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Developing an evidence-based approach to environmental policy making: insights from Defra's Evidence & Innovation Strategy

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Developing an evidence-based approach to environmental policy making: insights from Defra's Evidence & Innovation Strategy[1].

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Abstract

Over the past ten years the literature on evidence-based policy making has paid increasing attention to the need to focus not only on *what* evidence is supplied to the policy process, but also on *how* it is supplied and the nature of demand for evidence from policy makers. This paper draws on such academic perspectives as well as experiences at the UK Government Department for Environment, Food and Rural Affairs (Defra) to offer some insights about environmental policy making and evidence processes. We begin by analysing the drivers of change that have come to condition the types of evidence supplied to policy makers, concluding that the composition of the evidence base for environmental policy is broader and more complex than can be delivered by purely research-based approaches. This analysis is supported by the wider shift from the 'Mode 1' to the 'Mode 2' paradigm of knowledge production[2]. The background sets the context within which we trace the process of developing and conducting Defra's Evidence & Innovation Strategy; a systematic attempt to realign the Department's needs for evidence with its business and policy priorities. The insights from this process lead us to propose four principles of environmental evidence-based policy making. These are offered alongside a framework which better reflects the organisational realities of environmental policy making in the UK and lends itself more readily than existing frameworks to tangible implementation in a fast-paced and rapidly changing policy environment. The framework and the principles help articulate the links between the concept of public value and the Mode 2 paradigm; but demonstrate the paucity of the tools that policy makers can use to respond to the Modernising Government agenda.

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[1] This paper represents the authors' personal reflections with the benefit of several years' worth of hindsight, and should not be construed in any way as Defra policy. We are grateful to Donald Macrae for insightful comments on earlier drafts.

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[2] Mode 1 and Mode 2 were first defined by Gibbons *et al* in 1994. Mode 1 refers to "the old paradigm of scientific discovery...characterised by the hegemony of theoretical, or at any rate, experimental science; by an internally-driven taxonomy of disciplines; and by the autonomy of scientists and their host institutions, the universities...(Mode 2 referred to)...a new paradigm of knowledge production, which was socially distributed, application-oriented, trans-disciplinary, and subject to multiple accountabilities." (See Nowotny *et al*., 2003).

Introduction

The Department for Environment, Food and Rural Affairs (Defra) was formed in 2001 following machinery of government changes which brought together the Ministry for Agriculture, Fisheries and Food (MAFF) with parts of the former Department for Environment, Transport and the Regions (DETR) and the Home Office. At a time of steadily increasing concern about climate change and environmental limits Defra articulated its overall goals in terms of environmental leadership and sustainable development[3]. Its remit as a Department concerned with "enabling everyone to live within their environmental means" leaves little doubt as to this primary focus. From the beginning therefore, its agenda has been closely concerned with a number of long-term, multi-dimensional (economic, environmental, social and political) challenges such as climate change, air pollution, water resources, sustainable agriculture and fisheries, and waste management.

Given the scale of today's environmental and sustainability challenges, Defra's remit is ambitious and broadly defined; requiring complex processes to define goals, set targets, devise policies and deal with trade-offs with other policy areas. A strategic exercise to identify future evidence needs[4] noted that new policy instruments to promote change in the behaviour of producers and consumers, as well as innovation in technologies, will be required in coming years. The interdisciplinary nature of these long-term challenges means that the evidence needed to underpin policy must also be broad, long-term and interdisciplinary[5].

In the autumn of 2004, the Science Strategy Team in Defra embarked on a programme of work entitled the Evidence and Innovation Strategy (E&IS). This programme was intended to systematically realign the Department's evidence needs around its five Strategic Priorities and eighteen Strategic Outcomes that had been identified in Defra's 5-year strategy (see Defra, 2004b). The E&IS was an exercise designed to review Defra's £325M knowledge investment and plan for the future. It quickly became an exercise that also had to come to terms with how policy makers were tackling a rapidly developing policy agenda; a complex legacy in terms of processes, budgets and stakeholders; and multiple perspectives on what constituted its future needs for evidence & innovation. The E&IS gained significant external support[6], and moreover highlighted the need for *practical* ways of working and incorporating evidence

[3] Defra, 2004a.
[4] Defra 2004a p26
[5] For example, the Defra 10 year strategy document noted the urgent need to strengthen long-term policy appraisal capabilities to inform current policy decisions on issues such as electricity generation and the housing stock. Defra (2004a) p20.
[6] See, for example, the OSI review of Defra science http://www.berr.gov.uk/files/file35751.pdf.

into the policy process. This journey; its drivers, challenges, techniques, processes and findings; are discussed in this paper.

Understanding and utilising the evidence base is a particular challenge to policy makers. In order to use evidence to identify and appraise policy options in a dynamic and changing social, political, environmental and technological context, they require processes for acquiring and using evidence which can handle this degree of complexity. Cabinet Office or major Departmental strategy reviews are able to perform this function periodically; and policy makers have a suite of tools with which to fulfil evidence needs for the ROAMEF-type policy cycle[7] such as cost-benefit analysis, impact assessment and feedback in the form of formal written consultations. Individually, these tools are able to deliver discrete aspects of the evidence base. However, based on our experiences with Defra and the Evidence & Innovation Strategy process we argue that even taken collectively they do not allow policy makers to develop the types of strategic knowledge needed to ensure that the appropriate evidence base for policy making is continuously available. Furthermore, they do not provide sufficient scope for the dispersed and multi-disciplinary types of knowledge that dominate the evidence base and characterise the Mode 2 paradigm (Gibbons, *et al*. 1994).

We believe that accounting for this paradigm shift is a necessary part of successful environmental policy making in Government. By firstly tracing the theoretical and conceptual inputs to the E&IS, and secondly its analytical development and practical framework, we argue in this paper that a new approach to evidence-based policy making is needed which focuses not only on the particular actions that are taken in support of evidence-based policy development but also on the ways that they are carried out. The approach we propose bears closer resemblance to fluid knowledge management frameworks than the more traditional and linear 'research-flows-into-policy' model[8]. We argue that while it is impossible to prescribe a particular set of actions that make up 'evidence-based policy making', there are four underlying principles which need to inform the tools we use in the day to day business of Government. Such tools need to be driven by the need for policy-relevant evidence rather than simply the need for high quality evidence; they need to recognise multiple interpretations of evidence from a variety of stakeholders and do so openly and transparently; they need to encourage the entire policy process to spend more time looking to

[7] Rationale, Objectives, Appraisal, Monitoring, Evaluation, Feedback. See *A Department's policy-making function: a typical model.* p23 in NAO (2001).

[8] See Bielak *et al* (2007) who argue that the changing contexts within which information is received and used in policy require relationships between science and policy which have a greater focus on 'demand-pull' from policy than on 'supply-push' from science.

the future; and they need to recognise and promote the various ways Government fosters innovation.

Combining these principles with the insights gained from the E&IS process and an analysis of the changing drivers of environmental policy making, we ultimately draw out a functional framework for evidence-based policy making which reflects the reflexive and non-linear nature of the policy process. In doing so we also break away from the concept of a policy cycle; long used in the UK Government and elsewhere to describe the way that a policy is developed[9]. We believe this allows a more accurate reflection of the "loose, shifting and contingent" relationships between research and policy (Nutley *et al*, 2002, p9). The implications for how evidence-based policy making is practiced deep within Government remain an overarching focus of this paper.

