Better by design: Rethinking interventions for better environmental regulation

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HIGHLIGHTS

► A typology of environmental policy and regulatory instruments has been refined through interviews with UK policy makers.
► Factors affecting policy makers' choices of instrument are identified.
► Direct regulation is considered necessary in many areas, to reduce environmental risks and tackle poor performance.
► Co-regulatory approaches may offer advantages for managing uncertainty, developing evidence and refining objectives.
► Policy makers' skills for effective design of policy and regulation are examined.

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ABSTRACT

Better regulation seeks to extend existing policy and regulatory outcomes at less burden for the actors involved. No single intervention will deliver all environmental outcomes. There is a paucity of evidence on what works why, when and with whom. We examine how a sample ($n = 33$) of policy makers select policy and regulatory instruments, through a case study of the Department for Environment, Food and Rural Affairs (Defra), UK. Policy makers have a wide range of instruments at their disposal and are seeking ways to harness the influence of non-governmental resources to encourage good environmental behaviour. The relevance of each influence varies as risk and industry characteristics vary between policy areas. A recent typology of policy and regulatory instruments has been refined. Direct regulation is considered necessary in many areas, to reduce environmental risks with confidence and to tackle poor environmental performance. Co-regulatory approaches may provide important advantages to help accommodate uncertainty for emerging policy problems, providing a mechanism to develop trusted evidence and to refine objectives as problems are better understood.

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1. Introduction

Around the world policy makers, who design and implement policy and regulation, face the challenge of choosing among a range of policy and regulatory instruments to achieve their governments' environmental and economic objectives, pursuing 'clean' or 'dirty' development paths as their economies grow (Esty and Porter, 2005). The term 'regulation' is used here in its broadest sense to include all forms of social control, including those that harness wider social forces beyond government, including the influence of businesses and other actors in society (Gunningham and Sinclair, 1999). 'Instrument' is used to refer to a component part that makes up regulation, such as licensing, taxes or public information campaigns. Instruments include traditional direct regulation typically based on licensing and inspection, economic instruments such as taxes and subsidies, approaches intended to change behaviour through better information

provision, approaches negotiated between government and industry, relying on industry self-regulation, and seeking to increase knowledge and capacity. Variants exist within each of these broad categories (Table 1).

Direct ('command and control') regulation has been associated with significant improvements in environmental conditions in industrialised nations. However, concern that direct regulation may inhibit innovation and international competitiveness has led governments to seek alternative approaches to achieving environmental objectives (see, e.g. BIS, 2012). Governments have sought to improve the implementation of regulation using a risk-based approach, targeting regulatory effort towards the greatest risks (e.g. Gouldson et al., 2009; Pollard et al., 2004, 2008; Hampton, 2005). Commentators have also observed a shift from 'government' to 'governance' as governments seek to harness the influence of wider social forces to influence the behaviour of individuals and businesses (Gouldson, 2008; Jordan et al., 2005) by sharing responsibilities for managing public risk and associated costs. In practice, instruments rarely operate in isolation; instead forming a complementary mix that influences behaviour through different levers across multiple actors.

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Table 1
Typology of policy and regulatory instruments (Taylor et al., 2012).

Type	Variant
Direct 'command and control' regulation	Ambient pollution requirements
	Input restrictions and output quotas
	Non-transferable emissions licences
	Technology controls
	Zoning/location controls
Economic instruments	Taxes and subsidies
	Tradable rights
	Payments
Information based instruments	Targeted information provision
	Naming and shaming/faming
	Registration, labelling and certification
Co-regulation and self-regulation	Voluntary regulation
	Covenants and negotiated agreements
	Private corporate regulation
	Private professional regulation
	Self-regulation
	Civic regulation
Support mechanisms and capacity building	Research and knowledge generation
	Demonstration projects and knowledge diffusion
	Network building and joint problem solving

In Europe, the European Commission has a long-established programme for regulatory reform across member states and in recent years has sought to further the ambitions of the 'better regulation' agenda towards 'smart regulation' (European Commission, 2010). The Organisation for Economic Co-operation and Development (OECD) similarly has promoted regulatory reform across its members (OECD, 2008). Emerging economies experiencing rapid industrialisation and economic growth are also tackling the challenge of designing effective regulatory frameworks to deliver sustainable development. For example, China has recently announced its Plan for Energy Conservation and Emission Reduction for the 12th Five-Year Plan Period (Ministry of Environmental Protection, People's Republic of China, 2012), which includes strengthened pollution controls and reduction targets for specific sectors, as well as the promotion of environmental management labels for vehicles.

In England, the Department for Environment, Food and Rural Affairs (Defra) develops environmental policy and regulation across multiple policy domains. Regulation is implemented by a network of regulatory agencies including the Environment Agency (EA) and regulators in local government. Programmes of work that drive regulatory reform have been pursued by successive governments in the United Kingdom of Great Britain and Northern Ireland (UK) over recent decades. The current 'Red Tape Challenge' (Cabinet Office, 2012a) seeks to reduce regulatory burdens through a process in which policy makers, politicians and the public scrutinise existing legislation to identify 'what should be scrapped, what should be saved and what should be simplified'. Simultaneously, the UK government is aiming to reduce government spending while devolving more decision-making to a local level, including through voluntary civic action (Department for Communities and Local Government, 2011).

Policy makers and regulators face the challenge of selecting suitable instruments to encourage green growth (OECD, 2011), reduce regulatory burdens, support wider government fiscal and social objectives, and maintain or improve environmental quality. However, they are hampered in their pursuit of 'evidence based policy' (Solesbury, 2001) by a lack of evidence on which policy and regulatory instruments work, why, when and with whom (Taylor et al., 2012). Our research seeks to help address this gap by answering the following research questions for a sample of policymaking practitioners: (i) What types of policy and regulatory instrument can policy makers choose between?; (ii) Which factors influence the effectiveness of these instruments in practice?; (iii) How do policy makers select instruments to deliver better policy and regulation?; and (iv) What does this imply for the skills and tools required by policy makers?

Answers to these questions are likely to set a richer context for the Red Tape Challenge programme for environmental policy and regulation and inform a route map by which a revised mix of interventions, of lower burden, can be designed and defended.

2. Methods

2.1. Rationale

The research used a case study approach (Yin, 2009; Summerill et al., 2010) using semi-structured interviews with policy makers to gather qualitative data. This interview approach allows open discussions to reveal nuances of policymaking practice without straying too far from the research objectives. Cycles of coding were used to elicit results from this data.

