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Can Indicators Bridge the Gap between Science and Policy? An Exploration into the (Non)Use and (Non)Influence of Indicators in EU and UK Policy-Making

Léa Sébastien, Tom Bauler, and Markku Lehtonen

Abstract

This article examines the various roles that indicators, as boundary objects, can play as a science-based evidence for policy processes. It presents two case studies from the EU-funded POINT project that examined the use and influence of two highly different types of indicators: composite indicators of sustainable development at the EU level and energy indicators in the UK. In both cases indicators failed as direct input to policy making, yet they generated various types of conceptual and political use and influence. The composite sustainable development indicators served as "framework indicators", helping to advocate a specific vision of sustainable development, whereas the energy indicators produced various types of indirect influence, including through the process of indicator elaboration. Our case studies demonstrate the relatively limited importance of the characteristics and quality of indicators in determining the role of indicators, as compared with the crucial importance of "user factors" (characteristics of policy actors) and "policy factors" (policy context).

Keywords: boundary objects, energy, evidence, policy, role of knowledge, sustainability

Introduction

The past couple of decades have seen a multiplication of environmental and sustainability indicators designed to improve the evidence base for policy-making and to bridge the perceived gap between analysis and action—between science and policy. However, it is uncertain to what extent indicators have actually delivered on this promise. Indicator producers are often frustrated at what they see as scarce, erroneous, selective, and opportunistic use of indicators by policy makers (e.g., Grupp and Schubert 2010). Yet, intended indicator users continue to call for the development of more and better indicators. While a simplification of the complex processes of coproduction between science and policy (Jasanoff 1987), the perception of a "gap" between science and policy is illustrative inasmuch as it highlights two alternative approaches to improving indicator work at the science-policy interface: producing new—supposedly better—indicators, or enhancing the uptake and integration of existing indicators in the policy process.

Research in this area has overwhelmingly concentrated on the former objective of developing new indicators and improving the technical quality of the existing ones (e.g., Ritz et al. 2009). Even initiatives entailing, for example, participatory "end-user validation" of indicator quality (Meul et al. 2009) have given little attention to the fate of indicators in policy-making and their role as evidence. Hence, we still know little about how and why policy makers, stakeholders, and citizens use indicators and, more importantly, whether and in which ways indicators actually influence policy and society.

The European Union (EU)–funded research project POINT (Policy Influence of Indicators)[1] examined the roles that environmental and sustainability indicators play (or indeed, fail to play) in policy making in different countries, in different sectors, and at various levels of governance. In contrast with the dominant rationalistic approaches to the analysis of indicators, the project sought to examine the various indirect ways in which indicators exert their influence. This article presents two of the POINT case studies—the composite indicators of sustainable development (SDI-Cs) in the EU and the UK Energy Sector Indicators (ESIs). Composite indicators typically aggregate diverse types of information in order to facilitate communication to various publics and to compare performance across policies, sectors, or countries. Sectoral indicators are usually targeted at a specific set of policy makers and designed to monitor progress in an individual sector.

The article is structured as follows. After this introduction, the second section presents the theoretical framework for analyzing the roles of indicators in policy making, distinguishing between the concepts of "use" and "influence" of indicators, and outlining a series of factors that can help to explain these roles. The third section applies this framework for analyzing our two case studies. The last section compares the cases and discusses our results in the light of generic patterns of indicator use and influence.