Drivers of change in the evidence base for environmental policy[10]

We begin our analysis of the drivers of change in the evidence base for environmental policy in Defra with the starting point for the E&IS itself: a discussion about the growing awareness within the UK government over the past ten to fifteen years of the important role of evidence in policy. This has led to an increasing recognition within government of the long-term and complex environmental impacts of a wide range of policies. We begin by bringing out what appears to be a disconnect between the literature on evidence in environmental policy making, and the wider Modernising Government agenda which shapes how policy makers behave, individually and collectively, as they source and use evidence. We then introduce an overview of some of the major drivers of change in environmental policy making we believe have significantly affected the way environmental policy was conceived within Defra. These lead us to propose some practical implications of evidence-based environmental strategy and policy making that set the development of the E&IS in context.

Drivers of change: the role of an evidence base for policy

From our point of view, the major change in the literature on evidence-based policy making over the past ten years has been a shift in its focus: from supply to demand. With regard to the supply side, and especially in respect to environmental issues, the past decade or so has seen policy making take on board a greater range of types of evidence (Bochel & Duncan,

[9] See www.policyhub.gov.uk and linked pages.
[10] This section does not pretend to offer a formal academic analysis, although it clearly draws on past and current thinking from the policy and academic literature. However it represents an "inside" view, which we suggest is sometimes missing from academic discussions.

2007). While biological and physical sciences have traditionally been the principal sources of UK policy makers' knowledge about the environment (see, for example, Sutherland *et al.*, 2006), these relatively limited sources are increasingly complemented by evidence from the social sciences and economics.

This broadening in the types of evidence supplied for policy has been complemented by an understanding (reflected within wider literatures on policy making) that research is only one dimension of policy-relevant evidence (see Nutley *et al.*, 2007; Brand & Karvonen, 2007). There is also a demand function within policy making which conditions the uptake and use of multiple types of evidence (Nutley *et al.*, 2007, Sarewitz & Pielke, 2007). However, with regards to environmental policy making this demand function is not well described, either in academic analyses or within government. While various models of the policy process attempt to assess the impact that the supply of research has on policy (see Shaxson, 2005), little practical work exists which establishes what an effective demand for robust evidence actually means in practice (McNie, 2007). Sarewitz & Pielke (2007, p5) note that reconciling this is "the neglected heart of science policy", and McNie (2007) observes that more work needs to be done to analyse the demand for science in policy making[11]. In part, we believe that this lack of practical analysis of what constitutes 'policy demand for evidence' results from a lack of attention to the internal drivers of evidence-based policy making – a point we return to at the end of the paper.

There appears to be a general consensus that, in the UK, the emergence of the evidence-based policy making movement can be traced to the election of the Blair government in 1997 and its stated concern with 'what works' (Davies *et al*, 1999, Solesbury, 2001). It is not new, however; and in the introduction to their recent book, Bochel & Duncan (2007) provide a clear timeline; tracing the rise of a general concern with the use of evidence in policy in the 1960s and 1970s, through the Conservative governments of 1979 – 1997, to its clearest expression in the *Modernising Government White Paper* of 1999. In that year the Cabinet Office's Strategic Policy Making Team published a guidance document titled *Professional policy making for the 21st century.* This set out the nine core competencies of better policy making[12], and it has – for the past decade – clearly influenced policy making. What are often referred to as 'the nine principles', have filtered through into internal training programmes on policy processes, and informed the creation, in October 2005, of the *Professional Skills for*

[11] As we began work on the E&IS in 2004, this analysis was non-existent – though as will be seen, the focus on policy demand was in fact its central plank.

[12] These are: forward looking, outward looking, innovative & creative, using evidence, inclusive, joined up, establishes the ethical and legal base for policy, evaluates, reviews & learns lessons. See Bochel & Duncan (2007) for an analysis of each one.

Government (PSG) agenda. This identifies a skills framework which forms the basis for annual reporting and career progression; one of the core skills being 'analysis and use of evidence'[13]. At the same time, the Cabinet Secretary instituted a rolling series of Departmental Capability Reviews which focused attention on the sets of skills Departments need to adequately deal with current and future challenges. It focuses in three areas: leadership, delivery and strategy. "Base choices on evidence" is one of the three sub-themes under the latter[14].

Discussing the net effects of these three major pan-Government initiatives, Bochel & Duncan (2007, p215) note that there is 'considerable scope for further coherent and collective action on the ideas that they … seek to promote.' We suggest that this abstract set of demands on policy makers helps increase rather than reduce the disconnection between the theory and practice of evidence-based policy making. What define the *practice* of evidence-based policy making are the competencies that policy makers are expected to exhibit to progress in their careers – as outlined for individuals in the PSG competencies wheel and for teams and Departments as a whole in the Capability Review criteria. We suggest that while some theorists may see the Modernising Government agenda as a far-reaching undertaking on the part of Government, in practice it may be interpreted by policy makers simply as a commitment to comply with existing processes.

Against this backdrop, the next section sets out specific drivers of change in environmental policy making which have directly affected the pressures on Defra's policy makers. From broad changes in the way environmental policy is conceived, we identify issues that have emerged around environmental limits, technological innovation and stakeholder engagement. Each of these uniquely affected the design of the Evidence & Innovation Strategy and arguably our final conclusions about the principles underlying environmental evidence-based policy making and the ways in which we can embed the use of evidence in the policy process.

Drivers of change: modernising environmental policy making

At the same time as the Modernising Government agenda was beginning to take effect across Government, Defra came into existence. The greater political weight given to the environment from the late 1990s onwards fed through to a pan-Government emphasis on environmental issues and Defra's unambiguous goal of "Delivering the essentials of life: air,

[13] See the PSG 'competencies wheel' and related pages at http://www.civilservice.gov.uk/iam/psg/skill_selection.asp.
[14] See http://www.civilservice.gov.uk/about/accountability/capability/tools/model.asp and linked pages.

water and food"[15]. However, Defra remains more of an influencing rather than a delivery Department. Others hold important policy levers, and it works with arms-length bodies such as the Environment Agency, Natural England, and the Carbon Trust for implementation. As a central Department, Defra creates policy and strategy, working closely with other Departments to develop goals that are made increasingly complex by the changing (and itself increasingly complex) nature of environmental policy.

The main change over the past decade has been the real absorption, by policy, of the weight of evidence suggesting that many environmental impacts are long-term in nature (e.g. flood management, marine acidification), increasingly cross-disciplinary (e.g. biosecurity policy, sustainable consumption and production), with a greater focus on issues which cross traditional Departmental remits (e.g. policies for water management in built-up areas) and with multiple external stakeholders (e.g. the development lobby). Unavoidable climate change is the overarching issue in all of this, affecting the potential impacts of specific policies while simultaneously increasing the complex web of relationships between them.

There are three aspects to how this change has manifested itself. The first is the development of international assessments; notably on climate change, ecosystems, and science & technology for agriculture[16]; which combine modelling, forecasting and interdisciplinary expert analysis (see Watson, 2005). These serve to build international consensus on strategic challenges and priorities for action, and help frame the role of national policy makers. The second consists of the changing priorities of the body of publicly-funded environmental research in the UK. The rise of interdisciplinary research programmes such as the Living With Environmental Change initiative[17] is in its early stages, but the simple fact of its creation as an interdisciplinary body funded between several Research Councils testifies to the new ways in which large parts of public sector environmental science are defined, sourced and managed.