2.2. Selection of interviewees

The case of a single government department (Defra) was studied. Defra has primary responsibility for English environmental policy development across a wide range of policy domains, and may be considered a critical case (Yin, 2009) for testing theories of environmental policy practice. Interviewees (Table 2) were senior policy makers selected to provide insight into the practices within their policy domain. It should be noted that policy makers in the UK government often circulate between policy domains during their career, so some interviewees drew on wider experience. In line with Yin's (2009) rationale for single case study research, the aim was not for statistical generalisation, rather, to determine whether established theory provides correct propositions for this critical case, or whether alternative explanations are more relevant, challenging or extending theory.

2.3. Collection of data

Semi-structured interviews (33 individuals in 28 meetings) were conducted to collect narrative during September and October 2011, and lasted between 30 min and 1 h. Interviews were conducted using open-ended questions, structured around research questions examining the range of policy and regulatory interventions available to policy makers, their experience of effective and ineffective policy

Table 2
33 policymakers were interviewed in 28 interviews across a range of policy domains.

| Policy domain	Number of interviewees
Exotic animal disease control	1
Climate change adaptation planning	1
Sustainable consumption and production	2
Local environmental control	2
Farming Regulation Task Force	2
Biodiversity	1
Food	2
Marine strategy	1
Common fisheries policy	1
Peat and Soils	1
Contaminated land	1
Food and Environment Research Agency (FERA)	1
Noise	1
Chemicals	3
Marine licensing	1
Livestock and livestock products	1
Cross-cutting	1
Water in the environment	1
Water quality	1
EU negotiation coordination	1
Landscape and forestry	1
Crops and Agricultural Products	1
Flood risk management	2
Animal welfare	1
Waste management	2
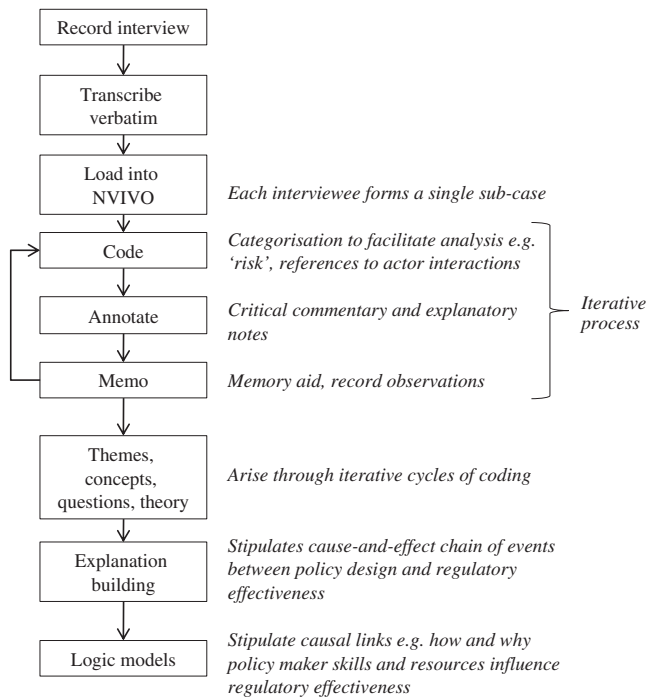
Fig. 1. Analysis approach, after Summerill et al. (2010).

and regulation in practice, and the factors influencing instrument selection and effectiveness. Prior to each interview, interviewees were provided with a briefing note explaining the purpose of the research and assuring their anonymity, listing the questions to be addressed during the discussion and presenting a typology of policy and regulatory instruments established through a prior literature review (Taylor et al., 2012; summarised in Table 1). Interviews were recorded with permission using a digital voice recorder and transcribed verbatim. Relevant documentation concerning the policy and regulation within policy areas was obtained, and was supplemented with direct observation, conversation and collection of field notes.

2.4. Data analysis

Data analysis was performed through a systematic process of coding, annotation and memoing using NVIVO 9™ computer assisted qualitative data analysis software (CAQDAS) (Bazeley, 2007; Miles and Huberman, 1994). A stepwise approach (Fig. 1) was used for coding narrative data to identify descriptions of characteristics of or interactions between actors (e.g. policy makers, regulators, businesses) that affect instrument selection or effectiveness, and recurring concepts (e.g. cost, fairness, risk) used to explain the choice of policy instruments.

This coding approach was used to ensure that a representative range of interactions and explanatory concepts referred to by interviewees was captured, providing a well-grounded data set to inform inductive theory development. The coding was then reduced to a set of explanatory themes. The development of these themes reflects the 'theoretical sensitivity' (Kelle, 2005) of the researchers, informed by a literature review undertaken prior to the interviews (Taylor et al., 2012). Comparison between the themes identified through the literature review and the themes reduced from the interview data has been used to corroborate the relevance of existing theory to the interviewees' explanations of policy and regulatory instrument selection in practice. The results of this analysis are reflected in the text.

3. Results and discussion

Table 3 summarises respondents' opinions on the range of policy and regulatory instruments they can choose from, with reference to the typology of instruments provided during the interviews. Table 4 lists factors identified by policy makers that influence the effectiveness of instruments and how many respondents discussed them, and summarises the benefits and limitations of these factors. Fig. 2 illustrates the actors and interactions that policy makers consider during instrument selection. Table 5 lists other factors affecting the choice of instruments, the number of respondents who discussed them, and summarises respondents' views on these factors.

3.1. Typology of instruments available to policy makers

Interviewees were asked to comment on the typology of instruments provided at Appendix A (including revisions applied following interviews). In general, policy makers felt that the typology provided an accurate summary of the range of interventions available, and were able to identify examples of different variants used in practice by reference to it (Table 3).

Several respondents commented that the typology would be a useful prompt for policy makers considering options for regulatory reform. One respondent was concerned that if the typology was used as an instrument selection check-list by policy makers, it could constrain their creativity and openness to new ideas. It was also clear from the discussion that the presentation of instruments in a list fails to communicate the reality of instruments working in an interrelated mix.

The policy areas covered during interviews were primarily concerned with the management of risks to the environment (e.g. biodiversity loss, unsustainable consumption of natural resources) and risks to humans arising from environmental conditions (e.g. flood damage, losses from animal disease, health risks arising from pollution). Defra also has responsibility for the regulation of economic performance of some sectors (e.g. the water industry), but economic regulation was rarely discussed. In one case the interviewee felt that the typology was not very relevant for their policy area because it concerned environmental rather than economic regulation.

Table 3
Summary of respondent opinions on instrument typology.

