioxide emissions in particular, such taxes could in principle be set up with relative ease. The main choices in working out such taxes relate to who receives the proceeds. If it is the national governments implementing them, this would create an incentive for effective implementation. However, the carbon resource owning countries would effectively pay a large part of the bill as a result of reduced prices for gas, oil and coal. Ideas on legal frameworks as being discussed in the WTO tend towards giving these countries a right to compensation. Alternatively, the emerging global political community, potentially in the form of a *World Environment and Development Organisation* (see Simonis 1998) needs financing, and the carbon tax proceeds would seem an ideologically acceptable source.

13.2.4 General Tendencies in Environmental Problems

The structural economic developments described above have changed the nature of our relations with the environment (see also Box 13.1). Five basic trends may be discerned, each of which is important in its own right. Together, they are creating a challenge for policy instrumentation which cannot yet be met.

Depletion problems of materials supply, never really high on the political agenda, would lead to a greater emphasis on all forms of recycling. It seems that the real environmental drive behind this emphasis is not so much depletion but avoiding the detrimental effects of primary production and final waste disposal.

Traditional environmental problems of final wastes and emissions tend to become *more global* in nature. The remaining 'old' toxicity problems are of a more global nature, being related to substances that are not broken down and circulate in the environment for a long time, like heavy metals and pseudo-estrogens. Acidification and eutrophication now also tend to involve larger areas, like subcontinents and coastal seas. Some of the newer problems, like ozone depletion and climate change, are essentially of a global nature.

Appropriation of nature (Fischer-Kowalski et al. 1997; Ingold 1986; Imhoff et al. 2004, going back to Marx's *Das Kapital* in a slightly different meaning), in terms of the share of biomass production controlled, harvested and consumed by humans, is growing. Room for natural type ecosystems is vanishing fast and the remaining ecosystems are controlled for their human oriented biomass production. Tendencies towards biomass production for energy applications will give further impetus to this development. This will decrease the actual volume of non-edible algae and plants and of all creatures living off them – animals, fungi and one-celled organisms.

The *share of non-man made ecosystems* is decreasing, with full human control emerging except for protected nature reserves. This leaves ever smaller patches of ecosystems, which in principle cannot be stable in terms of the number of species they can support, and hence will become more dynamic.

The combined effects of the appropriation of nature and the increasing spatial scale of human control reduce the ecological basis of humanity not only in terms of volume but also in terms of quality, as many ecosystems require large spaces for their long-term existence.

The *homogenising of ecosystems*, closely related to the globalisation of production and the emergence of global recreation, may well become a major new focus

Box 13.1 Policy instruments in a long-term perspective

Culture
- Reduced role of internalised norms and values
- Reduced role of local groups
- Increasing role of international mass media
- Some cultural elements globalised

Social stucture
- Fewer intermediate organisations
- Expanded liability
- More private and national ownership of biotic resources

Government
- Formalised and litigative tendencies in binding instruments
- Decreasing role of binding instruments
- Increasing role of horizontal mechanisms, especially locally
- Uncertain role of purely private mechanisms

Population
- Continuing growth over the next decades
- High growth rates in many poor countries
- No further growth in industrialised countries
- Higher average age in industrialised countries

Prospects for instruments
- Dynamic effectiveness of instruments: halving environmental effects per unit of income required every 25 years
- Internationally co-ordinated instrument choices essential
- Instruments for safeguarding ecological resources to be developed
- Decreasing overall effectiveness of instruments
- Financial instruments essential for high level of trade-off between economy and environment

Economy
- Increasing technological complexity
- Functional differentiation of innovation
- Shift from product to service
- Shift from service provider to service organiser
- Co-ordination: shift from hierarchies to markets and condtracts
- More flexible co-ordination in networks

Environment
- Decreasing ecological resources
- Local problems dealt with reasonably
- Emphasis shifting to continental and global problems
- A-biotic depletion only in very far future
- Increasing appropriation of nature and biotic depletion
- Continuing climate change
- Continuing loss of biodiversity
- Natural areas diminishing fast
- Threats of ecosystem instability

Strategic instrument choices ahead
- Tradable right to environmental damage versus collective right to unspoiled environmental quality
- Equal right to environmental use space versus equal efforts for damage reduction
- Global equity versus global efficiency
- Means-directed technology-specific instruments versus goal-directed environmental incentives
- Normative integration of policies with broad internalisation in society versus political-administrative debate per item of choice

for policy. As species from different ecosystems mix, the diversity of ecosystems is reduced. As new species are introduced, from viruses and bacteria to fungi, plants and animals, it will be the generalists that have the greatest chance of survival, out-competing the niche specialists. In addition, competition between niche specialists will occur, reducing the numbers of their species. As a result, new ecosystems will evolve, with new selective pressures towards new species. Since new species of higher organisms evolve over a longer time scale than smaller and simpler organisms, it is especially new variants of viruses and bacteria and other mono-cellular organisms that will arise in the short term, posing threats to humans and crops, as well as to other species.

Overall, the pressures of emissions, combined with the three other types of structurally increasing influence

on the biotic environment will lead to rapidly decreasing biodiversity, instability in the genomes of smaller creatures and an influence on the life support functions of natural ecosystems that is more difficult to specify. Policy options may focus on prevention of these mechanisms, or on the control of undesirable consequences. Examples of the first are bans on the transport of species, which are already in place in many countries for plants and plant material, for agricultural reasons. Solving problems after they have occurred often seems difficult. Disease control by vaccination is one activity that is obviously to be stimulated in terms of research and instruments for their operational application to large parts of the population. This level of problem analysis cannot yet be generally related to policy instruments, thus allowing the problem to grow. This is an undesirable state of affairs for broad sustainability reasons. Ultimately, the influence of human activities may reach a point where viable ecosystems can no longer exist unless fostered by specific human activity. Such a total control of our biotic environment, and hence also of our a-biotic environment, is not feasible at a scientific level, let alone that policy instruments could already be envisaged.

13.2.5 Prospects for Instruments

As explained above, the role of technology binding instruments is expected to decrease further. Only in industries not exposed to international competition, like building and infrastructure, and in the context of some internationally binding agreements on prohibiting emissions like the Montreal Protocol for most ozone depleting substances, may instruments binding private addressees remain dominant (see e.g. Castells Cabré 1999). International coordination, for instance by technology guidelines or Best Available Technology rules as in the EU IPPC Directive (Integrated Pollution Prevention and Control), may help to leave some space for technology binding instruments, especially in matured industries with relatively little technology development. In other fields, different types of instrument will take over or at least become more important. Private choices in production and consumption are increasingly being guided by cultural and informational instruments like life cycle assessment (LCA) and Environmental Audits, both standardised by ISO. Such analysis instruments may have a broad influence especially if the information in the instruments is complemented with normative information about the relative importance of different types of effect. However, they create a limited incentive only, due to the collective nature of most of the environmental effects involved. Where real choices are to be made, with substantial costs involved in environmental improvements, information and normative statements will not suffice. If binding instruments lose their importance in limiting options, only financial instruments and liability instruments can substantially correct the pay-offs for those making choices, be they governments, business and environmental associations, or private producers and consumers. Softer cultural instruments are important to support prime movers and to generate political support.

Thus, a major problem for future environmental policy relates to methods compensating for the diminishing role of technology-specific binding regulations. With few exceptions, the role of financial instruments has so far been limited. Broader use will be based on a number of conditions. To begin with, a clear choice is required between issuing emission permits, against the polluter-pays principle, or creating emission taxes, in line with it. Secondly, the operational applicability at the level of emissions and resource use (e.g. CO_2 taxes), as opposed to application at product and technology levels, has to be improved. Thirdly, international coordination in terms of the design and levels of taxes is needed to avoid unfair and overall costly shifts in competitiveness between firms in different countries. Fourthly, better integration of various environmental aspects is required for cultural instruments, as real actions always involve virtually all environmental problems that exist. This is not only a matter of information but of clearer normative guidance as to the relative importance of various environmental interventions, based on their potential consequences. Lack of conceptual clarity is a major problem here. Can we realistically specify the ultimate consequences of CO_2 emissions at an 'endpoint' level? Or should we evaluate at the 'midpoint' level of global warming potentials? Or are potential instability and uncertainty about possible catastrophes the prime motives for reducing greenhouse gas emissions? Such questions need to be answered in a very practical manner if a trade-off between, for instance, energy use, land use and a diverse array of emissions is at stake, as is the case in most practical decisions in production and consumption. Such normative

guidance, which is only partly based on empirical evidence, is not only a prerequisite for practical decisions on specific technologies, but also for more aggregate developments, as in steering technology development and creating more sustainable lifestyles.

What is ultimately needed is not only a view on the relations between the various environmental effects involved, and the trade-offs between environmental interventions implied in our actions. The trade-off between economy and the sum total of environmental effects also needs to be stated as a clear principle, guiding the quantification of all types of instruments in a uniform way. Without such guidance, equal treatment of similar cases cannot be achieved, leading to both injustice and substantial static and especially dynamic inefficiencies.

Finally, structural instruments, such as changes in institutions, constitute an option for new policy instrumentation that has not yet been fully exploited. For example, cases against the tobacco industry in the US have shown how large the payments can be in a specific judicial setting. In all cases, creating the right incentives should be accompanied by removing the wrong incentives. The situation in many countries is such that there are substantial subsidies on energy use, as in Eastern European countries, and similarly by tax exemptions as for aircraft fuel on international flights; that the cost of infrastructure is not reflected in prices, as with un-priced roads; that new technologies are difficult to implement due to complexities of regulation; and that a global perspective on environmental policy development is prevented, as implied in emerging WTO regulations. If a broad shift in policy implementation were to emerge, the result would be a more balanced internalisation of environmental consequences, both in public and private actions.

Instrumentation for newly emerging environmental problems is usually lacking. The *appropriation of nature*, that is, a decreasing share of nature in the total biomass production, is accompanied by an even faster reduction in natural biomass breakdown, which is the source of food for all fungi and animals. This is one of the new environmental problems, defined here at 'midpoint' level, relating to biodiversity, the life support function of ecology and the quality of nature. Instruments that can work at a global level hardly seem to be available. For some aspects, such as the protection of available genetic information, the road towards structural-institutional instruments has already been taken, with governments or private organisations owning the species on their territories and their genes, whether naturally found in organisms or constructed. This may help to protect and regulate the existence of gene pools. It does, however, not necessarily help to create healthy ecological conditions. The preponderance of single protected genes, as in agricultural production, may even lead to monocultures of such economically dominant genes, with probably negative overall ecological effects through reduced biodiversity.

Two lines of instrumentation are presently available for saving and creating ecological values. One is the creation of nature reserves, as an option-creating instrument. However, increased spatial needs for food production to feed the growing and more affluent populations and increased mono-cultural production of biomass for energy purposes literally leave less room for this instrument, given the largely fixed area of land on earth (which even will decrease due to rising sea levels). The other, 'integrational', line is to create more ecological quality in areas primarily used for agriculture, recreation, infrastructure, production and housing. Again, the options have hardly been investigated and instrumentation is largely lacking. Apart from emission reducing instruments, there is a clear lack of instruments safeguarding ecological richness in diversity and volume, not only in nature reserves but also in human-dominated ecosystems. Furthermore, ecology-oriented instruments still lack theoretical foundations and operational development.

13.2.6 Strategic Instrument Choices Ahead

Our first assumption here is that it is not possible to avoid choices regarding environmental policy instruments by doing nothing. Economic growth, population growth and globalisation tendencies make internationally coordinated policy development inevitable. At the same time, it is impossible to make independent choices on policy instrumentation for each individual case. A well-argued strategy has to guide serious development of policy instruments. If the polluter-pays principle is accepted, all instruments have to take it into account. Basic choices should preferably be made

consistently, according to generally recognised principles. Some major lines of development are discussed here, relating to basic liability rules, environmental ethics, the importance of efficiency and equity, means-directed or goal-directed types of instruments and, finally, principles of policy integration.

13.2.6.1 Liability Rules

Liability rules have traditionally been set up to prevent active infringements on the goods or rights owned by others, either individually or collectively. The 1960s saw the start of a debate in economic circles on the other option, that is, giving everybody the right to infringement of the goods or rights of others, especially in the environmental domain. The discussion was opened by Coase (1960), who showed that there was no difference between these options for the outcome in real terms, if transaction costs needed to arrive at these outcomes could be neglected in both cases. In the debate following his paper, the latter restriction has been somewhat relaxed in that Coase's conclusion also holds if transaction costs are similar. Transaction costs result from the necessary contacts, primarily the labour time of all involved, including costs of negotiation, control and litigation.

This point of view has had a major influence on environmental policy, where the same period had seen broad acceptance of the polluter-pays principle. Different versions of this principle exist. A basic element is that polluters have to pay for the environmental damage they cause, thus internalising environmental aspects in their decision-making. Since Coase showed that the principle is not required for cost-effective policies, policy-makers may reason towards policy instruments on the basis of net costs in terms of real outcomes including transaction costs, and do 'what is best', on a case-by-case basis. This has opened up the path to tradable emission permits, which give the owners a direct right to pollute.

The conflict between the polluter-pays principle and the pragmatic do-what-is-best in each case principle somehow needs to be clarified and resolved to allow basic innovation in national, and particularly in international policy instrumentation. In-between options are possible, but not necessarily more attractive (see Tisdell 1998). One option is to market emission permits with a very limited term of validity. Effectively, this means that the right to emit has to be bought again each time to operate an installation. If the number of permits brought on the market by governments is set so as to achieve a predetermined price level, the difference with an emission tax of a similar level is really very small in terms of effects, and may even be similar in its administrative operation.

At a practical level, the liability instrument works by linking cost to environmental interventions. The US has taken a practical approach in the field of waste management, by making firms liable for the sanitation cost of illegal landfill with chemicals. This programme (Superfund Programme 1986) has conferred substantial cost on polluters, based on ongoing sanitation activities pre-financed by government, see e.g. EPA (1999). Similar programmes have been developed in the Netherlands. In the US, these programmes function against a background of already existing extended liability ('chained and several liability'), where larger firms in the chain are liable, and if the damages result from emissions of several firms, each one is liable. In Europe, developments towards extended environmental liability are ongoing, based on the Environmental Liability Directive.