However, in this paper we are more concerned with the third aspect: how the changing nature of the evidence required for environmental policy and the increasingly complex relationships between environmental issues have affected everyday policy making processes at the

[15] This was Defra's goal as set out in its first five year strategy (Defra, 2004a). This goal has now changed in its wording (see p1), but is arguably still focused on key areas of environmental concern.
[16] See http://www.ipcc.ch/ (climate change), http://www.millenniumassessment.org/en/index.aspx (ecosystems), http://www.agassessment.org/ (science & technology for agriculture).
[17] See http://www.nerc.ac.uk/research/programmes/lwec/

Departmental level. We focus on three specific drivers which we believe have affected the way Defra conceives of evidence-based policy: environmental limits, the role of challenge and external stakeholders in policy development, and technological change and innovation.

We close this introductory section by noting the some practical challenges for embedding an interdisciplinary approach to the evidence base, drawing conclusions for the policy making process as a whole within Defra. This discussion sets the context for the development of the E&IS.

Environmental limits

The concept of environmental limits gives collective purpose to what otherwise might be seen as a group of separate policies. Issues such as resource constraints, pollution sinks and irreversible biodiversity loss have driven environmental priorities deep into mainstream areas of policy making such as energy supply, housing and planning, transport infrastructure, and agricultural production; in addition to less immediately obvious areas such as international relations and defence (see, for example, Haines-Young *et al*, 2006). Further reflecting the growing importance of environmental limits in policy making is the indication (although the methodology is still contested and the evidence uncertain[18]) that the country's global environmental footprint is becoming an important consideration for policy makers in areas that may previously have been more UK-centric, such as waste policy.

The implications for evidence production and policy making have been clearly felt, though they do not translate readily into a clear set of guidelines for policy makers. Incorporating environmental limits into policy means improved long-term policy forecasting and appraisal, and increased engagement with other parts of Government in a variety of disciplines, not just the natural sciences (in particular economics, given its status within the decision-making process[19]). The creation of joint targets offers an opportunity for improved joint working, but poses a challenge for policy makers as they attempt to manage disparate evidence bases across Departments and reconcile different Departments' policy goals. Careful negotiation and discussion is needed to ensure a joined-up approach is taken.

[18] See Risk & Policy Analysts Ltd (2007)
[19] The creation in [2004] of a cross-government Coordination of Research and Analysis Group (CRAG) chaired by the then-Permanent Secretary at Defra may be argued to be partly as a result of this trend.

Crucially, 'while the definition of an environmental limit may be based on the biophysical properties of a natural resource system, its identification also depends on the way people value the outputs from it.' (CEM, p *vi)*, emphasising the need for deliberative decision-making processes which encompass a wide variety of stakeholders. However this conclusion should not be constrained only to the use of environmental limits in policy, and brings us to the second issue driving change in environmental policy-making.

The role of external stakeholders and challenge in relation to the evidence base for policy

The last 10-15 years have seen something of a crisis of confidence in UK Government science. For Defra, created in the aftermath of both BSE and FMD, this was a particular concern. The Department even went so far as to note that: "A primary objective of Defra's science policy work is to make our science more trustworthy in the eyes of the public" (Defra, 2004a, p.16). In order to address this, steps were taken such as the creation of a new horizon scanning programme intended in part to address the 'lock-in' of research to issues identified by 'closed' science-policy communities[20], and the development of a social research capability. Longstanding demands to open up the black box of policy making – in part also to reduce the scope for self-justification and the effects of embedded power relationships; but also to move away from unitary and prescriptive policy advice (Stirling, 2004)[21] – have led to a greater openness in some policy processes.

However the full challenge to Government science policy implied by the analysis of Gibbons *et al.*, which introduced the arrival of the Mode 2 paradigm, still seems to be unanswered. Policy makers have struggled to understand how to recognise and adapt to the more dispersed and trans-disciplinary approaches to knowledge production. Existing policy tools have not been systematically re-examined with the availability of new techniques – particularly in regard to citizen engagement. While new methods of engagement such as citizens' juries, policy wikis, web-based consultations focus groups and mixtures of deliberative methods have been used to open up engagement[22] and bring new modes of consultation and external challenge to policy discussions[23], they remain as stand-alone projects in fairly specific areas of interest. The recent revision of Guidelines 2000 to address *inter alia* the need for public dialogue offers criteria so broad as to cover almost any significant environmental policy issue

[20] Berkhout et al. "Report on the consultation process for a new DEFRA horizon scanning research programme" 2002 (unpublished)
[21] In essence the 'one size fits all' approach to making policy.
[22] See Gavelin *et al* (2007)
[23] See, for example, Stirling & Mayer (2001)

and is thus, arguably, incapable of implementation through such methods[24]. While the principles of open engagement, multi-faceted, dispersed and trans-disciplinary approaches to knowledge generation that they embody are well recognised, policy makers do not have the tools which ensure that these principles are part and parcel of the processes they are required to use on a daily basis (and see Rayner, 2003). Barnett (2007, p8) note that consultation with stakeholders has long been part of policy making; but policy has not yet risen to the "challenge and an opportunity to more closely specify the role of stakeholder and citizen engagement in moving from identification of policy issues, through the development of policy options to the implementation of policy outcomes".

Technological change and sustainable innovation

There is a third driver we identify as having influenced the ways in which Defra's policy makers perceive and interact with the evidence base. Against the background of the Rothschild reforms in the 1970s, followed by the focus in the 1980s on reducing public support for near-market research, the recent rise of sustainable development in the policy agenda has become a significant driver of innovation policy. The 2003 UK Innovation Report "Competing in the global economy: the innovation challenge"[25] identified the environment as a key driver of innovation, and the DTI's technology strategy subsequently included a number of sustainability themes.

However, coupling the relatively economic drivers of innovation with the environmental demands of sustainability is not straightforward. As Stirling (2007, pp 3-4) notes, technological progress is not "the unfolding of a self-evident logic along a single, pre-ordained path". Innovation needs to be "viewed in a…sophisticated and realistic fashion – embodying a rich array of contexts, processes and contending directions". Taking a strategic approach to environmental policy making thus includes taking a careful look at how to foster sustainable innovation, and manage the transition to what may be new socio-technical regimes (Smith, 2007). There are two implications for the policy process: first, policy makers will need to focus on identifying knowledge gaps in terms of desired innovation which Departmental funding can appropriately address. Second, they will simultaneously need to broaden the range of possibilities by avoiding restrictive assumptions about which pathways of innovation should be encouraged.

[24] See http://www.berr.gov.uk/files/file9767.pdf
[25] See http://www.berr.gov.uk/files/file12093.pdf

Thus, Government needs to recognise a diversity in innovation, moving away from technological determinism and towards a more value-rich idea of how innovation delivers change that is desirable for society. This would allow policy makers to remain open to the different ways of delivering desired environmental outcomes, whilst ensuring the policy making process is as efficient as possible in demonstrating its improved understanding about the diversity of future innovation pathways, incentives and other policy levers able to deliver them. The heading "Evidence and Innovation" was intended to convey this twin challenge.