Number of interviewees	Summary of opinions	Detailed comments and illustrative quotes
14	Considered typology to be representative of options available to policy makers, or raised no objections	"I think you look like you've covered, yes, all the different categories in quite a useful way." "I'm sure some of them would probably span more than one category but I imagine that they're fairly comprehensive one way or another."
15	Provided proposals for refinements	Include "codes of practice" (3) Include "insurance" (3) Include "do nothing" (1) Other clarifications (10)
3	No comment	One person in group responded on behalf of others present.
1	Questioned logic of existing structure	Thought the categorisation and naming of instruments should be further refined. Highlighted the example of "voluntary regulation", which is a term generally used to describe an overall regulatory strategy rather than to specify a type of instrument (like "taxes and subsidies" or "technology controls") as it has been used in the typology.

Table 4
Summary analysis of impact of factors influencing achievement of environmental policy and regulatory objectives.

Factor influencing effectiveness (number of interviewees referring to factor)	Potential benefits to achieving environmental objectives from policy maker perspective	Potential limitations to achieving environmental objectives from policy maker perspective
Industry motivations and attitudes towards compliance (28)	Leading businesses may pursue positive environmental behaviour independently, e.g. in pursuit of corporate social responsibility objectives.	Policy objectives may conflict with business objectives, undermining regulatory effectiveness. Deliberate non-compliance undermines regulatory effectiveness.
Individual motivations, capabilities and attitudes towards compliance (26)	Pro-environmental attitudes of public may influence other actors.	Direct regulation often infeasible as not possible to enforce. Bounded rationality may inhibit behaviour change; "behavioural interventions" may be required.
Influence of conditions along supply chains (23)	Can extend policy influence beyond national boundaries. Powerful influence in some sectors (e.g. food retail, government procurement).	Businesses unlikely to enforce standards to extent of limiting supply. Higher procurement standards may be expensive for government.
Regulator capability (23)	Can prove more credible than central government in providing advice and guidance to influence behaviour change. Can provide expertise to address localised problems.	Lack of capability or resources directly limits effectiveness.
Industry capability (20)	Greater capability may reduce the need for government intervention.	Lack of capability reduces regulatory effectiveness.
Strength of public buying decisions and other public influences (19)	Considered very powerful in some sectors where public concern is high, and retailers compete on basis of environmental claims (e.g. food).	Sensitive to loss of trust in environmental claims or low levels of public concern. Consumers may become confused as environmental claims proliferate.
Regulatory threats, of harder regulatory regime or enforcement action (14)	Can motivate action to avoid harder regulation, or to avoid punishment.	Impact may be undermined by lack of political will to regulate. Credibility and therefore impact may be undermined by lack of enforcement resources. Measures may not bring about behaviour change despite being easy to inspect and enforce (e.g. "tick box" exercises).
Industry capacity to self-regulate (10)	Self-regulation may reduce the need for government involvement.	Self-regulation may not be viable in large diverse industries.
Scrutiny of business environmental performance by NGOs and media (7)	Can publicise successes and failures. Can have stronger influence than government in some policy domains.	May lack focus on lower-profile policy objectives. Objectives or activities may conflict with government objectives.
Investor and insurer influence on businesses (7)	Can act directly on business financial drivers.	External investor influence not relevant for privately owned businesses. Investor risk perceptions may lead to lack of investment. Insurer risk perceptions may lead to lack of private insurance provision.
Politicians extolling better environmental performance (5)	Can catalyse action. Can publicise positive initiatives.	May misdirect effort.

The typology of instruments, including recommended amendments as per Appendix A, may be considered to be a useful aide-mémoire for discussions about regulatory reform for environmental risks, and a workable structure for organising evidence about regulatory practice. However, it was also apparent that the process of instrument selection in practice is not formalised, and is complex and nuanced. Analysis of discussions revealed a range of considerations that policy makers take into account when developing or changing environmental policy, including:

- the suitability of instruments to tackle different types of market failures and to manage public risks;
- the extent to which instruments harness the influence of industry, civil society and government actors to maximise their impact;
- the design of instruments to provide necessary degrees of flexibility and to reinforce each other in the overall policy mix;
- the alignment of instruments with wider social and political requirements.

Respondents also commented on the evidence and skills required for effective policymaking. These findings are discussed in detail below.

3.2. Selecting instruments to tackle market failures and manage public risks

3.2.1. Use of economic concepts (e.g. market failure) to explain instrument selection

When discussing reasons for choosing particular instruments, 12 respondents explicitly referred to economic concepts (public goods, information failures, market failures, externalities, property rights, polluter pays principle) as reasons for public intervention, or reasons why a particular instrument had been selected. These economic concepts were used in discussion about sustainable consumption and production, noise, waste management and food and agriculture.

Under UK government guidance, government intervention may be justified to tackle market failures, government failures, or to manage public risks (HM Treasury, 2003). Experience suggests that different instruments are appropriate for different forms of market failure (Perman et al., 2003). For example, market failures due to asymmetries of information may be tackled through interventions that improve the availability of information, such as mandatory business performance reporting through company accounts, or labelling schemes to improve information available to consumers. These results indicate that models of instrument performance from the environmental economics literature
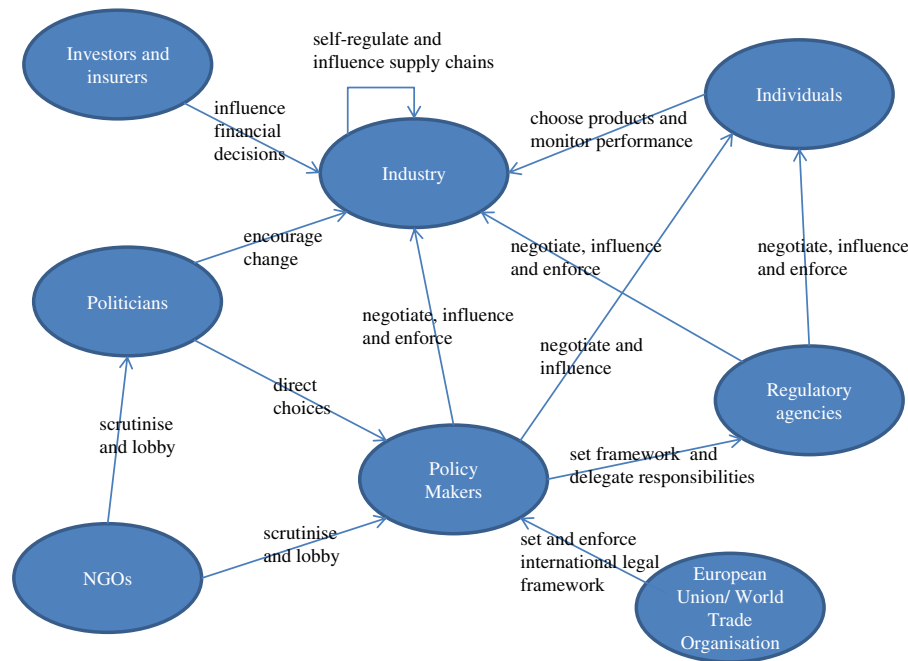
Fig. 2. Summary of key actors and interactions that policy makers consider during instrument selection.