13.2.6.2 Ethical Norms

In the international setting of a globalising world, basic discussions relate to the ethical principles which provide guidance in handling distributional effects. Though sustainability involves an accepted distributional principle, concrete ethical norms have not been agreed upon. Should all citizens of the world have an equal share in the environmental use space? Is this share tradable? Does every citizen have the same right to a certain minimum environmental quality? Are the costs of environmental improvements to be distributed equally per head of the population? Or is an equal percentage of income to be spent on environmental protection?

The answers to such questions have a direct bearing on instrument choice. Internationally, the use of emission rights as a political-administrative instrument, with initial rights distributed to countries according to their share in world population, would be in line with equal environmental use space. Emission permits inversely related to average income give more per capita emission use space to the poor. Equal emission taxes worldwide would roughly lead to equal shares of income being paid for environmental protection. If such principles are

to be more than a guise for tactical interest protection, i.e. if they have real meaning, the implications for policy instrumentation will be quite direct. Still, there is not one principle that can force the decision.

13.2.6.3 Efficiency and Equity

A further strategic choice concerns the relation between *global efficiency* and *global equity*. For the sake of efficiency, marginal costs of environmental protection or improvement should be equal across the entire world, which means that environmental improvements should be achieved in all choices, up to a particular level of cost per unit of improvement. If this rule is not satisfied, with some doing less and others doing more, the world could benefit from a shift in effort, with those still having cheap options for improvement doing more and those with high costs of improvement doing less. A real Pareto improvement is then possible, with everybody being better off if those who reduce efforts compensate for those increasing their efforts for environmental improvements.

The broad emphasis on efficiency as a guiding principle for trade relations indicates that this principle would also have prime importance in environmental policy instrumentation. Internationally tradable private emission permits and emission taxes that are the same the world over would be prime instruments. Who is receiving the 'grandfathering' rewards of initial permit distribution and who is receiving the proceeds from the emission taxes is not relevant to efficiency considerations. This indicates that there is some room for combining efficiency with equity, by redistributing proceeds. Full emphasis on equity will lead to other instruments, however. The justice principle (as embodied in the polluter-pays principle) would shift the choice from emission permits to taxes on adverse environmental impacts.

13.2.6.4 Goal-Oriented and Means-Oriented Instruments

A further major choice concerns the aim that has been made operational in the environmental policy instruments. For instance, an emphasis on easy implementation means that regulators have a clear grip on technology development and makes policy integration an aspect of policy development. Dynamic efficiency, the most important cost aspect in the long run, remains a problem in this approach. This means-oriented approach is contrasted with the goal-oriented approach, in which policy instruments have to internalise sustainability goals as fully and directly as possible, allowing for decentralised technology choices with incentives for environmental improvements.

It is clear that efficiency considerations also imply a choice to adopt the goal-oriented option. In the liberal ideal, the choice is clearly to adopt goal-directed instrumentation, while in social-democratic and socialist circles, preferences might lean more towards means-directed instrumentation. However, ideas in European social-democratic parties indicate that the broad integration of environmental considerations in private decision-making is to be preferred over the option of having governments decide on technology choices on a case-by-case basis. Thus, there is a broadly supported political tendency favouring a shift towards goal-oriented instruments, though means-oriented instruments remain the main vehicle for environmental policy, also because the controls for regulators seem more easy to implement.

13.2.6.5 Principles of Policy Integration

In means-oriented policy instrumentation, the integration of the various environmental aspects involved is implicit. One may assume, optimistically, that a single policy-maker will be consistent in the way he or she uses the implicit trade-offs between various environmental aspects, as well as the trade-offs against social and economic aspects. If multiple policy-makers are involved, in both public and private organisations, consistency cannot be expected to come about automatically. In goal-oriented policies, there is a logic to making an explicit statement on the relative importance of various environmental aspects related to activities, at the operational level of emissions, extractions and disturbances, that is, trade-offs are to be stated more explicitly, allowing for equal trade-offs in different situations. An example is the equivalence between 14 t of SO_2 and 1 t of CO_2 which is being used informally in Dutch environmental policy. Worldwide, however, explicit statements on such trade-offs are lacking, while decentralised environmental decision-making cannot do without them. Where tradable emission permits come up, the comparative reference may be the price paid for the permit. This may be the case in the European Union for climate changing emissions (in the Emissions

Trading Scheme) if it develops to a mature system, and in the US for acidifying emissions. These markets are very partial and not yet global however.

Reasoned choices in this respect require explicit statements about the reasons for choosing particular trade-offs and the links between these environmental aspects and concrete economic actions. Such relations depend on evolving normative ideas about what is important, on the state and development of the environment and society, and on the way these relations can be modelled. Consistency, including consistency over time, can only come about on the basis of an explicit and comprehensive debate. This ideological superstructure to operational policy is poorly developed. In Dutch environmental policy, the 'themes approach' was developed as a conceptual framework over a decade ago, including themes like eutrophication, acidification and ozone depletion. This approach has been followed in various ways by other countries. The European Union, for instance, has defined a large number of Preferential European Environmental Problems, not as a systematic treatment of the subject but based on political consensus, including quite incommensurate items ranging from waste prevention to biodiversity preservation. Waste prevention, however, is not an environmental aim but a means to achieve environmental aims. This means that the means-oriented approach is reintroduced through the backdoor. The explicit and general normative integration of environmental policy aims, as opposed to the implicit choices sufficing for technology binding instruments, is a clear task ahead.

13.3 Policy Instruments: What Are They Good for?

13.3.1 Policy Instruments: What Are They?

There are many instruments that might be relevant to environmental policy, including analysis tools, checklists and plans. More generally, environmental policy instruments can be seen as the means of implementing such policies. Here, a slightly more restrictive definition is used:

Environmental policy instruments are structured activities aimed at changing other activities in society to achieve environmental goals in a particular time schedule.

The main focus here will be on public policy, but the definition is not limited to this. The internal tradable permit system developed by Shell (see Box 13.4 in Section 13.4) is a perfect example of an environmental policy instrument. It has been superseded by public carbon trading systems like in Norway and the EU, see Hoffman (2006). Of course, not all policy instruments are intended for environmental policy. Other instruments for public policy, like those on energy and transport, may include environmental policy goals in addition to the prime non-environmental goal, or instruments may be multi-goal oriented, or the goals are not explicit, as with excises on petrol and alcohol. Multiple goals are implied in integrated policies. The division between environmental and non-environmental instruments is thus not strict. This is not a real problem, however, as policy instruments for non-environmental goals may be analysed in a very similar way.

Not all policies are structured, in the sense of being institutionalised in terms of instruments. Setting up the high-speed rail link to reduce air traffic between Paris and Lyon did indeed reduce air traffic at first, and reduced its growth afterwards. Green politicians may exhort the people in public speeches to leave their cars at home for at least 1 day a week, with some success. Such incidental activities towards policy goals, however, are not seen as instruments, as instruments would need to have an element of repetition in their application and operation. Hence, if high-speed railroads are built consistently on trajectories with rising air traffic, this provision of infrastructure can be regarded as an option-creating type of policy instrument. If a politician's speeches are part of a series set up for public education, they too may be seen as part of a communicative instrument. The dividing line is not strict, but, again, this is not really a problem.

As a final distinction in the definition, it may not be clear what exactly the environmental policy goals of some instruments are, and if these are really environmental goals. Raising prices for dumping waste in landfill sites may have non-environmental aims, for instance to increase the availability of easily accessible landfill sites, or to provide an incentive for increased use of under-utilised incineration plants. Or it may be seen as a means of reducing primary materials production, reducing resource depletion and the environmental effects related to ores processing. What exactly constitutes the 'real' prime motive is often difficult to establish, but also not very relevant. Such borderline instruments may still be analysed as instruments for

environmental policy, with environmental effectiveness as one aspect of their assessment. The actual environmental effectiveness of instruments may not always be a distinguishing criterion. In certain circumstances, subsidies on environmental improvements, for instance, may have adverse effects, by delaying structural change which otherwise would have taken place. These subsidies are then environmental policy instruments that are not adequate for the particular situation, but they still are environmental policy instruments.

13.3.2 Why Have Policy Instruments?

Why bother about environmental policy instruments when actual policies based on integrated assessments can integrate environmental and other consequences in everyday actions? The main reason is that the complexity of all empirical relations and that of assessment are so great, and the information requirements so vast, that this option is not really available beyond a limited number of relatively simple occasions. Instruments work by simplifying a complex reality. They can be studied and assessed at a general level to decide what conditions can be identified for their sensible application. This may reduce the complexity of policy-making. At the receiving end, in society, most policies have their effects not in terms of directly correcting current activities of regulatees but, to a large extent, by guiding the planning of and decision-making on future activities. Having instruments whose nature is known from the relevant literature and past experience will make policies more predictable and facilitate adjustments. These adaptive mechanisms in society, if structured in stable patterns, can be regarded as a part of policy instrumentation as such, and may be more important than specific policy applications themselves. Without such applications, however, the general adaptive mechanism would cease to exist.

13.3.3 A Framework for Analysing Policy Instruments

Various policy instruments may be characterised in a common framework, with an empirical part explaining how they work and an evaluative part providing criteria on their value and adequacy. Such an empirical and evaluative analysis may be part of the policy cycle, in which the effects of policy, combined with other developments, feeds back into new policy preparation. The evaluative part is worked out in Section 13.3.6 below. The framework for the empirical part of the analysis has four main components: regulators, regulatees, society and the environment. These four components, as applied to one particular country or region, are mirrored by the same entities abroad (see Fig. 13.3). The framework defines the basic structure for modelling the functioning of environmental policy instruments. In a very basic mechanistic model, there is a single causal chain from the regulator's actions to the environmental effects. This limited framework already opens up a world with a rich variety of instruments and a high level of complexity of mechanisms in society.

The starting point in the model is some public regulation, which may be collective, as when a public body sets an emission standard in the metals plating industry, or private, as when the management board of a firm sets an environmental performance target. As a first step in the causal chain, there is the technical adjustment enforced among regulatees as the subjects of instrument application, see step 1 in Fig. 13.3. A second step usually centres around economic mechanisms and

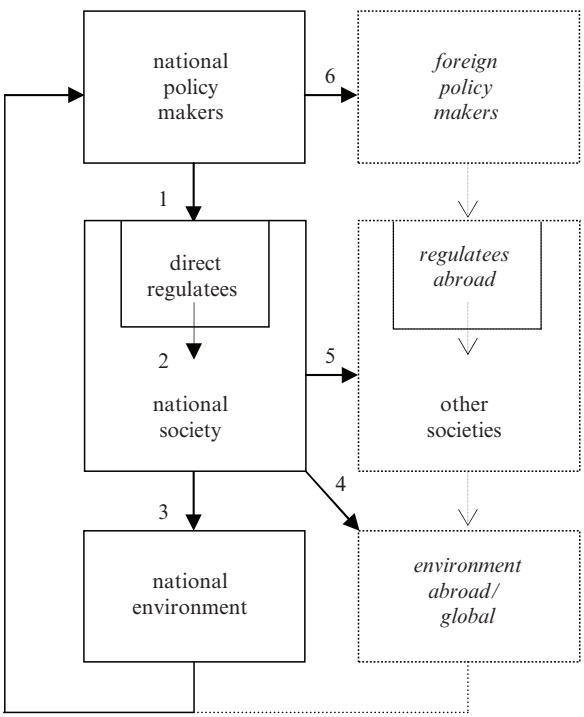

Fig. 13.3 Regulation: a simple model without feedback loops

relates to the costs imposed on regulatees, that is step 2 in Fig. 13.3. The degree to which such secondary effects are taken into account may vary. Effects on markets and other technologies will usually be part of the analysis, and will depend on the specific circumstances in these markets. Stricter emission standards in a small, open economy with a few large internationally operating firms may lead to emission reduction by shifting production to locations abroad, without necessarily changing technologies, and without reducing emissions at a global level. Conversely, technology adjustments in a large country with many small firms producing for the national market will be more pronounced, with only limited changes in the volumes produced. For a given set of national technical effects and volume changes, the net resulting environmental interventions can be defined and linked to effects on the national environment (3) as well as on the environment abroad and ultimately the global environment (4). As most markets are now international, national policies will induce economic changes abroad (5), which also have certain environmental effects. Finally, policies in one country may directly influence policies abroad (6). Dutch excises on petrol, for instance, are limited by the German excises on petrol, as too large a difference will lead to the closing of petrol stations in the border regions. Similarly, Californian regulations on 'emission-free cars' have set in motion regulatory activities and technology development in Japan and Europe.

The model with one-way causalities does not, however, correspond fully to reality, where feedback mechanisms, always dynamic, abound. Such feedback mechanisms may be quite complex. If regulatory capacity is limited, as in some way it always is, using regulatory power to solve one problem precludes its application for solving others. Also, using one type of instrument for one problem, like covenants to achieve the best available practice for energy saving in industry, will render the later introduction of emission taxes on CO_2 and NO_x rather unacceptable to industry. Negotiations on a covenant depend on what the industry sees as an alternative to the covenant: maybe emissions taxes or maybe costly actions. Hence, such negotiations necessarily take place 'in the shadow of the law', as Galanter (1981) and Scharpf (1991) phrased it. Indirect effects in society, in terms of the economic and environmental developments they induce, result from further feedback mechanisms. A very common mechanism is that by which regulations induce costs and hence lead to market changes and technology adaptations. For instance, costly measures to reduce emissions in the metals plating industry have induced a shift to high quality coatings, with other types of emissions resulting and with other policies being required. On the other hand, inducing changes in an industry may mean that cost-saving innovations that were already available come to be introduced faster and on a wider scale.

The ultimate feedback, of course, is that relating to environmental quality. The poor air quality in Mexico City not only raises direct costs of production by requiring air filters in many processes, it also reduces the legitimacy of the government and makes it difficult for firms to attract managers and specialists from abroad. Visible actions, in terms of standards and regulations, are most suitable to remedy these negative effects in the short term, by showing that 'something is being done'. Less visible actions, like changes in liability rules and market structure, might, however, be more effective in the long run. Hence, various feedback loops can influence instrument choice. Feedback mechanisms by their very nature are dynamic, with past choices determining future ones. Once a particular policy for some environmental problem has been designed, for instance one issuing emission rights, it becomes very difficult socially and even juridically to change over to policy instruments that are more in line with the polluter-pays principle, where emitters have to pay for their infringement of the right of others not to be polluted.