The Framework

Indicators as Boundary Objects

Indicators have been defined as "variables that summarise or otherwise simplify relevant information, make visible or perceptible phenomena of interest, and quantify, measure, and communicate relevant information" (Gallopin 1996: 108). The underlying assumption is that of "indication", that is, assessing a phenomenon that is not directly measurable (e.g., biodiversity or sustainability) through a limited set of measurable parameters (Turnhout 2009: 403). Unlike many other knowledge types, notably data and statistics, indicators are based on an underlying conceptual framework, which anchors indicators in theory, establishes a logic to the selection of indicators, and provides the supporting technical definitions, metrics, and linkages, thereby situating an individual indicator within a broader network of information (Gudmundsson 2003: 4; Pintér et al. 2005: 16). Often indicators are also based on a utilization framework that defines the intended functions of the indicators—for example, information, monitoring, or control (Gudmundsson 2003: 4). As a way of operationalizing the concept of evidence-based policy, indicators are expected to serve multiple functions, in particular communication and awareness raising, monitoring and evaluation of performance, early warning, political advocacy, control and accountability, and improved quality of decisions. Whichever the primary objective, indicators are expected to simplify and facilitate communication by reducing ambiguity (Hardi and Zdan 1997; McCool and Stankey 2004: 295).

These expectations of indicator functions are habitually rooted in a rationalistic and linear conception of the *instrumental* role of science-based knowledge in policy making, entailing the assumption that more efficient and rational policy processes will automatically follow as robust, data-driven, objective, and value-free evidence is made available for policy

makers in a simplified, synthesized format, translated into policy makers' language.[2] The underlying logic is one of better information (because both robust and simple) for better decisions (because effective and efficient). The linear model still prevails as the main narrative in policy practice (Owens et al. 2004; Adelle et al. 2012), even though research on knowledge use (e.g., Vedung 1997; Weiss 1977; 1999) has repeatedly demonstrated that knowledge seldom plays such a straightforward role in policy making, but far more often interacts with policies through indirect and largely unforeseen pathways, for instance, by gradually shaping frameworks of thought or by serving as ammunition in political battles.

As a form of evidence, indicators have been conceptualized as boundary objects (Jasanoff 1987; Turnhout 2009), potentially able to mediate between different categories of policy actors, or "social worlds" (Star 2010), such as—to simplify—science, policy, and society (Bauler 2012). While boundaries serve essential functions (Bauler 2012: 42), they become dysfunctional when they develop into knowledge gaps, notably between science and policy, that is, "analysis" and "action". Each category of policy actors relies on its own mode of organization, norms, conventions, and habitus in terms of information production and use. As a specific form of translated, synthesized, conventionalized information, indicators can help to bridge the boundaries between different types of policy actors (Turnhout 2009: 403).

The potential effectiveness of indicators as "boundary objects" in connecting science and policy stems from their flexibility, ambiguity, and even vagueness, which allows them "to have meaning in both social worlds, and stable enough to travel back and forth between them" (Turnhout 2009: 405). Such flexibility entails the perception of indicators simultaneously as objective, exact, and scientifically robust information and as partly subjective, directly policy-relevant, and tailor-made evidence. Hence, a boundary object can be tailored to local disciplinary work within a single community or "social world", but it can nevertheless retain a common identity across settings (ibid.). Boundary objects allow groups to work together without consensus, in a continuous process of tacking back and forth between the vague and the more tailor-made forms of the object (Star 2010: 604–605).

As Star (ibid.: 613–614) notes, "people (often administrators or regulatory agencies) try to control the tacking back-and-forth, and especially, to standardize and make equivalent the ill-structured and well-structured aspects of the particular boundary object." The institutionalization of an indicator often entails the appropriation of both the calculus and publication of the indicator by administrations (typically by statistical offices). In such processes, indicators cease to operate as boundary objects, hence potentially generating new residual categories, communities of practice of "others" or "outsiders" (ibid.: 615), which do not fit within the established institutionalized and standardized frame.

Whether indicators actually fulfill their potential as boundary objects is an empirical question, and depends on the interplay between the social worlds that the indicator is designed to connect. This article will examine boundary work in two different case study contexts. The starting hypothesis for our analysis was that the shape of this boundary work exhibits notable similarities across different policy contexts and across types of indicators. The next section presents the framework used for examining the use and influence of indicators at the interface between policy and science. The framework first distinguishes between the different types of use and influence of indicators in policy processes, and then identifies the factors that help to explain and understand such use and influence.