(e.g. Perman et al., 2003) form part of policy makers' conceptualization of policy problems and rationale for instrument selection.

3.2.2. Use of risk concepts to explain instrument selection

23 of 33 interviewees discussed risk concepts extensively when discussing the selection of appropriate instruments, notably in the context of contaminated land, soil erosion, animal and plant disease control, climate change adaptation planning, chemicals regulation, flood risk management, reservoir safety and investment in infrastructure. Risk characteristics raised that reportedly influence the choice of instruments are summarised below (parenthesised numbers throughout indicate the number of respondents who commented on a theme).

Table 5
Summary analysis of other factors affecting choice of instruments.

Other factors affecting choice of instruments	Summary of respondent views
Cost (31)	Achieving cost-effective regulation was a central theme in all discussions. Benefit-risk trade-offs were discussed in regulation of contaminated land, soil erosion, animal and plant disease control, climate change mitigation planning, chemicals, flood risk management, reservoir safety and investment in infrastructure (e.g. for recycling). Benefit-cost tradeoffs were discussed in regulation of catchment sensitive farming, animal welfare, payments for ecosystems services (e.g. water companies paying land owners to prevent water pollution and agri-environment schemes), footpaths, forestry management, energy efficient products, waste reduction and resource efficient production.
European Union (EU) and World Trade Organisation (WTO) compliance (27)	The EU, and to a lesser extent the WTO, play a significant role in the choices made by policymakers in the UK, and policy makers, Non-Governmental Organisations (NGOs) and industry seek to influence policymaking at the EU level. While many policymakers feel constrained by the existing stock of EU regulations, others identified scope for flexibility in how EU rules are implemented nationally and believed that future EU policy design would make more use of approaches not solely based on direct regulation.
Industry and public preferences (19)	Views of industry and public reportedly influence the choice of regulatory approach through both direct formal engagement channels (e.g. industry advisory panels, statutory consultation processes), and indirectly through political influence (at a local, national and international level).
Political preferences (17)	Politicians reportedly play an active role in policymaking, often working directly with policymakers. The current government's preference for non-regulatory policy approaches featured in narratives of approximately one third of policy makers interviewed.
Fairness (12)	Interviewees raised fairness as an important characteristic of environmental policy or policymaking, primarily because regulations that are considered unfair are less likely to be accepted by stakeholders, who will make demands for change. Regulated industries reportedly value a 'level playing field', where businesses that comply with standards are not placed at a disadvantage by non-compliant businesses.
Impact on innovation (5)	One respondent emphasised that the use of best available technique requirements in licensing should not limit innovation. Instead regulators should be flexible in licensing to ensure that the intended environmental outcomes are achieved, while allowing the use of innovative technologies. Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation includes stimulating innovation within the EU chemicals industry as one of its three objectives.
Ethics (3)	One respondent argued that some supermarkets have identified that their customers want them to behave ethically, and that they therefore offer Fairtrade products. One believed that water companies had pursued ecosystem-based approaches to improving water quality for both cost and ethical/corporate social responsibility reasons. In the case of animal welfare, ethical considerations were considered to be central to how government policy has been designed and implemented; thinking has moved on from treating animals as property to treating animals as sentient beings.

Spatial characteristics (13): risks that vary spatially were argued to require approaches that include local assessment of risks (e.g. flooding, land contamination, diffuse pollution, biodiversity, chlorofluorocarbons (CFCs), river pollution), and may require national coordination or international agreements where impacts cross administrative boundaries.

Impact and likelihood of risk (13): higher impact risks were argued to require more certain regulatory measures to control them, normally assumed to be achieved through direct regulation (e.g. reservoir safety, chemicals, pesticides, air pollution, drinking water quality, release of invasive species).

Who is affected by risk (6): where the impact of a risk is constrained to the person or business causing the risk, it was generally argued that government need not intervene. However, where risks caused by one party impose impacts on others (e.g. the introduction of animal or plant disease) or where risks to society remain unmanaged (e.g. risks arising from climate change not managed by private sector organisations) it was argued that government intervention may be justified.

Number and variety of actors and mitigation actions (3): for problems involving multiple actors and risk mitigation actions (e.g. soil management, climate change adaptation planning, diffuse pollution) more complex regulatory approaches using a range of interventions targeted at different actors were reported to often be necessary.

Understanding of risk (6): risks that are not well understood (e.g. with respect to their sources in the case of diffuse pollution, with respect to impact in the case of land contamination and nanotechnology) may require different regulatory approaches compared to well understood risks. Interviewees discussed adopting a "precautionary approach" or seeking to establish a better evidence base before direct regulation is adopted as potential strategies to deal with a lack of knowledge about risks.

Persistence and irreversibility (3): some environmental risks may have impacts that persist in the environment for many years, or are irreversible (e.g. some chemicals, invasive species), in which case stronger controls to reduce residual risk were reported to be appropriate;

Speed of action required (3): where rapid government action is required to control the spread of animal disease after an outbreak, direct regulation was argued to be required, alongside planning and skills development to improve emergency response. Flood management also requires measures (e.g. emergency planning, flood alerts) to enable a rapid response.

An extensive literature exists on the relationship between characteristics of risks and the forms of regulation that are appropriate to manage them (e.g. Pollard et al., 2004). In concert, these results indicate that theories and concepts emerging from both economics (e.g Perman et al., 2003) and risk analysis (e.g. Kaplan, 1997; Short, 1984) are used by policy makers at Defra to conceptualize explanations for instrument selection, but to varying degrees by different interviewees. This could indicate, among other things, that economics and risk management theory are of varying relevance in different policy domains, or that expertise in risk analysis and economics is not spread evenly among policy makers, or reflects a deliberate avoidance of technical terminology to aid communication clarity.

3.3. Harnessing the influence of industry, civil society and government

Interviewees described a wide range of actors, characteristics of actors, and influences between actors that influence the effectiveness of instruments in practice. Table 4 shows the number of interviewees who discussed particular actor characteristics or interactions and provides a summary of how these factors reportedly affect the effectiveness of environmental policy and regulation.

Commentators argue that modern environmental regulation has been characterised by a shift from government (the State) to governance (formalised management, irrespective of actor), with policy makers increasingly seeking to harness the influence of non-governmental

actors to strengthen the effectiveness of interventions (see, e.g. Lange and Gouldson, 2010; Jordan et al., 2005; Gunningham, 2009). It is clear from these results that policy makers believe that the effectiveness of policy and regulation is affected by a wide range of social and political forces as summarised in Fig. 2. The extent to which these factors are relevant varies between policy domains. For example, large UK supermarkets driven by consumer preferences are considered powerful influencers of environmental behaviour in their supply chains. However, in other domains (e.g. local pollution control) consumer choice appears less relevant, where instead direct regulatory intervention and co-regulation feature more prominently.