Why is the question how instruments function so important for their characterisation? The answer is that in reality, instruments are not independent given 'things'; their definition and description, and the analysis of their functioning, are intertwined and closely related. Most instrument definitions focus on their functioning, mostly on only one aspect of it. Thus, technical prescriptions focus on technologies applied in industry; tradable emission permits focus on the equalisation of marginal emission reduction costs between firms, industries, or countries; liability rules focus on specific enforcement procedures and actual compensation and covenants focus on the procedure in the policy formation process. None of these descriptions take all steps in the framework into account, let alone the feedback loops that usually exist.

Limited description may easily lead to simple assumptions about the other steps in the causal chains required for environmental effectiveness. For instance,

many believe that emission permits may not be ideal in terms of minimising costs, but that at least they are a sure means of reaching specified results. In most countries, however, this belief is not well founded (Bardach and Kagan 1982; Bonus 1998; Hawkins 1984; Vogel 1986). Rules often exist on paper only and are not necessarily linked to actual practice, though the tendency towards formalisation as taking place in Europe may lead to closer correspondence. While environmental standards and regulations in the former Soviet Union were among the most stringent in the world, environmental quality was worse than in most other countries. This means that defining rules and regulations, or at least viewing their functioning in a broader framework, helps to avoid the myopia of partial views, making the context of their functioning more important.

13.3.4 Policy Instruments in Context

Most people would agree that policy instruments should be placed in the broader framework of their functioning. However, if this functioning were the basis of their definition, this could lead to counterintuitive results. Specifying this framework may show that what is referred to as one instrument is actually something different in different contexts. And the implementation of one and the same instrument may be very different in different prevailing circumstances. In litigious societies with limited general legitimacy, technology-binding legislation may be implemented effectively only by various types of lawsuit, with years of delay, while in highly integrated and less formalistic countries, legislation and implementation may be nearly synchronous, seemingly originating from informal consensual communication (see Vogel 1986). Conversely, for regulatees, technology-binding legislation may lead to adverse reactions or to internalisation of the rules enacted. Are these two separate instruments or are they context-related applications of the same instrument?

The broader effects of policy instruments in society depend greatly on previously established institutions. Although several communist countries have enacted emission taxes, they have had little effect. As increases in production volume were the primary aim of state-owned firms, with prices fixed and with the state reaping the profits and shouldering the losses, emission taxes were simply entered on the balance sheet, with no behavioural consequences in the firm itself (see Cole and Clark 1998) (Box 13.2). By contrast, similar taxes in capitalist countries with competitive markets may induce far-reaching behavioural changes. For instance, Dutch wastewater taxes enacted in the 1970s were followed by overall decreases in effluent volume by a factor of 20, mainly through process-integrated technology changes (Bressers 1988; Huppes and Kagan 1989). Endres (1997) has described the contextual requirements for an effective application of market-based instruments.

In some Western countries, like England and the Netherlands, policy development and implementation have been linked in a less recognisable way. It was broadly accepted that firms functioned without the obligatory permits (see Vogel 1986). In such a 'slightly illegal' situation, regulators might actually have greater influence on developments than if they had issued seemingly strict permits which tended to petrify the past. Tendencies towards a more formalised and litigious type of society, as in the US, have made this style of regulation more difficult. In the old situation, there

Box 13.2 Main lines of argumentation in Section 13.3

- The prime role of policy instruments is in *reducing social complexity* to manageable proportions.
- Instruments as institutional arrangements may not only be seen as tools used by governments to influence private behaviour, but also as a means of guiding behavioural relations between public bodies, and between individuals and private organisations.
- Environmental problems mainly result from the *external effects* economic activities have on *collective goods*.
- Environmental policy instruments help to avoid the *tragedy of the commons* by solving *the prisoner's dilemma* and preventing the *free rider problem*.
- The evaluation of instruments for environmental policy is not only based on *first-order criteria* for the evaluation of effects, like eco-efficiency and distributive justice, but also involves *second-order* criteria, like effects on competitiveness and influence on technology development, and *third-order strategic criteria*, like fitting in with general institutional, cultural and economic developments.

was bargaining in the shadow of the (possibly unreasonable) law, with a permit as the eventual short-term fixation of a situation. In the new, more formalised situation, it is not so clear how administrators can have a flexible influence. The covenant has taken over the bargaining step, while the shadow has not been clearly defined. Thus, the precise definition of an instrument depends on a more accurate assessment of its functioning. In the Dutch and English contexts as they were, permits were actually not the 'real' instruments for environmental policy at all; rather, they formed the background for negotiations, with mostly informal deals between regulators and regulatees achieving the actual environmental improvements (Box 13.3).

Recognition of the contextual specificity of policy instruments seems to be detrimental to the basic aim of distinguishing policy instruments, which is to simplify reality and make the behaviour of all concerned more predictable. If the instruments in official use hide what is actually happening, they increase complexity and may more usefully be removed. In administrative science and in sociology of law, the consequence has been that the idea of standard instruments has more or less been abandoned. In an ideal horizontal government, all stakeholders participate, in principle on an equal footing, resulting in deals that are best suited to the situation (see von Benda-Beckmann and Hoekema 1987). Again, why then bother about instruments? The answer is not straightforward. Governments may increasingly stimulate decentralised use of analytical tools like LCA to guide the outcomes of negotiating procedures in the right environmental direction. Such sensible developments should not be denied when discussing the role of instruments; they can instead be

Box 13.3 Sectoral emission reduction covenant

A **covenant** between the Dutch central government and NOGEPA (Netherlands Oil and Gas Exploration and Production Association) specifies goals for emissions reduction and the procedures to be used to achieve them. These goals relate to the performance of the firms involved, not individually, but as a group. The means used to meet the emissions reduction goals, like technical measures, are not specified in the Covenant. The procedures to meet the goals are specified, however, including procedures to redefine the goals when circumstances require this, for instance because of technical and economic criteria. For the actual implementation, all firms involved are to specify an Environmental Business Plan (BMP). Collectively, the result of the efforts indicated constitutes the Industry Environmental Plan, leading to the goals specified.

There is no strict relation between the overall emission reduction targets and the contribution different firms have to make to this target, which is at least partly a subject for collective consideration. The Covenant stipulates that specific measures are to be selected based on their cost-effectiveness, or eco-efficiency, with specific rules to quantify this efficiency. The usual private costing methods are applied for the economic analysis. The environmental analysis starts with the life cycle environmental interventions for each technical measure, based in principle on LCA inventory modelling of the activity with and without the measure.

The further effects on the environment are specified in terms of policy themes (see Guinée et al.). Eco-efficiency is established by first aggregating these theme scores into one eco-indicator score, using covenant-specific weights established by all those concerned in the covenant (see Huppes et al. 1997). This is one of the few examples worldwide, in a regulatory context, where trade-offs between environmental aspects are specified explicitly. Combining it with cost allows the environmental improvements per Euro of expenditure, that is, the cost-effectiveness, to be established for each emission-reducing technique in its specific context. The firms involved can make an inventory of possible techniques and rank them according to this cost-effectiveness. The most attractive techniques in this respect are included in the four-yearly Environmental Business Plan. Plotting this against the cost per unit of environmental improvement results in a flat curve, which at a certain point starts to rise steeply. It is in the interest of the firms involved to develop technologies in the flat range, to avoid high costs in the next Environmental Business Plan.

For a general description of the covenant, see www.nogepa.nl, section Environment. The full text of the Covenant (in Dutch only) is available at the same website (Last visited: August 2007).

made part of the development of environmental policy instruments. Therefore, instruments can also cover situations where governments may be quite invisible or even absent.

Thus, the question is not really why we need environmental policy instruments but which ones we need, or are able to have. There are several reasons why the decentralised horizontal instruments do not suffice. Firstly, there are limits to horizontal government, in terms of the human resources and knowledge required for adequate negotiations. This limitation exists on the side of government but also on that of other stakeholders. Most firms hate continuous negotiation because it drains their management capacity and so endangers their current and future functioning. Sustainability requires continuous adjustment of the behaviour of all firms and all consumers, which is now mainly guided by market considerations. Influencing this behaviour is clearly beyond the scope of the negotiating government. Hence, corrections to the outcomes of in-firm decision-making, including technology development and product design, and of market processes can be the subject of negotiating governance only in special situations, within the capacity limits of regulatory bodies. In addition, there is a more positive reason for having environmental policy instruments. Institutional development in society somehow has to cope with sustainability in a structural manner. Leaving a key value like sustainability to day-to-day negotiations by private persons and lower level officials would be unwise or even immoral. Somehow, quasi-automatic mechanisms, such as institutions, have to be shaped to safeguard the sustainability of operational, tactical and strategic decisions. Environmental policy instruments that do not depend on horizontal negotiations will play an indispensable part in these mechanisms. In between, there are the horizontal negotiations to decide which instruments to apply and how to apply them in practical policies. If such negotiations are to succeed, other instruments must be available as well; these are the 'harsh' instruments, serving as more or less ready options for governments to base their negotiating position on. They constitute the 'shadow of the law' in which governments can safeguard the sustainability of the outcome of negotiations in the networks involved.

There remains a domain where instruments at first sight may not seem to be relevant, as with some single big issues. For instance, should we not just curb the further growth of passenger air transport with its noise, stench and emissions? One option here would be to limit the growth of airports, which would not require specific instruments for environmental policy, as long as building airports requires public decision making. Another option, however, would be to use the price mechanism for environmental purposes. Taxing the emissions of carbon dioxide, nitrogen oxides and noise at sufficient rates will reduce these emissions, not only through technology adjustment but also through a reduction of the numbers of passengers transported. The growth of airports would then be reduced as a consequence of environmental measures, not as an indirect means of fostering the environmental aim of emission reduction. Using instruments for environmental policy in this way may prove to be more useful than seemingly simple measures like preventing airports from growing.

13.3.5 Environmental Problems: Causes and Solutions

Understanding the working mechanisms of instruments in solving environmental problems requires some insight into the causative mechanisms resulting in such environmental problems. In virtually all causal models for societal actions, some rational actor models play a key role. It is in such rational actor models that many of the causes of environmental problems can be identified and specified, at least for a start.

Common to all environmental problems is the causal mechanism by which direct private advantages of some actions outweigh the adverse environmental effects for the persons (or organisations) deciding on that action, while at the same time this adverse effect may affect others. To this extent, the adverse effect is external to these private considerations: it is an *external effect* of private actions on some large collectivity. If the single owner of an island cuts down his forest to create a garden, he simply prefers the garden to the forest, and there is as yet no environmental problem involved. It is only if others are bothered by the disappearance of the forest or the consequences of its disappearance that there is an environmental problem. This shows the *collective good* nature of environmental quality, and is a necessary mechanism for environmental problems to occur. In economic jargon, it is external effects of private actions that are detrimental to a collective good.

An additional mechanism in problem development is that the detrimental effects usually result not from the actions of a single person but from the combined actions of many persons. Though not strictly necessary in a logical sense, this is the typical situation for nearly all environmental problems. It is the *tragedy of the commons*. Single actions may contribute very little to the problem, but it is the multitude that leads to overall undesirable effects, and ultimately to the breakdown of the ecological system.

Together, these two mechanisms have a power that is hard to break. If an individual producer or consumer corrects his behaviour, his action may have negative effects on himself, in terms of costs and efforts, even if only in terms of the burden of nuisance. At the same time, the positive environmental effects of the adjusted behaviour may well be negligible. Such cases result in the *prisoner's dilemma*. Rational actors will only choose the behaviour with the preferred outcome if they can expect most others to act in the same way. In the 'wrong' situation, actual behaviour by others proves that this expectation is not justified and rational actors will choose the sub-optimal behaviour of contributing their share to the environmental problem. If corrective action is taken by all but a few, the environmental problem is largely solved, benefiting these few while they do not bear their share of the costs. This is the *free rider problem*. If the free riders are visible, social norms on collective action may easily become eroded, and with it the collective environmental good. If the free riders are invisible, the flesh is weak. It then takes highly internalised values for most people to remain on the right track. Environmental policy instruments somehow have to break this circle, either by effectively influencing all (or almost all) people, or at least by creating the confidence that most others will act accordingly.

A criticism of this model has been that the rational actor model underlying it is based on too simple a view of the real motives of real people. In reality, many actors indeed often behave altruistically, because they like doing so, and groups of actors often have an explicit or tacit mutual understanding to avoid 'bad' behaviour (see Sen 1977). At least some people bother about separate collection of waste streams, even in instances where others cannot see what exactly they are doing. They have internalised environmental norms to some extent. However, even if the restrictions on rationality are relaxed to include such social aspects of human behaviour, the unpleasant situation remains that detrimental environmental effects do occur and are re-created all the time by people who know the problems exist. So, even after taking into account the social nature of behaviour, the wrong choices are still made so often that environmental problems result.

On the basis of these theoretical considerations, sometimes named the 'field model', it is now possible to specify what environmental policy instruments should do. They should:

1. Avoid external effects on the environment and thus save collective goods, in this case related to environmental quality
2. Avoid the tragedy of the commons
3. Solve the prisoner's dilemma
4. Prevent the free rider problem

The model also allows us to indicate the mechanisms that policy instruments may be aimed at. The behaviour of an individual actor can be corrected in a number of ways (see Bressers and Klok 1988 for a fuller treatment).

1. The set of available alternatives can be changed.

This can be done by offering new alternatives, like separate collection facilities; by removing alternatives physically, as by fencing conservation areas; or by improving knowledge of existing but as yet unknown alternatives, as in nature education programmes.

2. The consequences of alternatives can be changed.

This may be done positively, as by subsidies on unleaded petrol, or negatively, as by threatening those who dump toxic wastes with jail sentences or other penalties.

3. The evaluation of the consequences of alternatives can be changed.

This can be done by changing the value system of actors, through educational processes, or by improving their active knowledge of the consequences of available alternatives, as by eco-labelling schemes.