Practical challenges for an interdisciplinary evidence base

It is not sufficient simply to understand how the nature of environmental issues is changing. Policy makers must also actively mesh the different sources and types of evidence so that they inform complex policy decisions and challenge existing policy goals and other Departmental priorities. These cross-disciplinary issues have implications for the process of developing an evidence base. Particularly, they have led to calls for increased social inputs to defining problems, framing questions and ultimately formulating policy aims[26]. However in practice the established techniques of policy-making may restrict what evidence is recognised as relevant: evidence is often delivered through formal processes such as expert scientific committees and impact assessments and framed around economic appraisals conducted under HM Treasury Green Book rules. Although research in the social sciences has achieved formal recognition as a key source of insight and component of the evidence base for environmental policy making[27], in order to achieve influence it needs to either complement, or embed itself within, existing tools such as expert-based risk assessment and cost-benefit analysis that, themselves, were originally developed out of a concern to take a broader and more comprehensive view of the environmental impact of human activities[28].

Summary – driving towards practical implications for evidence-based environmental strategy and policy development and delivery

The drivers of change over the past 10-15 years have contributed to a change in the way environmental policy makers gather, resource and use evidence. The picture is extremely complex. Not only are Defra's policy makers being asked to consider different types of evidence, they are being asked to do so in new ways and with evidence from new sources.

[26] See RCEP (1998)
[27] See OST (2001) *Scientific Advice and Policy Making: Implementation of Guidelines 2000* at www.dti.gov.uk/files/file14479.pdf
[28] RCEP, *ibid.*, and see also the Stern review at http://www.occ.gov.uk/activities/stern.htm

They have to give greater consideration to the priorities of other Departments, generating and using evidence to try to improve the influence of the Government's environmental priorities on its other policy goals. They need to ensure that they respond to Government requirements for competency in working with expert and other stakeholder communities, in order to progress their careers. Overlaid on this is the speed at which policy processes can operate: Yankelovich (2003, p8) notes that "most (policy) problems are experienced with an urgency and immediacy that make people impatient for answers; policy makers must deal with issues as they arise and not in terms of their accessibility to rational methods of solution." In spite of these pressures for immediate change, environmental policy makers need to focus on the long-term and on the global impacts of options put forward for decision; though the impacts result from complicated relationships and the evidence is uncertain, nuanced and subject to challenge from a wide variety of stakeholders and the media.

As we worked through these implications in the initial design of the Evidence & Innovation Strategy, we realised that the strategic role of the evidence base and its relationship to the ongoing processes of strategy, policy development and policy delivery needed greater emphasis. We saw these three processes as distinct, but also intertwined in the daily work of the policy maker, and inadequately represented by the linear policy cycle (see NAO, 2001). However, we also recognised that, as outlined previously, the various pieces of guidance given to policy makers are complex and often only partially overlap with each other. They do not, in our view, reflect the constant process of negotiation, iteration and reliance upon an evidence base that characterises the day to day reality of policy makers' work. In particular, existing guidance fails to account for:

- The relationship between policy and strategy, and the specific role of the policy maker in turning strategic priorities into options and working with delivery partners
- The emergence of horizon scanning and foresight as important sources of evidence and analysis
- The need to open up the policy process to multiple forms of interpretation, engagement and analysis, encouraging wider inputs to the development of policy options and broader, more interdisciplinary views of robustness in the evidence base (see Shaxson, 2005)
- The need to create a line of sight between strategic goals and policy delivery, for cost-effective disbursement of resources
- The changing role of Government in driving innovation in support of policy goals

This suggests to us a need to carefully account for strategy, policy development and policy delivery, ensuring that all three are backed by robust evidence:

Strategy – setting the direction of travel by understanding and scoping existing and future context and challenges and developing the capability (skills) and capacity (total resources) to deliver desired outcomes.

Policy development – structuring choice for decision-makers based on robust evidence and analysis.

Policy delivery – implementing decisions with stakeholders in order to deliver measurable outputs.

Box a: Evidence-based definitions of strategy, policy development and policy delivery

These components are designed to be read together, not to be separated out into 'job descriptions'. In other words, policy makers cannot do their job fully without working with others, without understanding the dispersed and interdisciplinary nature of their evidence base; and without bringing strategy, policy development and policy delivery together into a single conceptual approach for policy making. As such, these definitions provide the foundation upon which we ultimately drew out the four principles of evidence based policy making proposed at the end of this paper. With this context in place, we now set the context within which we trace the process of Defra's Evidence and Innovation Strategy.

Defra's Evidence & Innovation Strategy – realigning Departmental evidence needs for policy

Overview of the analytical approach taken in this paper

We present this account of the progress of the E&IS and its outcomes not as a piece of research, but rather a reflection on a strategic process that grew and evolved from within a Government Department in response to its changing needs. The process was initially undertaken in support of Defra's policy goals, which, like the progress of the E&IS itself, changed during the implementation of the project. In this reporting, we also take advantage of the benefits of hindsight; including lateral leaps in ideas and understandings that resulted from (what at the time were) chance meetings, a wide but unsystematic reading of the literature, and interactions with academics and policy professionals.

We designed, piloted and implemented the E&IS in a rapidly-changing, pressured and complex policy environment. An internal evaluation of the process revealed that this did lead

to some fairly classic organisational change problems[29], but we do not believe it affects our conclusion about the need for *practical* tools, and *effective* mechanisms that will enable Government's policy makers and evidence base providers to understand and implement evidence-based policy making.

Developing the E&IS process

The E&IS was presaged by the appointment of Defra's first independent Chief Scientific Advisor in 2002. This kicked off a series of reviews and evaluations about the quality and use of science within Defra. Central to this programme of work was the ambition to ensure that the considerable resources available to the Department were focused on the areas and specific needs of greatest value to the Department in terms of delivering its strategy. These reviews saw the development of multiple arrangements for managing science and other professional disciplines (statistics, economics and social research); the initiation of a horizon scanning programme, the integration of science staff into policy units (as was previous practice at DETR); the establishment of new arrangements for quality assurance and peer review; and the appointment of an external Science Advisory Council.

It soon became apparent that action was needed at a number of levels, from the strategic level (balancing resources between different areas such as climate change and animal health) down to the level of individual policies and decisions. The Department had inherited very different approaches to the management of science from its main parents MAFF and DETR and a central review would be needed to bring them all together. In order to provide strategic background, a 10-year 'forward look' document[30] was produced by the Science Strategy Team, which provided initial evidence, at a strategic level, for resource reallocation[31]. However, the primary challenge was to ensure that policy makers had access to the knowledge base needed to perform their functions. The 10-year 'forward look' document stated that "the twin goals of our next science and innovation strategy will be to ensure access to a broad knowledge base and to the analytical and deliberative capabilities needed to underpin policy making and manage risk; and to use innovation strategically to achieve policy priorities and key outcomes" (Defra 2004b, p3).

[29] See, for example Kotter (2006) who outlines eight steps for successful organisational transformation: we would claim various levels of success against all his criteria – but this implies various levels of failure, as well.
[30] Defra (2004b)
[31] HM Treasury, DfES, DTI (2004, p121), Science and Innovation Framework 2004-2014 (HMSO: Norwich) p.121

Scoping and understanding the need for a new approach

The original impetus for the approach we took in the E&IS came from a consultancy report by Tony Taig in 2004 that explored how science was incorporated into policy across Defra, and developed guidance on doing it better. Taig reviewed a number of case studies across the Department, in particular using interviews with policy makers to assess their levels of satisfaction with science support. Major themes of his report were the general need for greater customer (policy maker) focus; the inadvisability of relying on scientific experts alone in determining research needs; the need for a more strategic approach to identifying research needs; and the need to put much greater focus on identifying which questions to ask, and on interpretation and advice (Taig, 2004).