3.4. Design objectives for policy and regulatory frameworks

3.4.1. Coherent mix of instruments

27 respondents discussed the interaction between instruments in a 'mix' as being an important factor in their selection and effectiveness in practice.

Instruments work in a complementary mix (14): respondents highlighted various examples of mixes in action. For example, the regulation of grass-burning uses direct regulation combined with a voluntary code; the Landfill Tax has worked in conjunction with the Landfill Allowance Trading Scheme (LATS; now discontinued) and infrastructure investment subsidies to improve waste management; and various instruments are used to reduce flood risk including development control and public awareness building.

Instruments interfere with each other (6): in some policy areas (e.g. fisheries policy and agriculture) respondents explained that existing regulatory frameworks needed to be simplified, to make them simpler and easier for regulatees to understand.

Instruments enable other instruments (7): cases of individual instruments enhancing the impact of existing instruments included introducing recognised standards in carbon footprinting and sustainable production, which could then be used to enable further measures such as procurement standards or differential taxation.

Instruments preclude other instruments (4): in other cases the existing regulatory framework can prevent the addition of new instruments, for example if existing direct regulation prevents additional direct regulation, or the scope for additional tax measures may be constrained by the existing tax system.

Policy makers need to work to coordinate design (12): Defra policies interact with other departments' policies, for example with the Department for Communities and Local Government (DCLG) and Department of Energy and Climate Change (DECC) on standards for domestic boilers, or with DCLG for planning policy that can affect future incidents of noise and nuisance (a Defra responsibility). While some coordinated policy was thought to have worked well, it remains a challenge in other areas.

Regulators need to work together to coordinate implementation (2): coordination is also required at the level of regulatory interventions. For example, the Environment Agency is a statutory consultee for planning applications managed by local authorities to assess flood risk impacts. Better coordination of inspections for farmers is an objective that has arisen from the Farming Regulation Task Force.

While early commentators tended to focus on the relative merits of individual instruments to tackle environmental problems, in recent years attention has turned to the design of complementary instrument mixes (Howlett and Rayner, 2007). The need for such mixes is widely recognised among the policy makers interviewed here. While the Tinbergen Rule would suggest that one instrument is needed for each policy target (Braathen, 2007), policy makers did not explicitly refer to the application of this rule in policy design. Policy makers report some successes in working together to coordinate the design of mixes across policy areas and departments, but for more complex policy areas understanding the existing mix in full remains a significant challenge.

3.4.2. Flexibility

21 respondents discussed ways in which instruments need to exhibit flexibility to remain effective as environmental and economic conditions vary spatially and temporally, and discussed ways in which this flexibility can be accommodated in design.

Incorporating flexibility to industry characteristics (7): respondents referred to the need to vary rules according to different industry characteristics. For example, the local pollution control regime has guidance for 80 different sectors. The use of licensing based on best available techniques allows regulators to be flexible to specific business circumstances.

Incorporating flexibility to environmental variation (4): interviewees identified examples where local environmental conditions vary, for example in fisheries, in land contamination, or in countryside biodiversity. As local environmental conditions vary, appropriate regulatory interventions also need to be varied.

Reducing regulation according to risk of business (6): at present, the Environment Agency can vary inspection charges and frequency depending on their assessment of the environmental risks posed by specific businesses. A similar approach described as 'earned recognition' is under consideration in farming, reducing government regulation if other inspection regimes are in place (e.g. under supermarket animal welfare schemes).

Using case law to refine regulation (2): one respondent described how in animal welfare, case law has been used to define acceptable treatment of animals, rather than attempting to define rules to cover all cases in statute which would have proved infeasible. In contrast, another respondent described the case of contaminated land, where case law has not proved an effective route to clarify legislation. In this case, UK legislation sets a test of "significant possibility of significant harm" to identify when land should be considered contaminated, and provides for statutory guidance to explain what this means. However, before 2012 statutory guidance did not provide this clarification, leaving regulators, businesses and other stakeholders uncertain over the definition and therefore the need for action. No cases went to court to provide case law to clarify the definition, partly reflecting fear among stakeholders of the implications of a single case decision for the management of other potentially contaminated sites. A clarification of statutory guidance by government has instead been necessary, giving greater legal certainty and creating conditions that might enable case law to further refine the test in future.

Modifying policy and regulation over time — flexibility vs certainty (11): policy makers discussed how policy can be changed over time as conditions change. In the case of the Courtauld Commitment, the flexibility afforded by this co-regulatory approach was seen by two respondents as advantageous, allowing objectives to change as government and industry understanding of environmental impacts improved. However, clear unchanging regulation was also reportedly advantageous, allowing businesses to make long term investment decisions. One respondent considered the Landfill Tax to have worked well because it provides long term certainty on the increasing cost of landfill. Balancing flexibility with clear long term signals is a challenge for policy makers. As one respondent put it:

"And it's that balance....there was a report from the Advisory Committee on Business and the Environment in the late 90s and that said businesses want both certainty and flexibility. I quote that back at business from time to time and they say yes that's right. One minute they'll be asking for one and the next they'll be asking for the other."

These results indicate that accommodating flexibility while providing clarity and certainty for businesses is a significant challenge for Defra policy makers. Some considered the flexibility afforded by co-regulation to be a significant advantage of this approach. Extending the use of 'earned recognition' is an active area of policy development, particularly in farming.

3.5. Social, legal and political preferences and constraints affecting instrument selection

In addition to the factors affecting effectiveness and instrument design considerations highlighted above, respondents discussed a range of other considerations that influence the choice of instruments. The frequency of these factors being raised is described in Table 5. A lower number of coding occurrences cannot be interpreted as reflecting a lower level of importance being placed on that factor by Defra corporately. For example, the relatively low frequency of explicit discussions of 'ethics' does not indicate a low level of concern about ethics at Defra; only that ethical considerations were explicitly prioritised in discussion in a relatively small number of policy contexts.

In addition to its effectiveness in achieving environmental objectives, environmental policy and regulation will also be assessed in terms of its economic/financial and social impacts (BIS, 2011), and these considerations were reflected in policy makers' narratives. Given the strong emphasis placed by commentators on the importance of technological innovation to address social and environmental challenges and the potentially deleterious effect of direct regulation on innovation (e.g. Gunningham and Sinclair, 1999), it is perhaps surprising that innovation was not discussed more frequently by policy makers. However, technology innovation is perhaps less relevant in some Defra policy areas than it is in the areas where it was mentioned, notably those concerned with production and use of technology such as REACH and pollution control.