These three types of mechanism in a policy instrument may avoid the *external effects* on the collective good, as well as the *prisoner's dilemma* and the *free rider* problem. In many situations, however, this is possible to a limited extent only and the situation may still be that of a prisoner's dilemma, with the free riding option lurking in the background. If only heavy industries

were induced to reduce their CO_2 emissions substantially, using a large number of specific measures, the prisoner's dilemma would remain for all other actions not regulated, for which free riding may still remain the norm. In addition, the non-heavy industries would still be riding free. Not only would they continue to emit, but lower energy prices because of reduced demand by heavy industry may even allow them to increase their emissions. Thus, there is another role of policy instruments in avoiding the *tragedy of the commons*, by solving the prisoner's dilemma through creating the trust that everybody will indeed take part in the creation of the collective good.

4. *Justified trust in everybody's positive and due contribution to our common good can be created.*

This would make free riding virtually impossible. In this situation, the individual may seem to be deciding alone. In fact, however, he is making his decisions as if he were the collectivity, deciding for all people simultaneously. This co-operative solution is a very direct option for solving environmental problems, with collective values being internalised in individual decision-making. Although this option seems highly idealistic, it is a normal solution to many problems, at least in small communities. Most people take the trouble to store their waste in waste bins, even in larger communities. Only in situations of reduced awareness of norms, as when alcohol is used collectively, do the norms on littering break down. Tasks for the common good are executed, that is, behaviour is adjusted, because one expects everybody to do so. Still, this ideal is not always achieved, even if only a small number of people are involved, as can be seen in some families where children (or indeed parents) may try to avoid the daily dish-washing duties, always with good excuses at hand.

What are the requirements for this type of co-operative behaviour? One element would be that free riders undergo negative sanctions for free riding when they are caught. This would mean that the bad behaviour is forbidden at the level of the individual, and hence the co-operative approach is absent. However, control and sanctions may be more informal, not involving police and administration but friends and family, or the next-door neighbours. Another prerequisite is that the behavioural norm is clear and non-compliance is visible.

13.3.6 Evaluation Criteria for Policy Instruments

The analysis of how instruments for environmental policy work is one part of policy instrumentation hat is indispensable for any evaluation. The question is, however, what criteria to use in judging policy instruments. Somehow, the framework for the evaluation of instruments, and instrument-related policies, is to mirror the empirical analysis, which ultimately has to indicate effects in terms of these evaluation criteria. This adds a layer of analysis of a normative and political nature. As it is the consequences of instruments which are used as the basis of evaluation, the approach is that of consequentialism, not in the narrow sense of a utilitarian type of economism, but in the broad sense given to this term by Sen (2000). In this broad view, consequences obviously encompass the preferences of individuals, as is the case with utilitarianism exclusively. However, collective aspects like 'sustainability' may well also be covered by this broader consequentialist approach. Most of the criteria for evaluation specified below belong to this second approach (see Table 13.1). Three groups of criteria are distinguished. First-order criteria are related to more or less direct operational consequences of the application of the instrument, with environmental effectiveness as the first criterion. Second-order criteria relate to broader aspects of administration and economy, like administrative capacity and technology development. Strategic criteria, the most general category, link the instrument to the broader culture and institutions in society.

Sustainability may be an agreed general goal behind all specific environmental policies, as in many countries it already is. Its specification is normative and political. While the environmental effectiveness of instruments is an indisputable part of their evaluation, 'sustainability' and 'environment' are to some extent catch-all concepts, without precise underlying definitions.

The question is in which terms and with what level of detail this environmental effectiveness is to be established empirically, taking into account the mechanisms and time horizon? Is there a right to some minimum quality everywhere, for which permits might be the most suitable instruments, or is some overall level of emission reduction enough, for which emission taxes might be an adequate instrument? Are

Table 13.1 Criteria for evaluating policy instruments

First-order criteria	Second-order criteria	Strategic criteria
• Effectiveness (st, lt)[a] • Social costs (st, lt) • Eco-efficiency • Distributive justice: – Intragenerational – Intergenerational – Justice as fairness • Generative equality	• Social and political acceptability • Within administrative capacities • Limited changes in competitiveness • Incentive for sustainable technology development	• Fitting in with the broader conceptual framework for public policy • Fitting in with the broader institutional framework of society • Fitting in with general cultural developments • Fitting in with general economic developments

[a]st: short-term; lt: long-term.

cost-effectiveness and efficiency important parameters for assessment, as costs will be important for most people? Or are distributional effects more relevant for instrument choice? Are economic and environmental effects abroad to be taken into account, or only national ones? Do other aspects of justice, like the right to pollute versus the right not to be polluted, play a role in instrument choice? Is freedom of choice on the part of producers and consumers an independent criterion? Even if one were to refrain from normative choices in these respects, the same questions return as empirical ones in developing and implementing policies. Other people *will* mind distributional effects, people abroad *do* mind being polluted, and a broadly defined polluter-pays principle is generally accepted, implying that he who pollutes should be held responsible for the consequences of his actions. If people perceive policies as running counter to their values, the legitimacy of these instruments is reduced, as is their effectiveness. No doubt, the normative acceptability of instruments is one major empirical factor in both their political relevancy and their environmental effectiveness. Thus, the normative questions return through the backdoor.

When unleaded petrol came on the market – at a slightly higher price than leaded petrol, accompanied by a government campaign to 'buy green petrol' – many people's reaction was that if they were to buy green, they would be part of a minority shouldering the costs, while the main problem would remain unsolved. Thus, buying green would have a limited or even negative effectiveness, combined with an unfair sharing of burdens. On the basis of their normative appraisal, many regulatees decided not to co-operate, forcing the government to use other policy instruments. While straightforward product rules might have been the preferred option, the Dutch government chose to solve this collective action dilemma differently, by making leaded petrol more expensive through a tax measure, equivalent to taxing lead. Thus, leaded petrol was effectively forced off the market, and everybody paid the higher price of unleaded petrol. In this solution, burdens for environmental improvements are shared equally, in the sense that everybody pays the same price per litre. This is in line with one of several justice criteria, which states that the effort required for a certain amount of environmental improvement should be the same for everybody, at the margin. It is not an equal effort per head, as those who drive more and drive bigger cars also pay more. This criterion happens to be nearly equivalent to that of economic efficiency, in its static variant (Baumol and Oates 1988). This efficiency goal is central in economists approaches to instrument design and evaluation, see e.g. the survey paper by Bohm and Russell (1985).

It would, of course, be strange if criteria for judging environmental policies were different from those valid for other policies. Hence, the criteria are related to general views on the tasks of government. The sum of neo-liberal and social-democratic views roughly encompasses the entire political spectrum, with different political groups emphasising different aspects, but by and large involving the same ingredients. Giddens has compared the new consensus on public policy tasks with more traditional views. These new views are very much related to structural developments in the economy, with global markets and international networks replacing command and control in firms and fixed contractual relations between them. The emphasis in policy is also shifting from 'control' to 'generative policies', which allow 'individuals and groups to make things happen, rather than have things

happen to them, in the context of overall social concerns and goals' (Giddens 1994: 15). The value of equality shifts from distributional equality, in terms of disposable income, to generative equality, in terms of security, self-respect and self-realisation (Giddens 1994: 191). These broader societal developments inevitably involve developments in environmental policy instruments.

What criteria can be used for the practical evaluation of instruments? In assessing environmental policy, the first criterion is probably environmental effectiveness. In the case of integrated environmental policies, however, effectiveness cannot easily be established separately from other values. How important is a toxic effect on child development compared to cancer risks at a later age and on a much longer time scale, and compared to the loss of plant species that might have had pharmaceutical value? Hence, environmental effectiveness can be established only on the basis of broader, non-environmental judgements. One such judgement relates to time. The time scale of effects requires choices in terms of the relative importance of future effects. The specific location of effects not only influences their type and magnitude, but involves different social groups as well. The spatial distribution also relates to the way effects abroad should be taken into account at home. Should national policies also aim at effects abroad as a part of their overall effectiveness? WTO regulations run counter to such considerations, unless the rules apply equally to home products and imported products. For imported products not produced at home, environmental rules will mostly be seen as undue trade limitations. Another problem is how to deal with low-probability, high-impact effects, where evaluating effectiveness is based on the degree to which risk avoidance or precaution is deemed important.

In addition to environmental effectiveness, itself value-based, there are also other values. One broadly accepted value is that of costs, or rather, welfare effects in terms of production losses required for environmental improvements. Instruments which help stimulate environmental technology development, like market-oriented, pricing-based, economic instruments, will entail lower costs in the long run (for the theoretical aspects, see Baumol and Oates 1988, for existing instruments see Opschoor and Vos 1989 and for empirical aspects, see Hemmelskamp 1997). A clear distinction is thus to be made in the cost criterion, between short-term costs (st) and long-term costs (lt). In multi-purpose instruments, the environmental cost-effectiveness (or 'eco-efficiency') can only be established by attributing one part of the cost to environmental goals and other parts to each of the other objectives contributed to. Other values relate to ethical categories of justice and equality, covering traditional distributional justice within and between generations, justice as fairness, and the newer generative equality (on these ethical issues, see Rawls 1972; Giddens 1994, 1998). Intergenerational justice has been made operational in an environmental context as part of 'sustainability' in the 1987 Brundtland Report. It is on a par with the discounting practice economists use, in which future effects count less than current ones.

However broadly the effects of environmental policy instruments are modelled, there will always remain relevant aspects beyond modelling that have to be taken into account and have to be specified as second-order criteria or as strategic criteria (see Table 13.1). The government has to operate with some legitimacy, which means that, on average, some minimum level of social and political acceptability and support is required in instrument application. Quantifying this aspect is difficult, but any environmental policy that forgets about such aspects will falter in the long run. Furthermore, instruments have to fit in to some extent with the capacities of the existing administration. Emission taxes are easier to implement in countries with a tradition of effective direct taxation. At a different level, major changes in sectoral competitiveness may create social instability and should generally be avoided. Another element, which is lacking in most quantified models, is how instruments influence technology development. Although these, partly overlapping, aspects are hardly quantifiable, they may be essential for a well-founded judgement on environmental policy instruments, and for the long-term effectiveness of environmental policy.

Since instrument choice may bind society for years or even decades to come, such choices are to be placed in a strategic context, not only taking account of relations as they are now, but also of developments taking place in this longer time perspective. Four main strategic areas can be distinguished, relating to politics, social structure, economy and culture:

1. Instruments are to fit in with the broader conceptual framework for public policy, e.g., along the lines sketched by Giddens (1998).
2. They should be in line with the broader institutional framework of society, e.g., in terms of increased mobility, functional specialisation of organisations and internationalisation of organisations.
3. They should take into consideration the general cultural developments, such as individualisation, mass culture and other-directedness, as outlined by many sociological studies.
4. Finally, instruments have to be adapted to general economic developments, such as the globalisation of markets, shifts from hierarchical co-ordination to network co-ordination, and shifts from the production of commodities to the production of services, as outlined by Castells (1996).

Some people, especially economists, simplify the evaluation by reducing it to an economic analysis. In principle, such an evaluation may cover all environmental effects; it is based on a specific discount rate; it uses a risk avoidance factor of zero; it uses an equal weight for every euro or dollar, thus disregarding income distribution; it takes only current private preferences into account; and it assumes these preferences to be independent, meaning that nobody cares about the welfare of anybody else. In this situation, each emission or environmental intervention may indeed have an environmental price tag in terms of a (negative) net present value. Of course, this also assumes that empirical consequences can be fully specified in terms of items relevant to such hypothetical individuals. Environmental policy instruments can then be evaluated in one unit: money. This overall score is the sum of the environmental effects, transformed into a net present value as outlined above, and the direct economic (market-related) effects. The single euro or dollar figure resulting then indicates which instrument to use in which situation.

In reality, of course, this hypothetical situation does not exist. Where price tags can be put on emissions, these prices relate to partial effects and will mostly be based on less than realistic assumptions. Several aspects of justice, such as equality and fairness, are omitted or included only superficially. Moreover, second-order and strategic criteria are mostly not suitable for economic quantification. Therefore, this option is too narrow to be the sole basis of a convincing instrument evaluation, although costs of course do play a role in such an evaluation.

13.4 Design, Analysis and Evaluation of Policy Instruments

Having described the role of environmental policy instruments in a long-term perspective, and having indicated their role in policy and the criteria for their evaluation, the final question is how to design, analyse and evaluate them at a more operational level. It should be clear by now that there is no one unique way of doing so. Many dimensions have their due place and not all of them can be included at the same level of aggregation. Four main dimensions can be distinguished, which together create a framework for design and analysis. The framework may be used to generate a large number of distinct policy instruments, well over a thousand, opening up options for well-argued choices on instrumentation. This section presents some existing examples of policy instruments, using the framework for their specification. The ultimate evaluation of designs and of implemented instruments is based on their actual functioning. Evaluation for the purpose of the design, or revision, of instruments has two main types of input (see Fig. 13.2 in the introduction to this chapter), one covering strategic points of view going beyond the level of the case, the other referring to the analysis and evaluation of the functioning of the instrument in its specific domain of application, i.e. for particular cases. The discussion of these two types of input completes the chapter on instruments for environmental policy.

13.4.1 A Framework for Design and Analysis

Instruments as societal structuring mechanisms bring order to the relations between actors and help to guide their behaviour. What is common to all policy instruments, and hence also to environmental instruments, is that they have to bring about a change in behaviour relative to the behaviour without application of the instrument. In specifying instruments, we distinguish four main types of dimension. In question form, these are:

1. Who influences whom?
2. What is the influencing mechanism?
3. What object is being influenced?
4. What is the operational goal?

These four empirical dimensions are quite general; in principle, they are the same all over the world, regardless of cultural differences. In addition, and again in principle, these four dimensions can be analysed more or less independently, while other instrument dimensions seem more closely tied to specific cultures and institutions. Juridical status, for instance, is often used as a defining characteristic, but juridical categories are linked to the specificity of judicial systems. For instance, an EU regulation does not have a counterpart in most other countries, while Anglo-Saxon common law is not used in most European or former communist countries. The systems converge however, as new legislation in Anglo-Saxon countries is statutory, while the courts in French law based European countries have increasing interpretational power.