Though high quality science was being commissioned, it was driven more by a need to address gaps in scientific knowledge, leaving Defra's policy-focused evidence needs patchy and fragmented, at best (Taig's conclusion 1). This fed into concerns that Defra was not optimising its investment in science. Did it have sufficient resources both to pursue high quality scientific research programmes, and to deliver a timely and robust evidence base for policy making? If the latter was suffering, where was the focus on policy getting lost, and how could evidence of all types (not just research, and not just work funded by Defra) be realigned to better deliver value for money?

In order to explore these questions, Taig proposed separating out the scoping and interpreting functions that feed science into policy (see Figure 1). He found that these were the key areas where the policy/research interface was breaking down. As he put it, "Defra should be at least as well focused on using knowledge as it is on advancing knowledge" (Taig 2004, p2).

Figure 1: Key Science/Policy Tasks

Figure 1: from Taig (2004)

Another issue which bedevilled the supply of evidence for policy was the formal distinction which is widely maintained between research (or R&D) and other forms of knowledge

development. Procurement procedures, which are designed to protect Departments' financial commitment to research, have the unfortunate side-effect of restricting policy makers' and research managers' ability to commission short-term, policy-focused analysis. This structural problem remains, although it has been addressed to some extent by an increasing focus on secondary research analysis.

The findings of the Taig report were part of a package of information presented to senior management within Defra which led to the decision to realign all evidence needs around policy goals, including both R&D and non-R&D funded work. It meant making practical use of Defra's five Strategic Priorities and 18 Strategic Outcomes. These had just been set out in a new Five Year Strategy for the Department (Defra, 2004b) which focused on policy and delivery goals (though it did not result in an immediate, and meaningful, questioning of how well the existing evidence base aligned with these new policy goals). Thus, the E&IS was designed to give each Strategic Outcome the same degree of attention by breaking it down into something 'concrete, manageable and achievable'[32]. By doing this in a structured process, the goal was to systematically understand what evidence would be needed to deliver the Strategic Outcomes. In addition, it was hoped that by identifying gaps or overlap in evidence and innovation within and between Strategic Outcomes, the exercise would lead to a more effective resource allocation across the Department as a whole.

Designing the process: Realigning evidence around policy needs

The central aim of the E&IS was to review Defra's evidence needs in a 'top down' fashion, starting with policy goals as defined by Defra's Strategic Priorities and Strategic Outcomes. The design principles for the E&IS were

- Putting policy in the lead: creating a demand-pull on the evidence base from the policy goals and other strategic objectives
- Consistent application of the E&IS tools across the Department, for consistency of analysis
- Focusing investment where it will optimise value in terms of Defra's priorities

These principles can be seen in all the key stages of the E&IS we discuss in turn below. The central theme, though, was reflected in the first principle: to keep policy in the lead. This meant that we placed emphasis from the outset (and indeed through the entire project) on the fact that the E&IS should be owned by the policy teams, not the evidence providers. This was

[32] Harrison, in Shaxson (2005)

more than a subtle change of emphasis: Defra's history of science activity and spend had been one of continuous evolution in a largely bottom-up way. The benefits of this new emphasis were intended to include giving policy makers a greater say over the evidence needed to inform their decisions, and the innovations needed to deliver them. It was also designed to improve the ability of evidence and innovation suppliers both to help formulate and help deliver policy goals; resulting in improved strategic management of the supplier base and stronger capability to act as an intelligent customer.

Taking all of the above, we developed a three-stage approach to the E&IS process:

1. Use interdisciplinary workshops to explore, in a structured way, what evidence and innovation were needed for each Strategic Outcome
2. Summarise the resulting information into a Statement of Need (that described policy needs for all evidence, making no distinction between R&D- and non-R&D-funded work) and use this analysis to inform resource allocation plans
3. Consult with our internal and external stakeholders

We entered into this process recognising that policy teams were already overstretched with their day-to-day activities. They had little time to spare for a major redesign of the way they procured evidence. However, they did recognise the central thesis of the Taig report – that supply did not match demand – and were generally willing to work with the project team to understand what 'realignment' of evidence needs meant in practice. In some cases, where less attention had been paid to developing a strategic approach to the evidence base, policy teams were keen to be offered the opportunity to think systematically about how to make best use of their budgets. Other areas were frighteningly busy and relied heavily on the project team and external consultants for analytical support. Perhaps most unfortunately of all, one area was in the middle of a consultative process to re-establish its high-level policy goals and its policy teams were less than pleased with the timing of the E&IS project.

Senior management's endorsement of consistency of approach across the Department meant that it fell upon the relatively small project team to negotiate these different demands on policy makers' time while maintaining internal consistency. A pilot project, with the area of Sustainable Consumption and Production policy, was used to appraise resource commitments for the E&IS process and to fine-tune the tools that were ultimately rolled out across the Department. The pilot took off in unanticipated directions and turned into a separate project

with a stronger focus on knowledge management than could be attempted across the entire Department[33].

We will now briefly describe the key features of each stage of the E&IS and the lessons we drew from them about the nature of environmental policy making in Defra and its relationship to the evidence base.

Conducting the E&IS: The workshops

The first step was to help initiate policy teams to the E&IS process and to begin prompting discussion about the information that would eventually populate the Statement of Needs. Structured, inter-disciplinary workshops were held to bring together policy team leaders, evidence providers (including social researchers, economists and statisticians) and senior management. To facilitate these workshops in a consistent and focused manner, the E&IS team adapted the principles of the logical framework[34]. This approach drove the analysis from the top down, and then checked consistency from the bottom up, thus maintaining the emphasis on 'policy in the lead'– focusing on what evidence and innovation would be needed to deliver the Strategic Outcomes – while encouraging open discussions of how the outcomes could be measured, over what timescale and with whose budget.

The workshops were not designed to build the evidence base from scratch, but to use Departmental knowledge of the existing evidence base to examine what more was needed, where there was duplication and where savings could be made *in support of the achievement of the Strategic Outcomes*. This was then summarised into a single document of up to 20 pages; the E&IS Statement of Need.

Conducting the E&IS: Developing the Statements of Need

The first major output of the E&IS was a Statement of Need from each Strategic Outcome policy area. We envisaged these would be used by managers within that Strategic Outcome to identify individual policy areas where it would be possible to rely on existing systems, where new research might need to be commissioned, where the importance of that policy was waning or rising, and where new partnerships and cross-cutting synergies might need to be

[33] See Ashridge Centre for Business and Society (2006) and Bielak, *et al*. (2008)
[34] A tool for project and programme planning, management, and evaluation. Several of the consultants to the E&IS were very familiar with the 'logframe' from experience with DFID, who have used it extensively See http://www.ifad.org/evaluation/guide/3/3.htm and http://www.norad.no/default.asp?V_ITEM_ID=1069.

forged. This latter point was raised consistently in our interactions across the Department. There was a general feeling that current systems failed to guard against duplication of research effort and it became a major focus of the E&IS to try and understand how to facilitate joined-up working across policy and research areas.