Distinguishing Between the "Use" and "Influence" of Indicators

We distinguish between the "use" and the "influence" of indicators. The distinction is grounded in a series of attempts (e.g., Knott and Wildavsky 1980; Rich and Oh 2000; Henry and Mark 2003; Boulanger 2007) to describe the interactions between information and policy as an "information pathway" comprising a set of stages (e.g., the existence, accessibility, collection, uptake, digestion, use, influence, impact, and discard of information). We chose to simplify the analysis by reducing the stages to two: indicator use by various governmental and nongovernmental policy actors in the two social worlds of "science" and "policy"; and indicator influence during the policy processes.

"Use" denotes the concrete act of handling the indicators in a policy context, whereas "influence" refers to the impact on policy processes at any moment in the indicator production and utilization chain. Indicator influence occurs through dialogue and argumentation (Valovirta 2002), either through "process use" (Patton 1998; Forss et al. 2002)—that is, social learning, networking, and increased focus and motivation among policy actors involved in indicator development (Mickwitz and Melanen 2009)—or as a consequence of the release of the final indicator or indicator set. While "use" traces back the objectives, intentions, and strategies pursued by actors handling the indicator (including those developing the indicator), "influence" reflects the ways in which indicators interact with policy-making.[3]

Indicator influence can concern the targeted policy or broader processes in society, such as the operation and shape of administrative structures and democratic institutions. It can entail new or reconfirmed decisions and actions, shared understandings, networking among policy actors, or changes in the legitimacy of policy actors (Valovirta 2002; Henry and Mark 2003; Lehtonen 2005). However, both indicator use and influence may differ from what was expected. Indicators might be designed, for instance, to monitor the evolution of a particular variable (say, the share of wind power in electricity generation) aimed at measuring policy performance (in promoting the production of renewable energy). Yet, the publication and use of wind energy indicators might fuel discussion on the desirability and harmful effects of wind parks, an outcome potentially at odds with the objectives of the wind power advocates.

We distinguish three types of indicator use and influence: instrumental, conceptual, and political. While *instrumental* use and influence entail indicators as direct input to policy making, *conceptual* use and influence occur when indicators help to constitute a broad information base for decisions by shaping conceptual frameworks, mostly through dialogue, public debate, and argumentation, thus resulting in "enlightenment" (Weiss 1999).[4]

Indicators can also generate overtly *political* use and influence. This can entail symbolic use and influence, where knowledge creation is a substitute for action or a delaying tactic (Vedung 1997; Ortega-Cerdà 2005). Indicators can serve as "strong justification" (Stirling 2006) by helping to justify predetermined positions and to persuade various actors about the qualities of policy plans that are already well on their way toward implementation (Hezri and Dovers 2006). Some types of indicator use have been framed as "misuse", involving, for instance, distortion or omission of significant elements (Grupp and Schubert

2010: 76). However, in the form of "weak justification" (Sitrling 2006), this type of political use and influence can also constitute an essential source of democratic legitimacy, or a form of advocacy for socially progressive objectives such as sustainable development (Parris and Kates 2003). Terms such as "misuse" and "shared concepts" are not neutral, and beg the question of who is to determine what counts as "misuse" and who defines the "shared concepts".

The perspective drawing a distinction between use and influence as described above partly calls into question Turnhout's (2009) claim that to be effective as boundary objects, indicators must rely on classifications that have become "invisible" and unquestioned. If the shape and framing of indicators are contested, indicators would be rejected and thereby fail to fulfill their function as boundary objects. However, this conceptualization seems to downplay those forms of political and conceptual influence that stem from disagreement, argumentation, contestation, and even protest. Controversies over, for instance, the proper definitions of indicators may not promote policy consensus, but they can crucially shape the perceptions and identities of the actors involved. The use of consensual indicators may indeed strengthen the prevailing framings and status quo rather than trigger change. Conversely, even when an indicator or an indicator set is not actively used, the classifications and framings embodied in the indicator system often exert significant influence.