Using these four dimensions, can we now specify in more detail what makes instruments into environmental policy instruments? The relations between actors, i.e., who is influencing whom, might give some clue. One could argue that instruments issued or used by a ministry or department of the environment are environmental policy instruments, using the first dimension. This would mean that an administrative reorganisation, for instance shifting policy-making in this area to the department of agriculture, could change their status. It would also mean that social instruments could never be environmental instruments. The second dimension, the influencing mechanism, is not suitable to define the environmental nature of a policy instrument either. Permits, taxes and excises and prohibitions have a general nature in all regulatory contexts. The third dimension, the object influenced has no specific environmental status either, as there are many rules on products and installations not related to the environment. It is the fourth dimension, the operational goal, indicating the direction of behavioural adjustment, that decides whether an instrument is an environmental instrument: its goal has to be an environmental one, or at least its ultimate aim should be. This is not always a clear-cut criterion. If, for example, a government stimulates hydropower with the intention of becoming less dependent on imported fossil fuels, this also helps to reduce CO_2 emissions. Hence, the operational goal of stimulating hydropower need not be based on environmental considerations. Such borderline cases will certainly exist in practice. Even if none of the participants sees a particular instrument as an environmental policy instrument, it could still be categorised and analysed as such, relating the instrument to this goal and ultimate aim.

Although the general tasks of environmental policy instruments – avoiding the *tragedy of the commons*, solving the *prisoner's dilemma* and preventing the *free rider problem* – could easily have been made into defining characteristics, they have not been included here because of their rather abstract and strategic nature. However, they do still play a role in instrument design and instrument evaluation, be it in general or at a case level. The normative evaluation criteria specified in the previous section have not been included here either, thus creating a distinction between empirical-descriptive elements of policy instruments and their normative evaluation. Of course, there has to be a link between descriptive elements and evaluation, since it is ultimately the evaluation that counts. The evaluation is based not only on the direct effects of the instruments; decisions should be guided by the 'ultimate' effects. There is a tendency to include some standardised effect mechanisms into policy instruments, like including global warming potential (GWP) in national and international climate policy. Thus, some mechanism may play a role in the goal specified in the instrument. Most social and environmental mechanisms, however, will be independent of the instrument, which means that their analysis must be included as a separate step in the evaluation of policy instruments, not in their definition.

The four main dimensions chosen now need to be defined in greater detail. It should be clear that there is not one general truth at this level either. For instance, 'actors' can be described in many dimensions, for instance as individuals or firms, while firms can be described as small or medium sized firms, large national firms or multi-nationals, etc. What would be the guiding principle for such further choices? In the end, the question that has to be answered is how policy instruments can fulfil their function of simplifying the complexities of reality to allow effective and concerted actions towards environmental goals, and distinctions should serve this ultimate purpose. However, the purpose of this section is also very practical, namely to decide how real instruments can be created and how their expected functioning can be evaluated. In approaching this task, there is a tendency to introduce further distinctions relevant to the situation. As our four main dimensions already lead to over a thousand instrument categories, further systematic detailing, however relevant it may be, should be used sparsely if at all. Such relevant additional aspects are more suitable for the evaluation of, in this sense, more sparsely defined instruments.

13.4.1.1 Who Influences Whom?

In deciding who is influencing whom, a major distinction can be made between governments on the one hand and non-governmental private actors, like individuals, firms and organisations, on the other. These two types of actors involved in instrument application lead to a further categorisation of instruments, involving a distinction between three types of actor relations (see Table 13.2).

This section uses the three main types of actor relations to categorise the instruments as political-administrative instruments, regulatory instruments and social instruments.

Regulatory instruments are the most common type. An environmental permit is a major instrument for governments to influence private actors (including publicly owned firms), as are emission taxes, such as SO_2 taxes creating a market incentive for reducing SO_2 emissions. Political-administrative instruments may work at an international or national level. An international treaty like the Montreal Protocol on substances that deplete the ozone layer is an instrument between governments, while an EU environmental regulation binds national governments in the EU. The ISO 14001 industry standard is an example of a social instrument. By specifying rules, it guarantees that environmental audits have a degree of generality and reliability in describing the environmental performance of firms, creating an incentive to take environmental aspects seriously. Other examples are private certification systems, such as those used for food in supermarkets, influencing the behaviour of food producers and creating options for environmentally oriented choices by consumers.

Table 13.2 Actor relations based instrument specifications

Actor relations	Name of instrument	Examples
Governments influencing governments	Political-administrative instruments	• Montreal Protocol • EU regulations
Governments influencing private actors	Regulatory instruments	• Environmental permits • SO_2 emission charges
Private actors influencing private actors	Social instruments	• ISO 14000 Series • Private certification systems

13.4.1.2 What Is the Influencing Mechanism?

The influencing mechanism specifies how one actor influences the other. We follow the main categories distinguished by Bressers and Klok as explained in the previous section, with some further differentiation as found in regulatory practice, see Table 13.3 for a survey. The first mechanism involves changing the set of available alternatives, for instance by their prohibition or prescription, or by the creation of new options. These define the first three instrument categories. Secondly, the consequences of alternatives can be changed, for instance by influencing market prices and market volumes. This is the category of economic instruments. The third major mechanism is the change in the evaluation of consequences, achieved for instance through information on the effects of actions and through normative guidance. These are the cultural instruments. In addition to these actor theory based categories, we distinguish the influence exerted by changes in the institutional structure of society, as structural instruments influencing actions. Liability rules are a major example. Finally, there are the procedural influences, functioning as procedural instruments. They are introduced separately here, as their use is widespread in specifically environmental contexts, as in covenants and audit systems.

The influencing mechanism is to be clearly distinguished from mechanisms further down the causal chains. Such further effects may well involve the same

Table 13.3 A typology of instrument mechanisms

Mechanism-based instrument specifications	Examples
Prohibiting instruments	• No cadmium stabiliser allowed in PVC as a building material
Prescriptive instruments	• Legal obligation for separate waste collection
Option-creating instruments	• Multiple waste containers for separate collection
Economic instruments	• Volume: auctioned car ownership rights • Price: energy tax, SO_2 tax
Cultural instruments	• Normative: ecolabel on products • Relate organic solvents to summer smog
Structural instruments	• Liability rules • Public decision-making safeguards
Procedural instruments	• Obligatory environmental officer in firm • ISO 14001 audit

mechanisms, but do not form the basis for instrument categorisation. For instance, a change in liability rules will ultimately involve market mechanisms and the creation of options with lower liability risks. The influencing mechanism, however, is that of a structural instrument. The terminology used in practice varies somewhat. For instance, the prohibition and prescription of options is also referred to as direct instruments or as juridical or legal instruments. This terminology seems awkward, however, as option creation can be seen as a direct instrument as well, and financial instruments like emission taxes also have a distinct legal status. The combination of prohibiting and prescriptive instruments is also referred to as binding instruments.

13.4.1.3 What Object Is Being Influenced?

A further dimension is the nature of the object being affected by the influencing mechanism. A first basic distinction in objects being regulated is that between single objects and classes of objects. This relates to the applicability of the instrument and to the options for implementation. A second distinction is that between products, which are mostly mobile physical entities; installations, which are mostly immobile physical entities; and activities, focussing on more general behavioural options. Such behavioural options will usually be linked to some physical object, like speed limits for cars in a city. These objects may be defined in very abstract terms, however, like environmental auditing rules for firms, relating to all their installations. In the US, most regulated physical objects are called installations. Since no example of a single activity being regulated comes to mind, this class has been omitted. As the classes of objects are necessarily restricted as to spatial scale level, a further distinction is made based on classes of objects being regional or global. This results in eight types of object (see Fig. 13.4 and Table 13.4). While no specific instrument names are linked to these classes, the term *product policy* is becoming popular in EU policy and in a number of countries, referring to classes of products in the EU.

Regulating material objects, as 'things', is not done because of their inherent properties. Ultimately, it is only the processes in which they function, as activities, which influence the environment by causing environmental interventions. Environmental policy instruments try to influence these interventions, not the techniques as such. However, regulating things may be easier than regulating activities, as most things can be inspected at any time, while effective inspection of behavioural aspects is much more complicated. Measuring the concentration of NOx in a boiler outlet requires real-time measurements, so it is easier to prescribe a burner type. Cadmium in PVC stabilisers in building materials, however, can be measured at any time. For the sake of regulatory efficiency, requirements are often specified in terms of the technical composition of the product or installation, assuming that these will result in an emission reduction. In a considerable proportion of cases, however, this relation is not fixed. Bypassing a flue gas purification installation, for instance, saves costs. Illegal

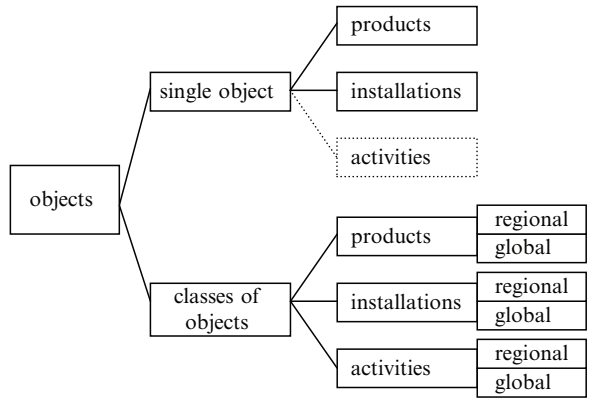

Fig. 13.4 A classification scheme of regulated objects

Table 13.4 A typology of influenced objects

Object influenced	Examples
Single product	• Single aircraft flying permit
Single installation/firm	• Testing whether a building harmonises with the landscape • Permit requiring safety valve on some pressure vessel
Product classes, regional	• EU rule on compulsory three-way catalytic converters in cars • Rules on NO_x concentrations from household boilers
Product classes, global	• WTO rules on non-discrimination
Installation classes, regional	• German rules on allowable SO_x emissions per kWh at power generation
Installation classes, global	• IAEA rules on safety requirements for nuclear installations
Classes of activities, regional	• Local speed limits for passenger cars
Classes of activities, global	• ISO 14001 requirements on environmental planning in firms

bypassing can be stopped only if the inspector calls at the right time.

Classes of activities may be defined narrowly, as with denied access to National Parks in Germany after sunset, or broadly, as in the environmental auditing of all firms in the world. A good deal of complexity can be introduced in defining classes of activities. LCA (Life Cycle Assessment) refers to all processes (= activities) involved in having the function of a product delivered. In environmental audits of firms, it is becoming common to incorporate the supply chains involved. This is similar to LCA, as the object is also a system of linked activities. Such larger entities are attractive, as a policy instrument may influence all of them in a balanced way. Since some arbitrariness is involved in defining such systems, binding measures may be more difficult to apply.

13.4.1.4 What Is the Operational Goal?

Operational goals specify what the instrument states as the objective to be approached or achieved. 'Cadmium in PVC window frames' may be forbidden, as in the US, or a 'weighted maximum of emissions' may be allowed, as in a number of Dutch environmental covenants. We can categorise the goals in relation to how close they are to ultimate environmental aims, see Table 13.5 for a survey. Most traditional binding environmental policy instruments, like the operating permit, have relied heavily on easily verifiable rules for the composition of a product or installation, like banning the application of PCBs, or prescribing a filter on air outlets, or banning some mercury-based technology for chlorine production. Since the 1980s, the emphasis on efficiency and problem prevention has induced a shift towards goal specification closer to the ultimate environmental goals. Goal-oriented permits specify the maximum emissions of the installation, or the maximum emissions per unit of product produced, as in SO_x per kWh of electricity produced in Germany. Policy integration, as a central element in efficiency, has led to further steps, through integration in terms of policy themes like global warming and acidification. The Kyoto Protocol includes steps to integrate various substances in terms of their contribution to the policy theme of climate change, based on their Global Warming Potential. Estimates by the World Bank indicate that such integrated policies, as opposed to the focus on CO_2 emission by energy systems, can reduce the cost of climate policy by 60%. Further integration, across various policy themes, has been occurring over the last decade, like the use of some eco-indicator as an integration of similar effect types, or even integrating all environmental effects in a normatively based overall environmental score. An overall evaluation of all environmental interventions makes the relative importance of various environmental effect categories explicit. By allowing a shift between them, based on the explicit trade-off, it is their combined effect which is regulated. The NOGEPA (Netherlands Oil and Gas Producers Association) covenant in the Netherlands specifies such an integration. It forms the basis for one further integration step, combining environmental and economic goals, in order to select the most eco-efficient measures for environmental improvement.

The closer the instrument goals are to environmental aims, the more efficient the instrument can be, by avoiding unnecessary technology fixation. If a policy instrument uses the mass of a car as a proxy for its emissions,

Table 13.5 Typology of operational environmental goals in instruments

Operational goals	Examples
Composition of product or installation	• Cadmium stabiliser in PVC as a building material • Percentage of post-consumer paper waste in paper
Technology characteristic	• Double skin in oil tankers • Inherent safety in nuclear installations • Take-back legislation (several European countries)
Single environmental intervention	• Noise-based landing fees in airportsCO_2 tax • Ambient air quality standards
Set of environmental interventions	• Set of allowable emissions as a goal permit
Single theme score	• Emission reduction targets (Kyoto Protocol) • Environmental policy plans
Set of theme scores	• LCA-based rules for waste prevention (Germany, Netherlands)
Effect-oriented eco-indicator scores	• Limited set of eco-indicators in building regulations
Single integrated environmental score	• Best Available Technology specification (EU) • EPS based design rules in industry • Theme-based weighting (NOGEPA covenant)
Combined environmental and economic score	• Eco-efficiency as a selection criterion for emission-reducing technical measures (NOGEPA covenant)

the regulation does not influence the type of engine characteristics or the driving style. If only the mass indicator is influenced, cars will get lighter but not necessarily cleaner at the same rate. If emissions are taxed or bound to a maximum, these other characteristics will primarily be influenced, with probably a limited effect on car mass. Measurement techniques for such instruments are not yet available but may well be developed in the near future.