Each Statement of Need began with a description of the key policy outcomes and associated targets for each Strategic Outcome, followed by an analysis of the trends and drivers affecting their potential achievement. Subsequent sections asked policy teams to use this analysis to describe their future evidence and innovation needs in detail. This was used to 'set the scene' for an assessment of how well aligned existing programmes of work were with the needs of the Strategic Outcome, the landscape for provision of evidence and innovation, and the implications for the Defra Agencies[35]. The final section asked for budget information – breaking down the traditional R&D / non-R&D into different types of evidence and innovation required.

Where policy priorities were clear and the Statement of Needs built on existing work on the evidence base, the documents were made available to stakeholders for discussion. For many policy areas, however, the relationship between policy and the evidence base was less developed and the documents were kept for internal discussion only. However, there was a general acceptance that by looking at all evidence – not just that funded from R&D budgets – we were giving policy teams the impetus they required to take a systematic view of their current and future needs from the evidence base.

Conducting the E&IS: the Consultation

As the Statements of Need began to materialise, the team realised that the outputs of the E&IS would have value to external stakeholders, not simply as an internal discussion tool. However, the information contained in the documents needed to be presented in such a way that it could be put out for external consultation. Based on an analysis that one consultant had already conducted for one policy area, the E&IS project team developed a systematic map of the evidence and innovation needs against a representation of the policy process which broke away from the concept of the policy cycle whilst retaining the key activities policy teams were undertaking relating to evidence and innovation. This formed the A-G category

[35] The Central Science Laboratory (CSL – now part of the Food and Environment Research Agency, FERA), the Veterinary Laboratories Agency (VLA) and the Centre for Environment, Fisheries and Aquaculture Science (CEFAS).

headings that were used in the final evidence and innovation maps that were published[36] for each Strategic Outcome (see Fig 3).

Given the project's time constraints, the headline categories could not be rigorously defined because of differences in scale between the Strategic Outcomes. This gave rise to some inconsistencies. However, initial scepticism of the value of the exercise by policy teams was subsequently tempered by a realisation that it was a very useful tool for evidence providers and policy makers. It was the first time the Department's entire evidence base had been presented in one place, with supporting analysis. Cross-cutting issues and other potential synergies in procuring evidence could be identified, as well as an assessment of how evidence production was balanced against different stages of the policy cycle. To their surprise, many teams found that they spent most of their resources in the 'understanding the evidence needs' stage, and very little resource on improving outputs or monitoring policy impacts. Moreover, because the maps included both current areas of evidence provision, in addition to 'hoped for' areas of evidence generation, it allowed everyone to look at the balance between existing commitments and potential new spends and how these aligned with current policy priorities and Departmental goals.

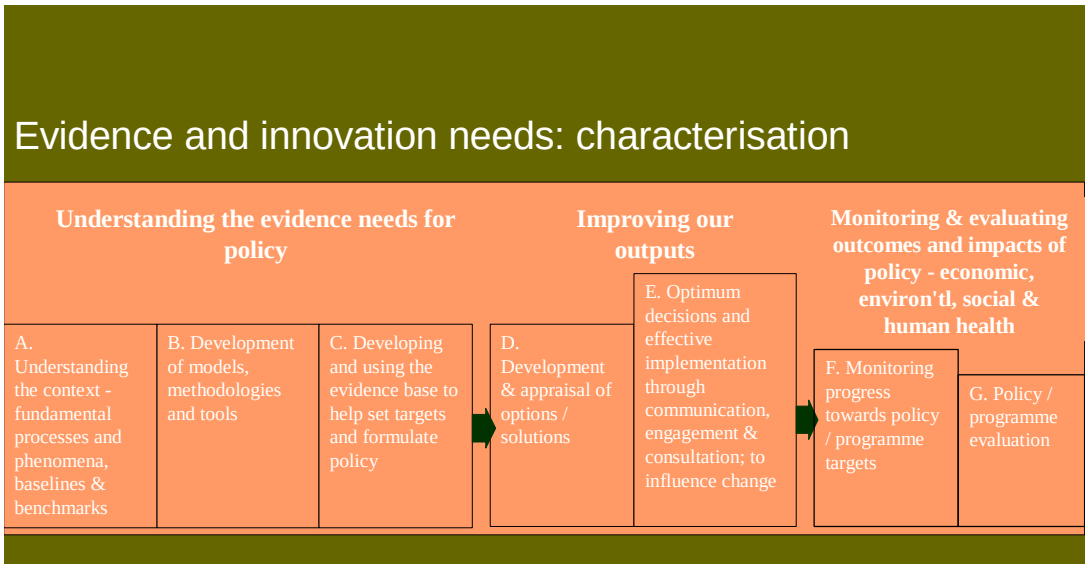

Figure 2: Map headings: characterising Defra's evidence & innovation needs

Once out for consultation, the maps generated a good deal of comment – whilst some were uncomfortable with what they perceived to be a reductionist approach to the evidence base, others saw them as "an impressive piece of work" (Duncan, 2005); "a welcome move towards

[36] Electronic copies of the consultation document which contained the completed maps are no longer online, but are available from the authors.

a more integrated and transparent framework for understanding, implementing, monitoring and evaluating…large-scale public expenditures" (Stirling, 2005) and, more generally, as a useful attempt by Government to open up the entire evidence base for policy. Organising the maps and supporting analysis around each Strategic Outcome reflected our central design principle and effectively put policy in the lead. By putting the entire Department through a clear process (and getting rid of the distinction between R&D and non-R&D), we ensured that the analytical tools were being consistently applied across a consistent definition of evidence: our second design principle. This would not have been possible if we had only concentrated on research-driven evidence and excluded the different types of evidence commissioned on a short-term basis, directly from policy teams.

The open analysis encouraged by the maps helped senior management take decisions based on the third E&IS design principle – focusing investment where it delivers greatest value to Defra. However, it would have been unrealistic to expect an optimal one-off reallocation of resources based on a single analysis of the maps. Political considerations and other pressures – including the complex web of relationships between the members of the Defra 'family' – meant that discussions about policy priorities and how they will be resourced are continuous and contentious. This does not negate the value of the maps at all: instead it demonstrates that even with tools which meet all the design principles, we need to do a great deal more work on how we can use evidence and innovation to deliver 'value to Defra'. We pick up on this issue of delivering public value within Government in the next section.

Towards a functional model of evidence-based policy making

Outlining the model

The outcomes and lessons learned from the E&IS process led us to reconsider whether we could articulate some basic principles of evidence-based policy making which built on our analysis of the literature and on existing guidance for the use of science in policy making[37]. As outlined above, our focus throughout the E&IS was on keeping the policy in the lead. Because of this, we were able to approach this critical examination from the perspective of policy demand, not science supply. This allowed us to bring practical insight to the wider academic work discussed earlier.

[37] See Office of Science & Innovation (2000), and Government of Canada (2000)

The basic principles of the E&IS and the simple 'three bubbles' framework in the Taig report addressed 1) decision processes about what information, and correspondingly, the types of science are needed, 2) approaches to procuring and managing new research, and 3) delivering, interpreting and applying the results to Defra's policy needs. These all point to the important role of demand within the process of developing and using an evidence base for policy making. Work within the SCP evidence team further supported this by pointing to the need to emphasise fluid knowledge management within the evidence base, trying to reconcile policy demand for evidence with that supplied by science, and ensuring that existing and emerging evidence is thoroughly reviewed to inform the procurement of new evidence. Additionally, as Taig pointed out, there must be active management structures in place to ensure the results, knowledge and information that comprise the evidence base are assembled rapidly in response to pressing policy questions. This was born out of the recognition that research results do not disseminate themselves. Taig also identified a need for research to be effectively interpreted, synthesised and applied to policy making processes.