Factors That Help to Explain the Use and Influence of Indicators

The second part of our analytical framework consists of the factors that could help explain patterns of use and influence. We build on Pregernig's (2000) typology of three factors governing knowledge uptake: the information itself (indicator factors), the knowledge and experience of the receiver (user factors), and the external settings (policy factors).

Indicator factors include the quality[5] of the indicators. *User factors* consist of the "repertoires" of the actors involved in indicator production and use.[6] At the individual level, repertoires can be conceptualized as "stabilised ways of thinking and acting" (van der Meer 1999: 390) governing, for instance, the individual choices among the information available and the ways in which an actor positions him- or herself in relation to an indicator or indicator development process (Hezri and Dovers 2006). At the collective level, repertoires relate to the "stabilised codes, operations and technology" (van der Meer 1999: 390)—in our case, for instance, the degree to which the use and production of indicators is part of an organization's operational routines. Particularly crucial is the match between the implicit or explicit conceptual model underpinning an indicator and the repertoires of the users involved (Turnhout 2009): to what extent does the framing of reality inherent in an indicator correspond with the framings held by the policy actors? *Policy factors* denote the "metasetting" within which indicators are produced and used. These include the long-term framework conditions, the short-term shifts in governing coalitions, and the characteristics of the policy issues at stake (Sabatier 1987).

Indicator, user, and policy factors are interdependent and partly overlapping. Their meaning varies according to the place in which an actor situates him- or herself along the continuum between the two opposite framings, described by Rametsteiner et al. (2011) as the "knowledge-production" and the "norm-creation" perspectives. The former emphasizes the

search for scientific, technical, objective knowledge—and, by implication, portrays indicators as objective data—while the politically driven "norm-creation" perspective stresses the balancing of norms, values, and interests in indicator work. The former framing would place indicator factors at the heart of the analysis, whereas the latter would emphasize the policy factors. According to Rametsteiner et al., both perspectives often downplay the normative dimension of indicator development: the science-driven perspective adheres to a strict separation of science and policy, while the norm-creation approach tends to forget the normative aspects involved in knowledge creation (ibid.: 62).

Combining the two categorizations results in a simple matrix describing the ways in which the three factors combine to shape the degree to which an indicator is used and influences policy instrumentally, conceptually, or politically. The matrix in table 1 should be read in the first instance by its columns: once a particular type of use or influence—or its absence—has been identified in a given policy situation, explanations can be sought at the three levels of indicator, user, and policy factors described above.

	Use and Influence		
	Instrumental	***Conceptual***	***Political***
Indicator factors			
User factors			
Policy factors			

Table 1: Theoretical framework.

Table 2 presents the two highly different sets of indicators that we examined in our case studies. The EU SDI-Cs are highly aggregated, inherently cross-sectoral, and aimed at awareness raising and communication. The UK ESIs, in turn, are far more disaggregated, limited to one sector, and aimed mainly at monitoring progress.

Composite indicators for sustainable development (SDI-C)	***UK Energy Sector Indicators (ESIs)***
Social sphere: main focus of analysis on the Human Development Index, less detailed analysis of Happy Planet Index, Worldwide Governance Indicator, and Human Well-Being Index. Environmental sphere: main focus on Ecological Footprint, less detailed analysis of Living Planet Index, Ecosystems Well-being Index, and Environmental Performance Index. Economic sphere: main focus on Genuine	Four headline indicators: 1. Low carbon: Greenhouse gas and carbon dioxide emissions 2. Reliability: Gas and electricity capacity margins - maximum supply and maximum demand 3. Competitiveness: Overall competitiveness score for selected EU energy markets 4. Fuel Poverty: Number of households in fuel poverty 28 supporting indicators (see annex A).