As regards integrated policy goals in instruments, there is a gap between what modelling can more or less realistically achieve (with adequate validity and reliability), and what is needed for integration in the single environmental score. Somehow, the modelled multitude of environmental interventions and other effects have to be transformed into an overall judgement. There are several methods for this purpose, which do the undoable. Economists derive overall evaluations in monetary terms on the basis of past behaviour and the stated preferences of individuals. In a very different approach, impact assessment in LCA first integrates, on the basis of modelling, into several environmental policy themes and then through a weighting procedure merges these into an overall evaluation. In whatever way this integration is achieved, for reasons of policy consistency it would be necessary to use the same trick every time. There is a modest requirement for the overall rationality of environmental policy, which is that the trade-offs between various effects are equal for each policy. This simple requirement can be transformed into a conditional statement (see von Neumann and Morgenstern 1953; Sen 1982): if policies are rational, there is a single set of weights on their effects which can 'explain' all policy choices made. If this condition is not met, this means that it would have been possible to reach the policy aims in a less costly, that is, more eco-efficient way. Given the theoretical and practical limitations of modelling, policy integration can only be reached through practical choices, based on incompletely developed arguments. Making a start here is better than accepting the even less attractive current state of affairs.

When making this start, the best one can do is to strive for a consistent and transparent solution, on the one hand taking into account the as yet only partly known real mechanisms, and on the other hand specifying the normative background of the evaluation. This problem area, it seems, has not yet been under serious scientific scrutiny. Some practical solutions are available, like using a panel of officials and experts (e.g., NOGEPA covenant, see Huppes et al. 1997); using policy aims for weighing emissions into one score (e.g., Swiss or Norwegian Ecopoints); using a mixture of partial economic valuations or some equivalency factors (e.g. ExternE and EPS); and applying some preferences or value types, see Guinée et al. (2002) for a survey.

All these practical models have been developed in limited domains, in hardly peer-reviewed studies, without a broad public discussion. Important questions are only touched upon and not answered. How can we differentiate between reversible effects, like ecosystem degradation, and irreversible effects, like species extinction? How can we differentiate between low-probability-high-risk effects, such as possible runaway effects in climate change, and more probable slow-change scenarios? Assuming that uncertainties can be specified in terms of risk or at least subjective probability, how can we evaluate options with different probabilities? Even in the extremely well researched area of climate change, surprises and outright disasters have not yet been incorporated in policy models, though the first frameworks are being developed (see Schneider and Kuntz-Duriseti 2002). Given the uncertainties involved for each policy theme, how can we make a comparative evaluation of climate change effects, which can hardly be specified in economic (i.e., welfare) terms, as against effects of acidification resulting in reduced crop yields and increased corrosion, which can quite easily be specified in terms of economic losses? Such fundamental problems have yet to be solved before integrated goals can be used more widely in policy instruments and in policy.

13.4.1.5 Combining Actor Relations, Mechanisms, Objects and Goals

Combining the four main dimensions, those of actor relations (3); influencing mechanisms (7); objects influenced (8); and goals (9), results in a large number of instrument types: $3 \times 7 \times 8 \times 9 = 1{,}512$. Not all combinations may be relevant, however, or even possible. A technology specification, as a goal, cannot easily be applied to 'classes of activities', as an instrument object. The combination of more binding instrument mechanisms with more encompassing objects of regulation and with more integrated policy goals makes policy

development and implementation increasingly complex. However, the problems involved in this integration at the instrument level are mainly the same as those at a policy level using several instruments. Criteria like consistency are very visible at the instrument level and not at the policy level. The aim would be to have consistency at the latter level as well, to avoid unnecessary costs in achieving environmental aims.

The aim of consistency in environmental policy, and the related aim of eco-efficiency, may be achieved through adapted markets, as by emission taxes, tradable emission permit systems and liability rules. Assuming some degree of competitiveness in the markets, the normative information on policy aims and the empirical relations in markets and technologies are combined in the price structure faced by individual decision-makers in society, and taken into account in their decisions. Such broadly applicable 'macro-instruments' (see Huppes et al. 1992; Huppes 1993) may, however, not be ready for widespread application, for administrative-technical as well as political reasons. The market-based information system, as Adam Smith's invisible hand, is therefore mainly lacking, guiding economic decisions in the wrong directions from an environmental point of view. It is to be created by environmental policy, as efficiency is a generally accepted central goal. All the more complex object types and goals types have been set up to create this integrated view on environmental regulation. Attempts to avoid problem shifting to other emissions, to other policy themes and to other times, which are preconditions for efficiency, constitute a key element in a tool like LCA, which is beginning to be incorporated in policy instruments.

In using the more integrated *classes of activities* as objects, their definition as a system with internal relations has become a research subject in itself, that of environmental systems analysis. Major tools for this purpose are SFA (substance flow analysis), LCA (life cycle assessment) and E-IOA (environmentally extended input-output analysis). They are mainly simple models, based on linear relations and constant technological relations. However, the fact that they are simple, with a limited validity and reliability, means they can be made operational. Where decisions on technologies and markets are made at a decentralised level without much direct government influence, as is increasingly the case in a globalising world, we need a decentralised tool that comprehensively indicates the ultimate effects of such decisions, incorporated in a policy instrument creating the incentive to use it. Mostly, such tools are incorporated in social instruments or in weak regulatory instruments. Thus, the potentially most efficient instruments can only play a very limited role at present, while the not-so-efficient regulation of technologies by prohibiting and prescriptive instruments still carries the main burden of environmental policy implementation.

When specifying integrated goals for complex objects in policy instruments, it should be clear that instruments cannot comprise the full extent of all real effect mechanisms. The creation of direct effects inevitably leads to a whole range of direct and secondary effects on society and the environment, not all of which can be incorporated. It is not even the most sophisticated models available which play a role in instruments, as in covenants in Germany and the Netherlands. The simplified standardised modelling in these instruments is an approximation, which should not be confused with state of the art modelling of real effects. By being operational at a decentralised level, the approximation may represent an improvement on other ways of regulating technologies and products, which may not take the simple effect mechanisms into account at all.

Fortunately, things in real world situations are sometimes less complicated than they are theoretically perceived to be. In such cases, environmental policy instruments can be simpler as well. For example, when banning a toxic and persistent agrochemical for which slightly more expensive alternatives are available, the real effect route in the economy hardly has primary or secondary effects in the chain, nor is there much complexity in the environmental pathways towards valued endpoints in terms of human and eco-toxic effects. There is then no reason to complicate the instrument and burden it with complex effect mechanisms and evaluations. A simple prohibition of the agrochemical will do, after a relatively simple analysis of effect chains in the policy formation process, including a check on the availability of not too costly alternatives. Such easy solutions have mostly already been implemented, however. After more than 30 years of active environmental policy, it seems that most simple end-of-pipe (add-on) measures and simple product prohibitions have already been enacted. Such policies may now even start to hamper environmental progress by fixing old technologies. The remaining problems are more complicated and may well require a more sophisticated instrumentation.

13.4.2 A Thousand Instruments Defined, with Examples

A policy instrument may be defined by combining elements from the four basic instrument dimensions discussed above, in principle leading to well over a thousand major instrument types. These dimensions are more or less independent, so they may be used as a framework for instrument development, as an *instrument generator*. Any combination defines the main lines of an instrument. Figure 13.5, 'the instrument generator', gives some examples. Take, for instance, 'social instrument' from the *actor relations* column; use 'economic instruments', used here in the sense of pricing, from the set of *instrument mechanisms*; take 'product classes, global' from the set of *objects influenced*; and take 'single environmental intervention' from the set of *operational goals*. This instrument then can be further specified in terms of the product classes, for instance using 'aircraft', with different noise levels, measured in a specified way, as the fully operational goal in pricing. The result is the 'noise related airport landing fees', which is a fairly common social instrument used by airports near larger cities. The motivation behind a social instrument may be another policy instrument, especially a regulatory one. In the example given here, the motivation-creating regulatory instrument may be the operating permit of the airport, stating maximum noise levels in surrounding residential areas, which is a prescriptive regulatory instrument for a single installation, involving both technology characteristics and sets of environmental interventions as its goals. A second motivation step, behind this regulatory instrument, may be a political-administrative instrument, such as an EU directive on permissible noise levels in residential areas. Another example, from the US, is the extended liability which has been achieved for toxic wastes that have not been treated properly, to avoid damages to the environment. It involves a structural mechanism and pertains to all waste sites with toxic wastes in the US. All highly hazardous substances are involved, as potential environmental interventions. Another example is the Kyoto protocol,

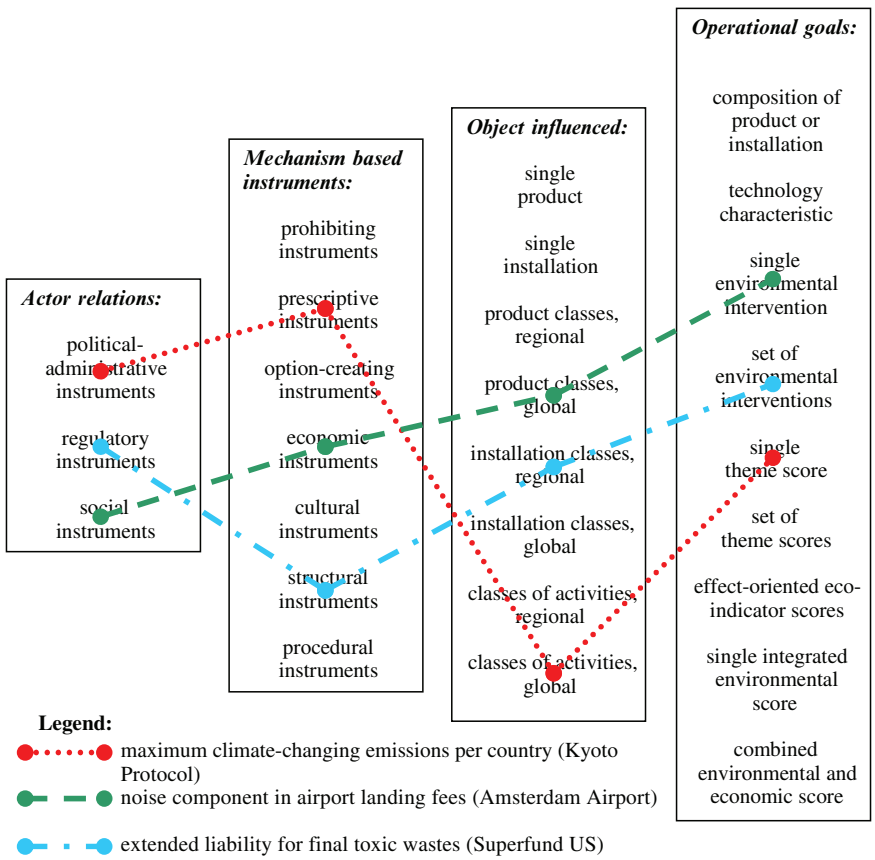

Fig. 13.5 The instrument generator

which limits the total amount of climate changing emissions in terms of their global warming potential. These limits are set for countries, involving all emitting activities in each country, as one level of geographic region.

Using only the first two dimensions, for a start, results in 27 instrument categories. An example of each is given below.

I Political-administrative instruments (guiding relations between public bodies)

The meaning of the word government is restricted here to the regulatory part of governments, engaged in planning, developing and implementing policies, and using policy instruments in such policies (in this case environmental policies). Other operative public tasks, like building and maintaining roads, canals and dikes, maintaining an army and distributing electricity, are productive or consumptive activities, to be regulated like any other economic activity. The relations between governments as regulators, and private persons and organisations as regulatees, are in most cases hierarchical. The relations between governments may be hierarchical as well, as when the EU binds the policies of countries with Directives, and national governments prescribe policies to regional and local governments. However, in the international context, most relations between environmental policies are horizontal, as in bilateral and multinational treaties. Some hierarchy is implied when international public bodies are involved. In addition, where bilateral relations seem to be involved, there may still be a hierarchy. For instance, while 'joint implementation' is dealt with at the interstate level, the rules for joint implementation are dealt with in the Kyoto Protocol, and the possible future extensions to that protocol might be designed hierarchically under UN leadership.

The prohibiting and prescriptive instruments are combined here as *Binding instruments*. In principle, the seven main implementation mechanisms discussed above can be applied.

1. *Binding instruments*

- International treaties and conventions including binding elements, like the Montreal Protocol, the Kyoto Protocol and the Biosafety Protocol
- EU environmental directives for member states

2. *Option-creating instruments*

- Clean development mechanism, as under the Kyoto Protocol
- Multilateral Ozone Fund under the Montreal Protocol

These options seem to stretch the concept a bit. However, their basic function is to allow states to develop regulatory activities which would not be possible or at least rather unlikely without the explicit development of the option.

3. *Economic instruments*

- Internationally tradable emission reduction obligations for climate changing emissions, as might be based on the Kyoto protocol

4. *Cultural instruments*

- International guidelines, as by OECD, and in the EU IPPC/BAT (Integrated Pollution Prevention and Control/Best Available Technology) rules
- Rio Declaration, AGENDA 21
- National indicative guidelines for local zoning laws
- ILO conventions regarding environment-related labour standards

5. *Structural instruments*

- WTO rules on environmental considerations in restrictions on trade

6 *Procedural instruments*

- International Criminal Court (ICC) (no environmental example available)

II Regulatory instruments (guiding public regulator – private regulatee relations)

Regulatory instruments guide regulator – regulatee relations; they are the traditional environmental policy instruments.

1. *Prohibiting and prescribing (= binding) instruments*

- Binding instruments can be either prohibiting or prescriptive. Prohibiting instruments are usually conditional, in that something is forbidden unless some requirements are fulfilled. In symmetrical situations, as with speed limits, the difference between prohibiting and prescribing instruments is small: it is forbidden to drive faster than the limit or prescribed to drive more slowly.
- Allowable coolants in household refrigerators
- Operating permits for installations, the workhorse of environmental policy
- Land use regulations and zoning laws

2. *Option-creating instruments*

   - Separate waste collection facilities, in all Western countries

Option creation can be direct, as in providing separate waste collection facilities to households that may voluntarily separate their wastes. No prescription or prohibition is involved.

3. *Economic instruments: price-changing (financial) instruments*

   - Emission taxes (or: charges, levies, excises) on CO_2 (e.g. Norway) or on SO_2, formerly in Japan, now in China
   - Road pricing (most Western countries)

4. *Economic instruments: market volume instruments ('things' only)*

   - Tradable emission permits, like SO_x permits in the US
   - Tradable production rights, like fishery rights
   - Tradable product ownership permits, like car permits in Singapore

5. *Cultural instruments: non-compulsory structured information*

   - Public eco-labelling schemes
   - Public certification of firms, as for refrigerator repair firms in the Netherlands

6. *Structural/institutional instruments*

   - Extended liability
   - Good housekeeping ownership rules
   - Educational system, Copernicus charter, etc.