We present the framework below (figure 3) as our interpretation of what a functional model of evidence-based policy making might entail – focusing less on the particular tools that need to be used and more on the behaviour that makes those tools effective. This was presented and used as the cornerstone of the final E&IS document, *Our Approach to Evidence and Innovation* (Defra, 2006).

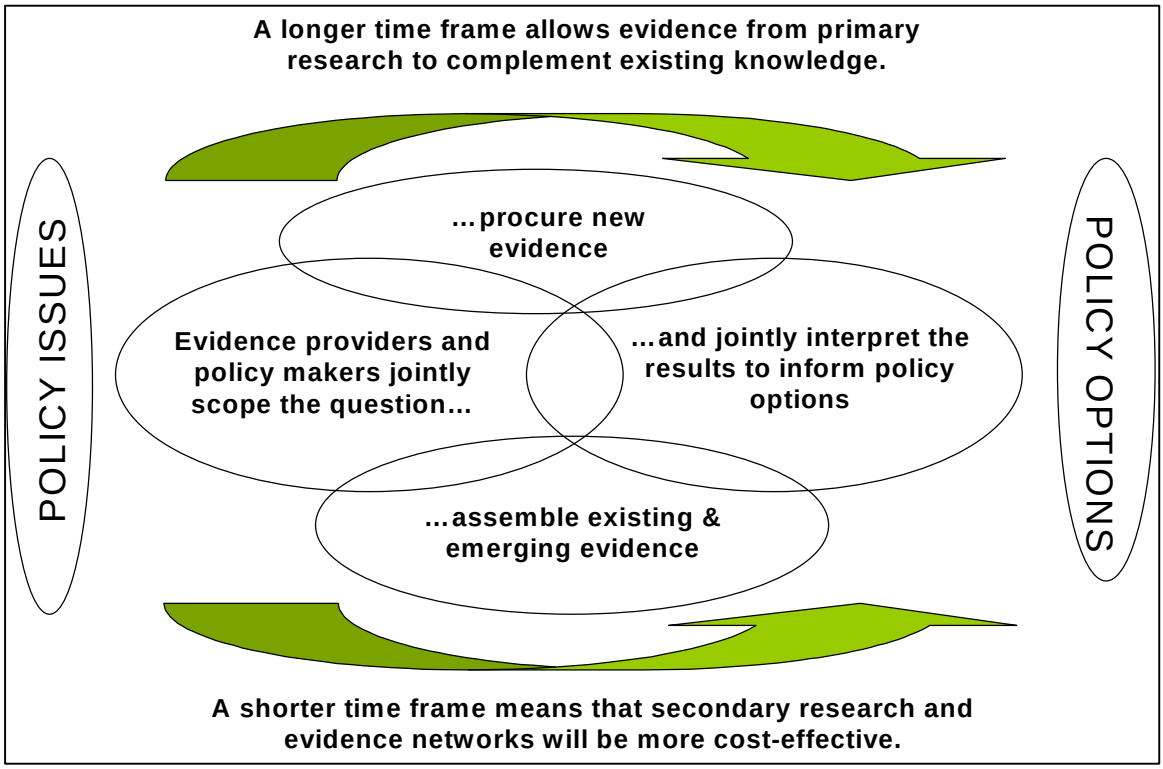

Fig 3 – The Defra framework for evidence-based policy making (taken from Defra, 2006)

Figure 3 was constructed to emphasise three points about the flow of evidence in policy. First, it shows that the process is not a linear one where issues are defined, evidence is procured, and it is made available for policy to use (what Bielak *et al* refer to as the 'supply push' model). Instead, the process of assembling and interpreting emerging evidence may challenge the relevance of the question that was asked in the first place, leading to a new search for appropriate evidence. Second, it makes the point that different time pressures will give rise to different approaches to sourcing and using evidence. Using networks and secondary analysis to answer pressing policy questions is as valuable a use of the evidence base as is the procurement of new evidence via primary research. Finally, the model separates the scoping and interpreting functions from those associated with procuring the evidence. Doing this helps engage both policy makers and researchers in an iterative process of challenge and reflection about what evidence is needed to demonstrate progress towards policy goals.

Four proposed principles of evidence-based policy making

While the above framework resonated with our policy colleagues, it is obviously not an off-the-shelf policy 'kit' which can be picked up and applied in all policy situations. There is an enormous variety of tools and techniques that could be used to ensure that the processes of strategy, policy development and policy delivery are underpinned by the effective use of

evidence. The four ovals are more a description of the behaviours needed throughout the policy process than recommendations for which tools to use and when.

However, it is important to be able to identify which tools may be appropriate in different contexts, and why. Given the range of possible tools it is impossible to draw up a checklist of what works and where, but based on our understanding of how evidence-based policy making works within Government Departments, we set out below a set of principles (the fact that there are four is purely coincidental). The principles help frame the choice of tools used in the evidence-based policy making process, while the Defra framework relates to how those tools should be applied.

Principle 1: Putting policy in the lead
Policy makers are responsible for the evidence base they use to develop policy options for decision. Developing the evidence base for policy is an integral part of the policy making process, led by strategy and policy goals, and linked to setting policy and delivery targets.

Principle 2: Robustness in the evidence base
Policy needs to be based on a broad definition of evidence which recognises not only formal knowledge from a wide range of disciplines, but also information which may be practical or context-specific, such as that provided through stakeholder engagement.

Principle 3: Delivering value by focusing investment around long-term priorities
Foresight, horizon scanning and futures (HS&F) work and other sources of analysis about longer-term possibilities will enhance the value that evidence brings to policy making by examining future opportunities, risks and uncertainties.

Principle 4: Government's role in stimulating innovation
Whilst most innovation takes place in the private sector, Government has a pivotal role in helping to identify potential innovation goals and pathways, defining targets, deploying appropriate policy levers, and promoting sustainable innovation through its own activities, such as public procurement.

An illustration of how these principles might be applied to construct new policy-relevant tools is given in Bielak *et al. (*2008), who describe how a structured dialogue with stakeholders helped shape the evidence base for Sustainable Consumption and Production (SCP) policy around the development of 'lines of argument'. There were no existing tools whose focus was to make the evidence base more policy-relevant and which were based on all four principles outlined above. Over a seven-month period the SCP evidence team formulated, piloted and implemented this new tool to good effect.

The difficulty of delivering public value

Throughout the process of developing and implementing the E&IS, we had been struggling with the question posed implicitly in the Taig report of how investment in evidence & innovation would deliver value to Defra – in particular, what did we mean by 'value to Defra'? A related question, which was important given the very wide range of Defra's stakeholders, was 'how do we reflect the value of Defra's E&I investment to others?' We drew heavily on Mark Moore's 1995 book, *Creating Public Value.* Put simply, Moore notes that public value is created by making the best use of available assets for the public good; recognising that value has multiple components including those, such as equity, which are not directly linked to products and services. As Blaug *et al.* note (2006a, p11), "Public value holds that public services should provide what the public values and do so efficiently[38]." But how do we find out what the public values and translate that into policy?