Savings, less detailed analysis of Index of Sustainable Economic Welfare, Corruption Perception Index, and Gini Index.	About 140 background indicators, grouped under five headings.

Table 2: Presentation of the two sets of indicators.

The Types of Use and Influence of Composite and Sectoral Indicators

This section summarizes the results of our analysis of the role of composite sustainability indicators at the EU level and the Energy Sector Indicators in the UK.

Composite Sustainable Development Indicators (SDI-Cs) in EU-Level Policy Making

Our first case study investigated the use and influence of composite sustainable development indicators (SDI-Cs) by institutionalized actors at the EU level. The empirical material was gathered via semistructured interviews,[7] participation in indicator workshops and conferences,[8] and the analysis of sustainability-related EU policy documents.[9] Twelve SDI-Cs were examined, each classified under environmental, social, or economic pillars of sustainable development (see table 2).

Absence of Instrumental Use: Lack of Demand or Mismatch between Supply and Demand?

In contrast with earlier literature, which attributes the multiplication of indicators to an increasing demand for tools to inform policy analysis (e.g., Rosenström 2002; Gudmundsson 2003), our findings showed weak or missing demand for SDI-Cs, and as a result, lack of instrumental use (Sébastien and Bauler 2013). Decision makers expressed a need for SDI-Cs to obtain a quick overview of sustainability and insight into current debates, to get an idea of what is measurable and what is not, and to enable comparisons. Yet, these same individuals suggested that the overwhelming number of composite indicators currently available would aggravate the problem of ambiguity. A number of factors can explain this discrepancy between "demand" and "supply".

First, most of our EU-level informants had a poor knowledge of the analyzed SDI-Cs. They generally were only aware of the Ecological Footprint and the Human Development Index, and often argued that they were not specialists of sustainable development. They did not feel directly concerned by sustainability indicators, which are generally designed for both policy makers and the society at large, and whose functions were seen as unclear and ambiguous due to their double role as decision-making aids and tools for advocating alternative worldviews. Our informants considered disaggregated indicators as more useful and influential than SDI-Cs. Also, the communication of SDI-Cs was seemingly not tailored to the needs of EU-level policy actors. Our informants argued that due to the inherent subjectivity of SDI-Cs—in combination with the complexity and the nature of sustainable development as a poorly defined policy area—practically every step in these indicators' production and diffusion would be "arbitrary".[10]

Conceptual Influence: SDI-Cs as "Framing Indicators"

If SDI-Cs are not used instrumentally, they nevertheless appear to exert indirect, conceptual influence. SDI-Cs are "framing indicators" that shape visions and frameworks of thought, mobilize action, and generate awareness and symbolic images (Weiss 1999; Amara et al. 2004), thereby possibly influencing future decisions. SDI-Cs can provide a conceptual framework, open for interpretation and application, that helps to organize diagnostic and prescriptive inquiry, form a "meta-theoretical language" enabling comparison between theories, and engender collective understanding of sustainability (Sonntag 2010). In this sense, SDI-Cs are theory-driven and have a strong conceptual element, allowing discussion on new paradigms rather than providing unambiguous and targeted policy advice. SDI-Cs were also used politically as ammunition in the efforts of policy actors to legitimize their positions, worldviews, and visions of sustainability.

Explaining the Lack of Direct Use and Influence

Policy factors were central in explaining the use and nonuse of the SDI-Cs. The failure of sustainable development to become an overarching reference point in EU-level policy making, the sheer breadth of sustainable development as a policy area, and the emergence of well-being and the associated indicators (WBIs) as a new master frame replacing sustainable development were believed to compromise the take-up of SDI-Cs.[11]

In terms of institutionalization (Beyer and Trice 1982), our findings suggest that WBIs are in the societal "adoption phase", generating "affective reactions" (including discussions about their role within society), whereas SDI-Cs would be at the more advanced "implementation phase", generating instead "receptive reactions" (i.e., discussions about how well messages are being understood and appropriated by different actors). WBIs engender interest, surprise, and dialogue among the interviewed policy actors, whereas SDI-Cs tend to generate conflict among producers and actors about their potential use. Many of our interviewees were disillusioned by SDI-Cs, and placed their hopes on WBIs as a framework that could be more instrumental for change.