7. *Procedural instruments*

   - Covenants, voluntary agreements 'in the shadow of the law'
   - Environmental Impact Assessment rules
   - Obligatory information disclosure, as in the US Toxic Releases Inventory (TRI) Act

III Social instruments (guiding relations between private actors)

These instruments are similar to political-administrative instruments in that they may reflect horizontal relations between equals, or have a hierarchical element in them, as is often the case in environmental supply chain management. Again, the six main implementation mechanisms apply.

1. *Binding instruments*

   - Contractually specified rules for waste management, as when firms commit themselves to delivering a certain amount of waste over a longer period of time (Netherlands)

2. *Option-creating instruments*

   - Battery take-back facilities in supermarkets

3. *Market instruments*

   - Noise-related landing fees at airports
   - Deposit-refund system on cadmium-containing rechargeable batteries for household appliances, on a voluntary basis
   - In-firm tradable emission permits (see Box 13.4)

4. *Cultural instruments*

   - Green marketing (all Western countries)
   - Green accounting (ISO)
   - Ecolabelling rules (ISO)

5. *Structural instruments*

   - Standard contracts specifying adherence to environmental standards, set up for instance by a branche organisation

6. *Procedural instruments*

   - ISO 9000 Series, on quality control
   - ISO 14000 Series, on environmental performance measures

The international standard on environmental auditing, ISO 14001, for instance, is a procedural instrument, requiring firms to take due notice of environmental aspects in their operations, in the sense of having an environmental policy plan, having officials responsible for checking its progress, etc. If rules were incorporated on how to further specify environmental performance, the instrument would become a cultural instrument.

13.4.3 Choice of Instruments in Policy Design

Using the framework for environmental policy instrumentation and the evaluation criteria indicated above would seem to suffice for a rational development of

Box 13.4 Multinational company tradable emission permit

Some major oil companies, including Shell, have introduced emission trading between the firms comprising these multinational companies. The emission trading focuses on climate-changing emissions, like carbon dioxide and methane. Each independent business unit within Shell has an number of emissions rights, which may be sold to other Shell units. There is an accounting system which establishes the actual emissions of each unit. Emissions without a permit are not allowed, resulting in a company-internal cost penalty. If a unit has more permits than it needs, it will try to sell them to other units. If it wants to expand, it may acquire permits on the internal but global company market. The total amount of emissions permitted is being reduced slowly, based on the company's environmental plans, by reducing the allowable emission volume per permit each year. The combination of business expansion and the reduction of the overall emission volume permitted results in upward pressure on permit prices, while environmentally oriented technological development leads to a downward pressure. What will the effects of this instrument be?

The effects in terms of company emissions are quite clear: the goals of Shell's environmental policy plan are met, while leaving the business units their technological freedom. The emission reduction is achieved in the most efficient way, as each business unit reduces its emissions to the level where cost reductions are (roughly) equal to the costs of having the permit. A major problem in implementing such a system is choosing the system boundaries. How can firms partly owned by Shell and partly by other companies participate in the scheme? What happens to the total number of Shell permits if Shell sells some of its activities, or acquires others?

What the net environmental effects in the global society will be, in terms of reduced climate-changing emissions, is less clear, which in this case is due to quite complex indirect effects. For activities where a company has competitors with less stringent policies, its costs will show a relative rise. Hence, in the course of time, there will be a shift to firms not participating in this (or a similar) emission permit trading scheme. Also, questions arise as to how company environmental policy relates to public environmental policies in the various countries where the company operates. If more stringent policies are introduced in some countries, the permit system will no longer have effects there, as induced costs of emission reduction are higher than the permit costs. In countries with emissions taxes, the firms involved will have a greater incentive to reduce emissions than other firms in the company, reducing the overall efficiency within the company. In this sense, companies using such a scheme will create an argument against more stringent national policies. Conversely, if public policies are less stringent than the company scheme, they become superfluous. In this situation, multinationals like Shell create an incentive for national governments to implement more stringent policies. The overall effect will be that public policies will tend to be harmonised at a global level towards the level of emission reduction indicated by the large multinationals. If most multinationals were to come up with similar and equally stringent schemes, there would be a clear drive towards uniform policies, at the level of stringency chosen by those firms, and not by governments. It should be relatively easy to extend the tradable permit system to trade between firms. The choice of their policy instrument will influence policy implementation by governments as well, making it very difficult for instance to implement emission taxing schemes on top of the company tradable emission permit scheme. Shell chairman Moody-Stuart has called upon governments to implement similar market-based mechanisms to achieve their Kyoto targets. For further information on the Shell tradable emission permit system (STEPS), see www.shell.com/climate.

policy instruments for the environmental problems facing us. The question may be asked, however, how the analytical approach depicted here relates to process aspects in instrument and policy design at a case level. This also involves preliminary choices that may start and guide the process, possibly leading to different results. In this final part of the chapter we comment on two such preliminary considerations, those underlying the definition of the case, and some case-independent considerations guiding instrument choice (Box 13.5).

Box 13.5 Main lines of argumentation in Section 13.4

- Policy instruments are not given entities to be examined; they are social constructions with many degrees of freedom.
- Four main dimensions are central to the definition of specific instruments, though probably not enough for a full specification of operational instruments. They are: the nature of actor relations; the instrument mechanism in implementation; the objects influenced; and the operational environmental goals embodied in the instruments.
- After specification, these four dimensions create an 'instrument space'. Criteria, ultimately evaluation criteria, signpost the route through this instrument design space for relevant instrument choices.
- Instruments are building blocks in the process of policy formulation and policy implementation; they are not the policy itself.
- In actual policies, public and private, consensual acts are at the core of behavioural adjustments. This should not obscure the fact that power and interests play key roles in such processes and that power is very much based on the availability of operational policy instruments.
- Given some maximum regulatory effort for environmental policy, there is a limit to the overall effectiveness of such policy. Focussing on social procedures in regulatory instruments may enhance the effectiveness of specific policies, but implicitly excludes other policies from being developed and implemented.
- Structural instruments like liability rules and emission taxes may exert their influence at low transaction costs and with potentially high environmental effectiveness, but for the time being only on a limited number of environmental effects.
- In design and evaluation of policy instruments and policies, one part of the analysis is empirical while the other is normative.
- The empirical analysis is partially subjective and concerns direct, indirect and, as far as possible, secondary effects. No broadly accepted models are available, leaving much room for complex debate.
- The criteria for instrument and policy evaluation refer to direct expected effects, but also include second-order criteria and strategic criteria, viewed from a long-term perspective of the development of environmental policy instrumentation.
- Basic choices on the desired nature of regulatory instruments, in view of overall institutional developments in global society, would have a direct bearing on instrument choices in specific cases.

13.4.3.1 Cases

Environmental policy instruments can best be chosen and designed in greater detail by specifying the characteristics most relevant to the case at hand. However, it is not always easy to say what exactly is 'the case', as the case is defined both by the problem context and by preliminary choices made before a specific instrument is designed. These reflexive or interactive relations make instrument design a much less rational and mechanical activity than might seem possible at first sight. If, for instance, one first defines the ecological effects of eutrophication as a manure problem, and then the manure problem as a consequence of too many animals per hectare, the choice to regulate the number of animals per farm seems logical. If one already had the traditional operating permit in mind, one would probably define the problem this way. By contrast, if the problem is defined in terms of a lack of oligotrophic areas, or as a lack of differentiation in nutrient concentrations, a regional regulatory scope will be more logical. If one already had a different instrument option in mind, like a substance deposit (see Huppes 1988), the scale of the problem could well be defined at a regional level. The use of individual permits then no longer seems so obvious. Evidently, it is not only the empirical context that indicates choices; normative considerations on how to regulate may well already play a role in the problem or goals definition phase. The polluter-pays principle reflects the normative principle that he who pollutes has to pay for the consequences of his action – and for the costs of preventing them, as is the case in

liability law in all Western countries. Tradable permits lead to prevention costs being borne by the polluter, but not the damages. In this respect, an emission tax is more in line with general social and legal considerations than a tradable permit. If it is specified as a regional substance deposit, the focus on individual emitters vanishes more or less completely. With such caveats in mind, we now turn to design choices in instrumentation, within the framework developed.

13.4.3.2 Process Aspects of Design

A possible objection to the above procedure might be that in this top-down approach, the uniqueness of actual problems and options for their solution will be lost. This is a valid objection. The answer is that for any *institutionalised* policies, the knowledge of the concrete cases is so far removed from the regulators that real knowledge of 'the case' will usually not be available. Another objection might be that, as there are so many relevant evaluation criteria, these at least should be reflected in the design space developed here. Such further criteria may indeed help to specify actual instrument design in a relevant way. Another objection may be that the top-down approach is a hierarchical, technocratic approach, even an anti-democratic one. Analytic hierarchy, however, is not necessarily linked to social top-down approaches. On the contrary, the quality of the democratic process may well be improved by reducing the complexity of the subject of regulation while at the same time giving a broader and more systematic perspective.

Policy design, in terms of selecting and applying instruments, is not a mechanical procedure with results independent of the wider social context and independent of the qualities of the actors involved. There have been simple descriptions of the policy process which assume that the legislator enacts what is best, after which the regulations are implemented by law-abiding officers, leading to the intended effects, provided of course that the technical preparations for legislation had been done properly. Political scientists have long since shown (see e.g. Easton 1965) how at a systems level, policy-making is related to political support, limiting options for politicians and making the expected outcome of regulations only one aspect in the process. Sociologists of law have shown that similar laws work out differently depending on the administrative and social context in which they are functioning. A major difference, for instance, is that between the litigative American style of regulation, where laws are often fiercely debated and enacted after lengthy litigative procedures, and the more horizontal policy process in England and the Netherlands, with officials influencing private decisions through discussion and information, and only ultimately through threats of harsh regulatory actions against non-cooperative regulatees (cf. Jänicke and Jorgens 1998; Vogel 1986). In such systems, implementation may take place 'in the shadow of the law', without any new laws or permits being enacted, or in a private context, with contracts or covenants being signed.

In administrative science, this has led to greater emphasis on the process of policy formulation and implementation, reducing the emphasis on the more formal characteristics of policies in terms of instrumentation. Policy-making is then easily regarded as a discursive process between all those involved, with outcomes in terms of their environmental actions based on the power, interests, resources and the shrewdness of the actors involved. The present authors prefer what they regard as a balanced view in this respect, indicating the role of policy instruments both in terms of structuring discussions and as indispensable means to wield power and shape both society and the environment. Of course, this does not deny the fact that politics play an essential part in policy development, nor that social processes are fundamental in terms of both policy-making, including instrumentation, and policy implementation, using instruments.

Distinguishing between the political-administrative process of policy and instrument development, and the policy instruments being used in the policy implementation process is sometimes straightforward. The US, for instance, has enacted laws on tradable emission permits for SO_2 emissions, after lengthy research on how this instrument could function and lengthy political discussions on its advantages and disadvantages in terms of efficiency, effectiveness and ease of implementation. Implementation is a largely administrative process, upheld by checks and balances in which self-regulation plays a key role. Since nobody wants their competitors to have a free ride, all trading parties support officials checking the outcomes of emission trade, especially if focussed on their competitors. The instrument is clearly differentiated from its broader social and political context. With other instruments, however,

the distinction is not so clear. Covenants between governments and groups of firms may be viewed from different angles. In some instances, they create the discussion platform leading to concrete actions, as in the Dutch packaging covenant. In this sense, it is not an instrument but a procedure that may lead to instrumental use, if needed. Or covenants may already specify concrete actions for specific parties, as is also the case in the Dutch packaging covenant. The 'shadow of the law' is very explicitly present in this covenant, which states that it replaces direct regulation and, if not successful, will be followed by more direct regulation. The threat, of course, only works if regulatees – in this case the private partners to the covenant contract – expect government to be able to come up with this legislation if deemed necessary.

Voluntary approaches (including voluntary agreements) cover procedural variants of regulatory instruments, as well as most social instruments. They are to be distinguished from the social procedures followed in the preparation of other types of regulatory instruments, like permits or emission taxes, which themselves are not voluntary. The difference is not always clear though, as in the example of 'permit preparation', which was formerly a major instrument for environmental policy in England and the Netherlands.

13.4.3.3 Instrument Analysis for Evaluation

Evaluating specific policy instruments requires a combination of normative and empirical analysis. The normative analysis guides the empirical analysis, as only results that are relevant in normative terms are relevant to the evaluation. As usual, however, things are not as simple in practice as they are in principle. In empirical terms, two types of mechanism are involved in the effect route towards environmental policy aims or, using a broader definition, sustainability aims. The first group includes mechanisms in society, the second those in the environment. For both types of mechanisms one may distinguish between primary effect mechanisms, essentially reducing causalities to one single chain, and secondary mechanisms, involving feedback loops, modelled in simple or more advanced ways. In normative terms, there is no well-structured set of values that can be linked to environmental policy. There is a possible classification, however, into major value fields related to human health, economic prosperity and the quality of nature. To these may be added amenity aspects, distributional aspects, the nature of our relation with the biotic and abiotic environment and other normative aspects. The evaluation criteria specified in a previous section may serve as a guide.

Since empirical analysis is often very scanty in environmental matters, it may be necessary to fall back on not fully proven assumptions. A striking conclusion from research on the effectiveness of voluntary approaches is that little is known about the functioning of such approaches (cf. Harrison 1999). Their effectiveness has not been thoroughly studied, and where it is assumed, this seems largely a matter of belief, similar to the old belief that binding instruments would automatically lead to the effects specified. This may have been the case to some extent in the US, but in most European countries, there is a well-known gap between legislation and implementation. In addition, legislation may enact what would have happened anyway. This safeguards effectiveness in terms of being in line with legislation, while effectiveness of policy in terms of a behavioural adjustment for environmental improvement may be more or less lacking. Similarly, instrument debates often state that tradable emission permits lead to definite environmental effects, unlike emission taxes. Let us take CO_2 emissions from electricity production as an example. If, due to unusually hot and cold weather periods, electricity consumption and related CO_2 emissions have eaten up the available permits, it can hardly be imagined that electricity production will therefore be shut down for the last half of December. Seemingly rigid instruments are not applied to the full, while soft instruments like taxes may have very predictable results at an aggregate level.