3.6. Impact of the state of knowledge upon instrument selection

27 respondents referred to the role that evidence (or the lack of evidence) plays in instrument selection and the strategies adopted to enable effective policy and regulation under conditions of uncertainty.

Research and policy evaluation (23): many policy areas identified government research as an important mechanism for increasing society's capacity to understand and manage environmental risks. Some policy makers expressed confidence in the quality of evaluation evidence available for regulation in their policy areas, whereas others found evidence to be lacking. For some, policies had not been in place long enough to show their impact. In others, measurement of impact was considered to be very challenging.

Evidence may be contested (7): interviewees noted cases where evidence of harm may be contested, which can reduce regulatee's willingness to comply with regulation based on the evidence.

Strategies for dealing with uncertainty — gradual policy development (7): interviewees discussed how the impetus for government action on some issues gradually increases over time, so the initial government response to an emerging issue may be limited to seeking further information or producing a position statement. For example, one respondent highlighted the gradual hardening of smoking regulation over time as public attitudes and evidence have evolved. Another characterised the development of global cooperation on illegal fishing as follows:

"…my experience of that was that you get like a zeitgeist effect. You know government is doing something on illegal fishing, Sainsburys and Marks and Spencers and Waitrose get interested… someone on TV…internationally…an NGO does it; and we all feed each other so you get that movement together…is it business already doing it or is it government? Probably in the real world these things feed off each other."

Strategies for dealing with uncertainty — adopting a precautionary approach (4): respondents described the regulation of nanomaterials, aspects of chemical regulation under REACH, and of land contamination as "precautionary", where hazards are known to exist but the risk is unknown. Respondents described a case by case approach to assessing the controls required for specific nanomaterials and chemicals. In land contamination, site-specific assessments need to be undertaken

effectively, requiring a suitable regulatory framework and measures to inform the decisions of individual regulators through knowledge sharing and capacity building.

Strategies for dealing with uncertainty — co-regulation (6): respondents noted that co-regulatory approaches can be beneficial where evidence is lacking or contested. For example, some voluntary programmes for improving the sustainability of products have initially focused on establishing an agreed evidence base and building buy-in from businesses, so that then improvement targets can be agreed. A new 'catchment based approach' for regulating water pollution and use reportedly shares similar features, where evidence is shared and solutions brokered between stakeholders within a river catchment, to create a collective understanding of issues and ownership for changes required.

According to commentators, the quality and availability of evidence on which to base policy and regulatory design are expected to be a central concern for policy makers seeking to implement 'evidence based policy' (Solesbury, 2001). Jones (2007) has identified a range of policy responses to uncertainty, ranging from simply acknowledging uncertainty through to 'adaptive management'. It is clear that for the policy makers interviewed, the quality and availability of evidence to inform policymaking have a direct impact on the choice of regulatory instruments deployed. Evidence may however be lacking, or contested. In some cases, a gradual approach to developing policy as evidence develops has been adopted, whereas in others where hazards are known to exist but risks are unclear, a precautionary approach has been selected. Policy makers have argued that their capacity to gradually develop consensus around accepted evidence and thereby bring about behaviour change is an important advantage of co-regulatory approaches (notably for improving the sustainability of products and in catchment based planning).

3.7. Capabilities for effective policymaking

Nineteen respondents alluded to skills and processes that affect the effectiveness of the regulatory reform process. Some emphasised the difficulties in understanding the operation of the human and environmental systems to be influenced and highlighted a lack of tools to improve understanding. Unintended consequences of government intervention can result, which then need to be addressed. As one interviewee put it:

"…you do some research on a problem, you find what you think is a solution, you come up with the policy instruments. Others think the same thing, everyone's prepared to go for it. You go for it. You've got to find out if it works or not and what the unintended consequences were because otherwise, you know, there's a reputational risk if you want to suggest something else next time. You then need to follow up to see if there are unintended consequences that… make things worse because you either need to stop using the policy instrument or you need a mitigating one."

Two interviewees highlighted the Defra policy cycle (Collier et al., 2010) as an iterative process from which to learn (Fig. 3). One interviewee argued that adopting a cautious, incremental approach to regulatory reform may well be a sensible strategy to deal with uncertainty and unintended consequences. This approach to policy making had been described in a 1970s public policy article as "the art of muddling through", and the interviewee felt that that description of policymaking "very often still holds".

Three respondents argued that policy makers and regulators would need new skills in order to establish community- or industry-led regulatory approaches in line with current political priorities. One commented:

"the more you're taking a voluntary or big society or working with industry approach, the more you need to be able to have the softer skills and working with people. The really challenging thing is trying to get people to believe it's in their interest to actually be doing this particularly if they don't think it is in their interest… part of it is being able to admit when government doesn't
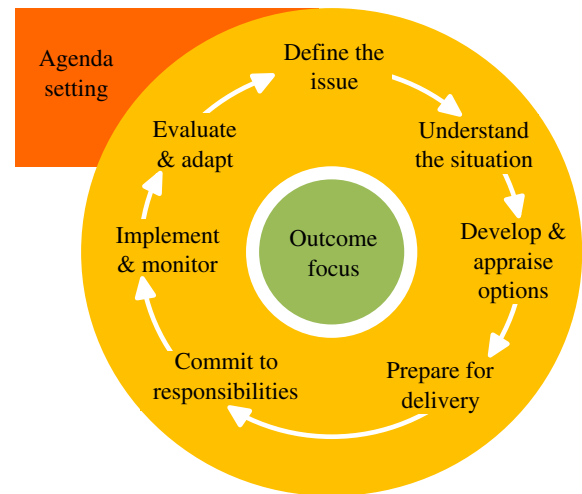

Fig. 3. Defra's policy cycle (Collier et al., 2010).

necessarily have all the answers which I think is a bit of a culture shock for some people."

Seven interviewees discussed the need to think broadly and laterally when considering the design of new policy. Working across policy domains to share experience and ideas was thought to help encourage creative thinking. One interviewee felt that the list of policy options provided for the interview was useful because it provided a more detailed explanation of variants than is often discussed and could act as a useful prompt, although another thought it was perhaps too detailed and could discourage policy makers from thinking imaginatively about options. For this interviewee, good policymaking required the policy maker to "look at each in case with its merits, think broadly, rule nothing out and use your nouse."

While various processes and procedures (e.g. regulatory impact assessment) have been introduced to improve the quality of decision-making for regulatory reform, some commentators argue that good policymaking and regulation remains a craft (notably, Sparrow (2000)). This analysis illustrates the wide range of skills and processes that policy makers need to bring to bear in the process of instrument selection, particularly as new forms of regulation that depend more heavily on business and civic actors are introduced.