The value of this concept in relation to evidence-based policy making is illustrated in Moore's arguments about the role of public managers (i.e. unelected officials), as in this passage about the role of managers in large service organisations - which arguably has equal applicability to policy making:

> "… what citizens and their representatives 'buy' from public managers is an account of the public enterprise – a story contained in a policy.… Viewed from the citizen side of this transaction, the authorization is the purchase of an aggregate enterprise that promises to create value. It is a collective, political agreement to meet a problem (or exploit an opportunity) in a particular way.… We know of course that it is treacherous to view political agreements as accurate reflections of the public will or the public interest. Political decision-making is vulnerable to many different kinds of corruption – the most important being the triumph of special interests over the general. It is also vulnerable to many kinds of irrationalities including short-sightedness, an unwillingness to make painful trade-offs, and an inability to deal appropriately with risk…. If public managers are to create value over the long run, then an important part of their job consists of strengthening the policies that are sold to their authorisers. Specifically, the policies that guide an organisation's activities must reflect the proper interests and concerns of the citizens and their representatives; the story about the value to be produced must be rooted in accurate reasoning and real experience; and the real operating experience of the organisation must be available to the political overseers…. Otherwise the strengths of the political process will not be exploited, the knowledge and experience of the operating managers will not be utilised, and the acknowledged weaknesses of the process will not be challenged."

Box 2: The role of public managers in delivering public value. From Moore (1995), pp 54-5

In applying Moore's work to the UK, Kelly *et al* (2002, p.4) observed that public value refers to "the value created by government through services, laws, regulation and other actions… (it) is ultimately defined by the public themselves… Value is determined by citizens' preferences, expressed through a variety of means and refracted through the decisions of

[38] Note that this definition, published in November 2006, was not available to us as we worked on the E&IS.

elected politicians…. The value *added* by government is the difference between these benefits and the resources and powers which citizens decide to give to their government." (original emphasis). They go on to note that other concepts, such as equity, ethos, trust and accountability are included in the idea of public value: as such it "provides a broader measure than is conventionally used within the new public management literature, covering outcomes, the means used to deliver them as well as trust and legitimacy" (*ibid.* p3: see also Blaug et al. 2006b). Public value is a powerful concept, yet it remains difficult to measure (Hills & Sullivan, 2006) and apply within the policy making environment.

At around £300m per year, Defra's evidence & innovation activities are a major element in its portfolio and resource spend. While studies on return on investment, such as that conducted by Price Waterhouse Coopers for NERC[39] or those that analyse the impact of international agricultural research (see for example Alston, Norton & Pardey, 1995) can give policy an idea of <u>where</u> to invest scarce research resources, they are unable to comment on <u>how</u> that investment should be managed, or how to seek to influence that investment to deliver against policy goals or priorities[40]. For Defra the complex UK research funding landscape, with much larger resources available to the UK Research Councils, adds an additional layer of complexity to decisions about where and how to invest. Reflecting Moore's contention that cost-effectiveness – rather than cost-efficiency – should be the hallmark of Government operations, we were concerned that the ultimate aim of the E&IS was better policy outcomes as well as more efficient resource allocation. The E&IS was driven by a desire to improve the quality of the decisions that were taken by policy teams, not simply to improve cost-efficiency in the evidence base.

Applying these ideas as we designed the E&IS led us to the supposition that there are two components to the public value of Defra's evidence & innovation activities[41]. <u>Policy value</u> consists of the benefits which accrue directly to citizens from better policy decisions – improving the quality of decision outcomes, promoting accountability and understanding, and building shared awareness of issues with Defra's wide stakeholder base. <u>Operational value</u> is the value of outcomes which accrue indirectly to citizens from improving the processes on which those decisions are based – whether this is via operational delivery, accountability for resources and results, or the value accruing from innovation in Government operations and the wider world.

[39] See NERC Economics Impacts Study Board (2006)
[40] See Shaxson (1999)
[41] We note, in passing, the potential to apply the public value approach to other public sector research funding.

Our reading of the literature on public value suggests an under-emphasis on what we term operational value which is of particular relevance to environmental policy making. However it may be defined, sustainability is a dynamic state which is made, shaped, and unmade through public choices (Dovers, 2006); and, we would add, through the policy making processes which help formulate the detail of those choices. A focus on policy value at the expense of operational value may result in evidence leading to policies that respond better to society's needs (mediated of course through the political process), but may not necessarily do so in a cost-effective way. Emphasising operational value over policy value may improve the ability of Government to disburse public sector revenues more efficiently, but may deliver societal outcomes that are less than optimal.

Our initial concern, as set out at the beginning of this section, was on how to deliver 'value to Defra', in terms of understanding both the value of what policy makers were delivering, and in terms of value to external stakeholders. There is an emerging literature on the measurement of public value (see for example Hills & Sullivan 2006, and Coyle, 2007) but we believe more work needs to be done to mesh the practical framework we propose above with the appraisal techniques they outline.

Conclusions

We have described several shifts in environmental policy and their practical implications. The rise of environmental limits as an issue, demands for greater social inputs, and the imperative of climate change to take a long-term, global perspective have all placed major new demands on the policy making process. However the science policy response to date has been imposed *on top of* existing policy processes. We suggest that it is the formal policy making requirements such as impact assessments and risk assessments within a linear policy cycle which define, in practice, the evidence policy makers gather and use in their day-to-day roles. The additional 'public engagement' requirements of Guidelines 2000, or individual policy strategy exercises, can only provide a one-off strategic snapshot of evidence needs and do not satisfy policy makers' needs for evidence that reflects the broader Mode 2-type processes which characterise evidence for environmental policy. Therefore, we see a need for greater consistency and better integration between the high-level Modernising Government principles, the requirements placed on policy makers to demonstrate competency in analysing and using evidence, existing evidence-using processes such as those demanded by the policy

cycle approach, and commitments to broader activities such as horizon scanning and public engagement.

The demand for evidence by policy is conditioned by the tools policy makers are required to use such as cost-benefit analysis, options appraisal and formal written consultations. In isolation, each is able to deliver robust evidence according to its disciplinary paradigm, but taken together they give policy makers a mixture of competing types of evidence with competing claims of robustness. The current mix of tools available in to policy makers cannot, we feel, consider the full meaning of 'value to Defra'. Nor can it take account of the more socially distributed way in which knowledge is produced.

Our application of Moore's work on public value and the development of the four principles of evidence-based policy making puts this problem into even greater relief. Instead of policy's needs identification for evidence being the province of research scientists or other disciplinary specialists, it becomes clear that determining evidence needs is a central part of policy making. Trust, accountability and awareness-raising should be seen as primary objectives for evidence activities, with their own contributions to the public value of policy making.

The results of the E&IS project suggest a practical framework which can be used to develop new tools, such as Lines of Argument[42], which offer alternative avenues for policy makers to pursue. Such tools are beginning to be picked up and used in parts of Defra[43] and elsewhere in the public sector, but they need to be further developed and trialled as part of a systematic re-evaluation of the policy making process, not just added on the top of policy's toolkit.

We recognise that this is only an initial analysis but in the face of such complexity we find it hard to see how evidence-based environmental policy making can be properly undertaken without such systematic approaches. And we believe there are wider lessons to be drawn from the E&IS experience which will help respond to Bochel & Duncan's call to complete the Modernising Government agenda.

End.

[42] See Shaxson, 2009 for a full description of the Lines of Argument tool and its use.
[43] See Wilson *et al*., 2007

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