This state of affairs in empirical analysis for evaluation may be discomforting but should not lead to inertia. In real life, as opposed to science, a best guess is better than none at all, and defective but comprehensive evaluation schemes are to be preferred to doing nothing, or to focusing policy on some partial effects because other things have not been fully proven. If a balance is to be struck, one at least needs to know what is not fully proven, and to see where evaluation problems reside. The scheme of Fig. 13.2 at least indicates a number of relevant types of information. An analysis and evaluation which may be faulty in some respects is better than none at all, and policy instruments should preferably be set up in a way which best reflects available knowledge, limited though it may be.

13.4.3.4 Strategic Considerations Above the Case Level

We now return to strategic aspects of instrument choice and evaluation going beyond the design and evaluation of specific problem-and-instrument combinations. One question is whether a specific problem can best be solved by one or a few instruments, as opposed to a broad mixture of instruments. Another question is whether instrument choice is to focus on a limited set of instruments for environmental policy, as opposed to a set that is as broad as possible in order to fit all purposes. Piecemeal improvement at the micro level of individual instruments may well be sub-optimal at the macro level of societal environmental policy as a whole. Instrument choice in the sense of adding new instruments may not simply be a matter of finding the best options for the environmental problem case at hand. Both of these general strategic questions relate back to instrument choice at the operational level as discussed above.

The first question actually asks whether there is a minimum, optimum and maximum number of instruments; in other words, it asks how sparsely instruments should be used and which level of variety is necessary and wise. In the context of macro-economic policy, there is a clear preference for using Occam's razor: the minimum number of instruments required is also the maximum number to be used. There is a basic logic in mathematical models that says that the number of independent variables, that is, the instruments, has to be equal to the number of dependent variables, the goals or aims (see Tinbergen 1967). This holds for a wide range of model types, but most clearly for linear models. The reasoning is different for the two types of possible deviations: fewer or more. A smaller number of instruments will not allow the goals to be achieved, and non-effectiveness is obviously a mortal sin in instrument design. If there are more instruments than goals, as is often advised, the system has an infinite number of solutions. The value of the instrument variables can only be derived by arbitrarily reducing the number of instrument variables to the point where the remaining number once more equals that of the goals. This could hardly be called a well-founded procedure. It would probably be more rational and adequate if, based on considerations external to the model, a selection of instruments could be made beforehand.

The discussion on policy integration is closely related to this subject. If trade-offs between different emission types are made, they define a number of equations (usually of the type ax = y). An example is the global warming effect as empirically modelled for various substances, for instance with 20 units of carbon dioxide (ax) equalling 1 unit of Global Warming Potential for methane (y). By eliminating the specific substances and their equations, the number of goals is reduced to one: global warming (more precisely: time-integrated climate forcing). This integration can be pursued further, on a normative basis, for instance by integrating the overall toxicity scores of all toxic emissions with this total global warming effect of all climate-changing substances, reducing them to one evaluation-based denominator. The level of aggregation defines the problem, in that this discussion on numbers of instruments and goals may hold for a given problem level.

Before accepting these quite stringent conclusions on instrument numbers equalling the number of goals, however, it should be examined if this line of reasoning is really applicable. There are several reasons why this does not seem to be the case. Some are based on the nature of goals in environmental policy, others relate to the somewhat loose nature of instrument and goal specification in relation to the underlying dirty and fuzzy models of the world. It may also be questioned whether the goals are really discrete values or are of the nature of variables to be maximised, for which overshooting the mark is no problem at all, merely yielding a slightly higher environmental quality than originally expected or intended. If this is true, the problem should be seen as a maximisation (or in this case minimisation) problem with boundary conditions, rather than as a solution to arrive at a discrete value. This implies that the requirement of equality between numbers of instruments and numbers of goals vanishes, as is generally accepted in administrative sciences (see e.g. Gunningham and Sinclair 1999). Different instruments may each take care of particular improvements, possibly supporting each other in their functioning, in that for instance an informational instrument may be conducive to the active development of permits. Furthermore, the relation between instruments and goals may not always be so clear as to imply a one-to-one link. In most real life situations, there is no clear model with instruments put in at one end and goal achievement pouring out at the other. The relation between instruments and goals is not so straightforward. Ultimately, each instrument is at least

to some extent linked to all environmental problems, albeit in widely different degrees and with very large uncertainties. Also, instruments may be mutually supportive. The underlying models for these instruments then differ somewhat in scope. A more practical approach would be to see them as parallel applications of several instruments.

Finally, some types of instruments belong together and may be mutually supportive, while others are conflicting. In environmental policy, there has always been a tension between the control-oriented permitting system and technology-binding and behaviour-prescriptive approaches on the one hand, and liability and taxing approaches on the other. A great deal of detailed legal sophistication has developed to reconcile these conflicting approaches in regulatory practice. Introducing the tradable emission permit, which is already operational in the US on sulphur dioxide emissions and is now being considered for climate changing emissions in Europe, leads to a substantial shift in this balance, for one thing because carbon dioxide emissions are intimately linked to all economic activities. The second approach, following the pure version of the polluter-pays principle that was worked out by the OECD three decades ago, is compromised by the advent of tradable emission permits. It will become quite impossible to shift to such a taxing system once the tradable permit system has been established, whereas such a shift is still possible whilst technologies are being regulated with permits. Such basic institutional choices, which need to be made explicitly, would have to be based on a rethinking of environmental regulation in particular, of public regulation in general, and of the even more general principles of social organisation. The outcome of this broader societal analysis and decision-making process could help guide all choices on instruments for environmental policy.

References

Bardach, E., & Kagan, R. A. (1982). *Going by the book; the problem of regulatory unreasonableness*. Philadelphia: Temple University Press.

Baumol, H., & Oates, W. E. (1988). *The theory of environmental policy*. Cambridge: Cambridge University Press.

Beck, U., & Beck-Gernsheim, E. (2002). *Individualization: Institutionalised individualism and its social and political consequences*. London: Sage.

Bohm, P., & Russell, C. S. (1985). Comparative analysis of alternative policy instruments. In A. V. Kneese & J. L. Sweeney (Eds.), *Handbook of natural resource and energy economics*. Amsterdam: North Holland.

Bonus, H. (Ed.). (1998). *Umweltzertifikate. Der steinige weg zur marktwirtschaft (sonderheft 9/1998 der zeitschrift für angewandte umweltforschung)*. Berlin: Analytica.

Bressers, J. T. A. (1988). A comparison of the effectiveness of incentives and directives: The case of the Dutch water quality policy. *Policy Studies Review, 7*(3), 500–518.

Bressers, J. T. A., & Klok, P. J. (1988). Fundamentals for a theory of policy instruments. *International Journal of Social Economics, 15*(3/4), 22–41.

Brundtland Report: World Commission on Environment and Development. (1987). *Our common future*. Oxford: Oxford University Press.

Castells, M. (1996). *The rise of the network society*. Oxford: Blackwell.

Castells Cabré, N. (1999). *International environmental agreements. Institutional innovation in European transboundary air pollution policies*. Amsterdam: Free University Press (doctoral dissertation).

Coase, R. H. (1960). The problem of social cost. *Journal of Law and Economics, 3*(1), 1–44.

Cole, D. H., & Clark, J. (1998). Poland's environmental transformation: An introduction. In J. Clark & D. H. Cole (Eds.), *Environmental protection in transition. Economic, legal and socio-political perspectives on Poland*. Aldershot: Ashgate.

Easton, D. (1965). *A systems analysis of political life*. Englewood Cliffs, NJ: Prentice-Hall.

Endres, A. (1997). Incentive-based instruments in environmental policy: Conceptual aspects and recent developments. *Konjunkturpolitik, 43*(4), 298–343.

EPA. (1999). Description of 9 proposed sites and 10 final sites added to the national priorities list in October 1999. *Intermittent Bulletin*, *2*(5) [online].

Fischer-Kowalski, M. et al. (1997). *Gesellschaftlicher Stoffwechsel und Kolonisierung von Natur*. Amsterdam: Verlag Fakultas.

Galanter, H. (1981). Justice in many rooms: Courts, private ordering and indigenous law. *Journal of Legal Pluralism, 19*, 1–47.

Giddens, A. (1994). *Beyond left and right* (p. 15, 191). Cambridge: Polity Press.

Giddens, A. (1998). *The third way: The renewal of social democracy*. Cambridge: Polity Press.

Guinée, J. B., Gorrée, M., Heijungs, R., Huppes, G., Kleijn, R., de Koning, A., et al. (2002). *Handbook on life cycle assessment. Operational guide to the ISO standards*. Dordrecht: Kluwer (now Springer).

Gunningham, N., & Sinclair, D. (1999). Regulatory pluralism: Designing policy mixes for environmental protection. *Law and Policy, 21*(1), 49–76.

Harrison, K. (1999). Talking with the donkey: Cooperative approaches to environmental protection. *Journal of Industrial Ecology, 2*(3), 51–72.

Hawkins, K. (1984). *Environment and enforcement. Regulation and the social definition of pollution*. Oxford: Clarendon Press.

Hemmelskamp, J. (1997). Environmental policy instruments and their effects on innovation. *European Planning Studies, 5*(2), 177–194.

Hoffman, A. J. (2006). *Getting ahead of the curve: Corporate strategies that address climate change. PEW centre on climate change. See chapter on shell*. Ann Arbor, MI: University of Michigan.

Huppes, G. (1988). New instruments for environmental policy: A perspective. *International Journal of Social Economics, 15*(3/4), 42–50.

Huppes, G. (1993). *Macro-environmental policy, principles and design*. Amsterdam: Elsevier.

Huppes, G., & Kagan, B. (1989). Market-oriented regulation of environmental problems in the Netherlands. *Law and Policy, 11*(2), 215–239.

Huppes, G., van der Voet, E., van der Naald, W. G. H., Vonkeman, G., & Maxson, P. (1992). *New market-oriented instruments for environmental policies*. London: Graham & Trotman.

Huppes, G., Sas, H., de Haan, E., & Kuyper, J. (1997). Efficiënte milieuinvesteringen (efficient environmental investments). *Milieu, 12*(3), 126–133.

Imhoff, M. L., Bounoua, L., Ricketts, T., Loucks, C., Harriss, R., & Lawrence, W. T. (2004). Global patterns in human consumption of net primary production. *Nature, 429*, 870–873.

Ingold, T. (1986). *The appropriation of nature: Essays on human ecology and social relations*. Manchester: Manchester University Press.

Jänicke, M., & Jorgens, H. (1998). National environmental policy planning in OECD countries: Preliminary lessons from cross-national comparisons. *Environmental Politics, 7*(2), 27–54.

Luhmann, N. (1989). *Ecological communication*. Cambridge: Polity Press.

Mayntz, R. (1978). *Volzugsprobleme der umweltpolitik (application problems in environmental policy)*. Stuttgart: Kohlhammer.

Mintzberg, H. (1994). *The rise and fall of strategic planning*. New York: Free Press.

OECD (Organisation for Economic Co-operation and Development). (1995). *Climate change. Economic instruments and income distribution*. Paris: OECD.

Opschoor, J. B., & Vos, H. B. (1989). *The application of economic instruments for environmental protection*. Paris: OECD.

Rawls, J. (1972). *A theory of justice*. London: Oxford University Press.

Riesman, D. (1950). *The lonely crowd: A study of the changing American character*. New Haven, CT: Yale University Press.

Scharpf, F. W. (1991). Die handlungsfähigkeit des staates am ende des zwanzigsten jahrhunderts. *Politische Vierteljahresschrift, 32*(4), 621–634.

Schneider, S. H., & Kuntz-Duriseti, K. (2002). Uncertainty and climate change policy. In S. H. Scheider & A. Rosencranz (Eds.), *Climate change policy: A survey*. Washington, DC/ London: Island Press.

Schumpeter, J. A. (1976). *Capitalism, socialism and democracy*. London: George Allen & Unwin.

Sen, A. K. (1977). Rational fools. A critique of the behavioral foundations of economics. *Philosophy and Public Affairs, 6*, 317–344.

Sen, A. K. (1982). *Choice, welfare and measurement*. Cambridge, MA/London: Harvard University Press.

Sen, A. K. (2000). Consequential evaluation and practical reason. *Journal of Philosophy, 97*(9), 477–503.

Simonis, E. U. (1998). Internationally tradable emission certificates: Efficiency and equity in linking environmental protection with economic development. In H. -J. Schellnhuber & V. Wenzel (Eds.), *Earth system analysis: Integrating science for sustainability: Completed results of a symposium organized by the Potsdam Institute*. Berlin: Springer.

Superfund Programme. (1986). This programme has been adopted in two steps. CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) in 1980 and SARA (Superfund Amendments and Reauthorisation Act) in 1986.

van Tatenhove, J., & Leroy, P. (2000). The institutionalisation of environmental politics. In J. van Tatenhove, B. Arts, & P. Leroy (Eds.), *Political modernisation and the environment: The renewal of environmental policy arrangements*. Dordrecht: Kluwer.

von Benda-Beckmann, K., & Hoekema, A. J. (1987). Hoe horizontaal bestuurt de overheid (how horizontal is government?). *Recht der Werkelijkheid, 8*(2), 3–12.

von Neumann, J., & Morgenstern, O. (1953). *Theory of games and economic behavior*. Princeton, NJ: Princeton University Press.

Tinbergen, J. (1967). *Economic policy: Principles and design: See Section 3.3*. Amsterdam: North-Holland.

Tisdell, C. (1998). Economic policy instruments and environmental sustainability: Another look at environmental-use permits. *Sustainable Development, 6*, 18–22.

Tönnies, F. (1887). *Gemeinschaft und gesellschaft: Abhundlung des communismus und des socialismus als empirischer culturformen*. Leipzig: Fues's Verlag.

Vogel, D. (1986). *National styles of regulation: Environmental policies in Great Britain and the United States*. London: Cornell University Press.

Weber, M. (1947). *The theory of economic and social organisation*. New York: Oxford University Press.