4. Better instrument selection for environmental regulatory reform

This analysis reveals the complexity of the challenge faced by policy makers in their efforts to reform environmental regulation. Policy makers' choices of policy and regulatory instruments are influenced by the suitability of instruments to tackle the intended policy objectives and targeted environmental risk characteristics, the range of policy instruments used previously in practice, the strength of factors enabling instrument effectiveness in the policy context, instrument design characteristics delivering coherence and flexibility, and a range of social, legal and political factors. Policy makers' state of knowledge about these decision inputs, and their capabilities in effective policymaking, mediate the final choices made (Fig. 4).

It is apparent that to suggest that the task of the policy maker is simply to select the right intervention from the list using a stable set of rules would be a gross simplification of reality and would reflect outmoded faith in the role of "decision support systems" popular in earlier decades. Policy makers must inter alia seek to understand the current experience of the regulated, attempt to predict how actors will respond in a particular context to particular interventions, and search out opportunities to use existing actors and relationships to achieve their objectives. A piece-meal approach to regulatory reform
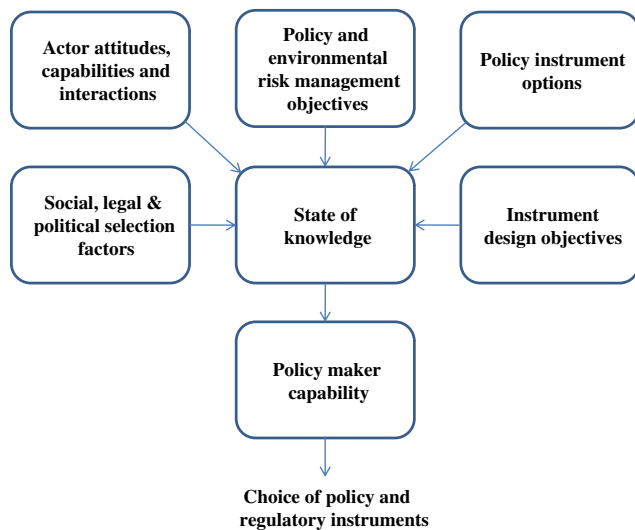
Fig. 4. Summary logic model of instrument selection emerging from this research.

based on analysis of instruments in isolation is likely to prove inadequate. An approach based on industry engagement (e.g. Farming Regulation Task Force) may provide a method to highlight cumulative burdens and also the coherence of policy mix.

Policy maker expertise in both economics and risk analysis is necessary, and an exchange of concepts between specialists may prove beneficial. Policy makers also expressed considerable interest in the insights provided by behavioural economics, reflecting recent interest across the UK government (e.g. Dolan et al., 2010). This research suggests that behavioural research (or "insights") can inform all regulatory design, so to see behavioural interventions as a separate class of regulation is to underplay the breadth of their application. However understanding of how they can be applied is at an early stage, and their relevance to business regulation remains unclear. Further understanding of the subtleties of regulatory practice, including the use of threats, knowledge exchange, and the role of credibility will help address this gap.

Policy makers may be assisted in their task by cross-government regulatory reform programmes, such as the Red Tape Challenge (Cabinet Office, 2012a). Specifically, such programmes can bring to bear resources and political influence to change the complex network of interactions that affect environmental behaviour. They can also include well-publicised programmes of public consultation to seek views on where and how regulatory reform could reduce burdens on business and the public. The Red Tape Challenge programme includes a public website that lists all current legislation and invites businesses and the public to 'fight back' to help 'free up business and society from the burden of excessive regulation' by identifying 'what should be scrapped, what should be saved and what should be simplified' (Cabinet Office, 2012a). The tone of publicity for the review programme has raised concern among pro-environmental groups (see, e.g. The Royal Society for the Protection of Birds (RSPB), 2012). A regulatory reform programme driven simply by a public vote on which regulations to change or remove would risk removing elements from this network of influences in ways that undermine cumulative environmental protection in detrimental ways, unanticipated by voters. However, the Red Tape Challenge programme also incorporates other elements of public and industry engagement, political scrutiny and policymaking by expert practitioners (Cabinet Office, 2012b); elements which this analysis suggests are all essential for effective policymaking. While the long term impact of the recently completed environment element of the Red Tape Challenge review (Defra, 2012) cannot yet be assessed, the Environmental Data Services (ENDS) Report summarises opinion among stakeholders that initial fears of a 'bonfire of environmental law' appear to be 'overstated', with recommendations focusing on merger and simplification of existing rules (ENDS, 2012).

5. Conclusions

This research has gathered new evidence of the factors that influence which instruments are effective in delivering their intended environmental outcomes in which circumstances, and why this is the case. It also provides insight into the realities of policymaking by practitioners, and the skills and tools required for the regulatory craft.

1) The refined typology of instruments (Annex A) provides a comprehensive summary of policy and regulatory instruments from which policy makers may choose, but does not express how instruments work together in a mix. The typology may prove most useful as a stimulus for policy makers considering options for regulatory reform and provide a framework for organising evidence of what works when and why;
2) The effectiveness of instruments in practice was reported to be influenced by a wide range of interactions between government, industry and civil actors, and by their respective motivations and capabilities. The relevance and strength of these factors vary from one policy context to the next, so the feasibility of using a given instrument depends on the policy context. The design of instruments, particularly with respect to their coherence in a mix with others and their flexibility to accommodate variations in actor and environmental characteristics, was also reported to influence their effectiveness;
3) Interviewees generally considered direct regulation to be necessary in circumstances where high impact public risks occur. The scope for the use of alternative approaches to direct regulation reportedly depends significantly on the strength of supply chain relationships, the capacity of the regulated sector to self-regulate, the strength of political commitment to regulation, and the exposure of businesses to public and NGO scrutiny. For some sectors regulated by Defra conditions for effective co- and self-regulation reportedly exist. However in others the scope for self-regulation may be more limited. One emerging advantage of a co-regulatory approach over law-based direct regulation is reportedly the ability to accommodate changes in direction as knowledge about the nature of environmental problems improves.
4) Policy makers described iterative approaches to policy and regulatory design, taking place under conditions of significant uncertainty and influenced by social, legal and political factors. The accounts of practitioners highlight their need for a wide skill set to design effective policy, including social science expertise in economics and risk analysis, organisational design, and softer skills in negotiation, openness to new ideas and alertness to new opportunities for alternative approaches. Hard rules to direct optimal instrument selection appear very difficult if not impossible to define; at best 'rules of thumb' can be identified. The recurring factors identified that influence instrument selection (Fig. 2 and Tables 4 and 5) could form the basis for a more systematic approach to analysing instrument mixes for regulatory reform, although its utility for policy makers remains untested.

The analysis presented here is limited to the perspective of government policy makers. Regulated businesses and regulatory agencies have first-hand experience of the nuances of regulatory interactions, analysis of which would complement this research. Further qualitative research will examine and contrast these perspectives.

Acknowledgements

Appendix A. Revised version of instrument typology reflecting comments made during interviews.

Table A1
Refined version of instrument typology in detail (modifications emphasised in grey).

Type	Variant	Description	Example applications
Doing nothing	–	Government chooses not to act as policy objectives will be achieved without government intervention.	–
Direct "command and control" regulation	Ambient pollution requirements	The regulator specifies required maximum levels of ambient pollution, allowing flexibility to polluters to decide how to achieve that level. In the EU, ambient targets have been set within EU directives, which members states tackle through their national policy mix	Water quality targets, air pollution targets
	Input restrictions and output quotas	Restrictions are applied in the use or output of products. If a material or practice is considered to be sufficiently harmful its use may be restricted or banned entirely, with penalties enforced for violations of the ban. Where banned materials remain in use, their disposal will need to be carefully controlled.	Restrictions in pesticide or fertiliser use, restrictions in production of potentially harmful chemicals
	Non-transferable emissions licences	Typically a regulator issues a non-transferable licence, in the UK often referred to as a permit, to a business that gives authorisation to operate according to specified environmental performance requirements, for example maximum permitted levels of emissions. The regulator monitors the operation to ensure compliance, and may enforce penalties for non-compliance. Conditional exemption from regulation (e.g. exemption from inspections in response to good performance) can also act to incentivise behaviour change.	Controls on emissions to air and water, controls on waste production and disposal
	Technology and process controls	The regulator sets environmental performance objectives and specifies or agrees appropriate processes or abatement technologies with industry. Variations of standards include application of "best practicable environmental option" (BPEO), "best practicable means" (BPM), "best available techniques not entailing excessive cost" (BATNEEC) and "best available technique" (BAT).	Mandatory use of catalytic converters in road vehicles, use of specific pollution abatement technologies, application of process standards (e.g. for animal housing and husbandry)
	Zoning/ location controls	Human impacts on the environment in a particular area can be controlled through spatial controls, which can be used to mandate practices in a given area, locate polluters away from people and sensitive ecosystems, to prevent clustering of harmful activities, or (less commonly) to move people away from sources of harm.	Low emissions zones in urban areas, building development controls, national parks and conservation areas, controlled fishing zones, marine conservation areas, nitrate vulnerable zones
Economic instruments	Taxes and subsidies	Environmental taxes and subsidies operate by changing the market price of a good or service, reducing or increasing the quantity demanded and supplied in the market	Taxes on emissions to air, land, and on resource use. Subsidies to support renewable energy
	Tradable rights	Tradable rights systems work by specifying a quantity of allowances, eg to abstract water or to emit carbon, which can then be traded amongst users. The system is designed to create an opportunity cost of using an allowance, and therefore also creates benefits from not using an allowance. Trading allows market actors to find the allocation of allowances that maximises the cost-effectiveness of using the allowance	Individual tradable quotas for fisheries, water abstraction rights, emissions trading eg for CO_2, SOx, discharge to water
	Payments	Conditional payments may be made to incentivise a particular activity. 'Payments for Environmental Services' (PES) involve beneficiaries (state or private) paying ecosystem managers for the benefits delivered by those ecosystems.	Agri-environment payments, conservation payments, deposit return payments
	Insurance	A business or individual may pay a premium to an insurer who in exchange will provide a payment should an event take place. Government may assign liability for damage to people or the environment creating the need for insurance (e.g. mandatory third-party insurance for vehicle drivers, environmental liability insurance), and may seek to ensure that the commercial insurance market is able to provide insurance for risks in lieu of government compensation.	Flood insurance, Livestock disease insurance
Information based instruments	Targeted information provision/ education	Information is made available by public or private bodies to enable businesses or individuals to make better-informed decisions that impact upon the environment.	Training programmes, advisory bodies (eg UK Carbon Trust and Energy Savings Trust)
	Naming and shaming/faming	Information is made available describing the environmental performance of businesses, through for example a publicised inventory of toxic emissions, with the intention of incentivising better environmental behaviour through avoided damage to or enhancement of corporate reputation.	Emissions inventories, public accolades and prizes, adverse publicity associated with prosecutions
	Registration, labelling and certification	Typically information describing the environmental performance of the businesses delivering a product or service is made available to consumers using a product label, enabling consumers to choose products with better environmental performance.	Food labelling, electrical product labelling
	Codes of practice	A set of rules or conventions describing good practice. May be used to clarify good practice to accompany mandatory rules.	Heather and Grass Burning Code

Table A1 (*continued*)

Type	Variant	Description	Example applications
Co-regulation and self-regulation	Voluntary regulation	A group of businesses, often organised through a trade association, chooses to apply environmental performance standards as a condition of membership of an industry group.	Responsible Care Initiative in chemicals industry
	Covenants and negotiated agreements	In this approach government makes an agreement with target businesses to achieve particular standards, which forms a contract and may incursanctions if the contract is not met. This may be enforced through inspection by non-government regulators.	Packaging reduction agreements, recycling agreements, pollution reduction agreements
	Private corporate regulation	Businesses may choose to apply environmental standards both within their organisation and along their supply chain, so that the purchasing business is effectively acting as a regulator of suppliers' performance. Government may enforce procurement standards that then propagate along supply chains.	Food retailer sustainability programmes, government procurement requirements
	Private professional regulation	A professional body acts to apply standards through conditions of membership.	Membership of professional bodies
	Self-regulation	Businesses may choose unilaterally to apply environmental performance standards, for example by adopting an externally monitored standard such as ISO14001 or EU EMAS, or as a feature of corporate social responsibility commitments.	Environmental management systems, unilateral commitments to good performance
	Civic regulation	Civic organisations, for example conservation charities or local community groups, may apply pressure to businesses to improve environmental performance through scrutiny of their behaviour and publicising good or bad performance.	Activities of NGOs and community groups
Support mechanisms and capacity building	Research and knowledge generation	Governments or other actors may undertake research to increase knowledge that informs better environmental decision making.	Funding of university research
	Demonstration projects and knowledge diffusion	Governments may choose to invest in demonstration projects to demonstrate feasibility, raise awareness and reduce risks of new technologies or processes. This investment could be managed through a specially designed investment institution, such as the UK's planned Green Investment Bank.	Carbon capture and storage, sustainable agriculture practice, eco-homes and buildings
	Network building and joint problem solving	Initiatives designed to encourage people to exchange ideas and learning to improve environmental performance.	Discussion groups, conferences, networking events

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