The lack of coordination and harmonization across the various EU institutions in sustainable development–related indicator work further helps to explain the modest degree of use and influence of composites. The EU sustainability policy appears to rely on different indicator sets based on contradicting conceptualizations of sustainable development proposed by different EU bodies,[12] and characterized by multiple separate but overlapping policy streams and frameworks (Saltelli et al. 2010). Some of our informants argued that this would not be a problem as such, since decision makers are free to choose those indicators that best suit the policy objectives of the moment. In principle, by evoking different paradigms, SDI-Cs could nevertheless shake up stabilized codes and repertoires and open up new ways of representing reality.

The influence of SDI-Cs seemed to be conditioned by negotiations among a limited number of privileged interest groups promoting rival worldviews. For example, according to some interviewees, some actors oppose the Ecological Footprint for fear of the radical change of policies that the indicator would call for. In the terminology of Turnhout (2009), the

Ecological Footprint indicator therefore failed as a boundary object largely because of an excessive distance between the underlying values and preferences between the different "social worlds" that the indicator was deemed to connect.

The perceived poor legitimacy of the producers of the SDI-Cs further reduced their influence. Many of the traditional composite indicators (including gross domestic product) were designed by experts upon specific demand from decision makers. By contrast, SDI-Cs are typically proposed "upward" to decision makers and "downward" to society at large by a variety of "midlevel" actors such as nongovernmental organizations and think tanks; SDI-Cs could therefore be labelled *middle-up* and *middle-down* indicators (Sébastien and Bauler 2010). However, as intermediaries between civil society and the political/institutional sphere, these organizations are not perceived as legitimate enough to impose their indicators in the public and political arenas.

Finally, in comparison with policy and user factors, indicator factors explained little of the indicator use and influence. Some methodologically robust SDI-Cs remain widely unused, while other indicators, often acknowledged to be of poorer quality, have been adopted because they generate little conflict. A greater conceptual robustness and precision hence tended in fact to reduce the ability of some indicators to operate as a boundary object.

Table 3 summarizes our results according to our framework and highlights the main types of use and influence.

	Instrumental	***Conceptual***	***Political***
Indicator factors	Demand for SDI-Cs unspecified	Indicator quality of minor importance	Divergent policy requirements regarding data within EU
User factors	Low awareness of SDI-Cs among policymakers Unclear target groups (policymakers and society)	Fundamental normative disagreements concerning visions and worldviews	Lack of legitimacy and trust in mid-level actors that produce indicators
Policy factors	Lack of harmonisation of indicator work across EU bodies	Rising well-being discourse and decline of SD as the overarching normative reference	Rising well-being discourse and decline of SD Multiplicity of policy streams within EU

Table 3: Summary of factors explaining the use and influence of SDI-Cs at the EU level.

Energy Sector Indicators in the UK

Our second case study analyzed the role of the UK Energy Sector Indicators (ESIs) introduced in 2003 to help follow the progress toward the four overarching policy goals set out in the government's energy white paper (DTI 2003): tackling climate change, ensuring the reliability of energy supply, fostering competitive energy markets, and eradicating fuel poverty. The set consisted of one headline indicator for each of the four goals; 28 supporting indicators (11 relevant to the climate goal, seven to energy security, five to competitiveness, and five to fuel poverty; see appendix A); and 140 background indicators. The case study was based on the analysis of government documents relating to the ESIs; semistructured interviews with 15 experts, stakeholders, and civil servants from the energy sector; participant observation in a stakeholder workshop on energy sector indicators organized as part of the research project; and an analysis of the treatment of indicators in the UK national press.

Absence of Instrumental Use: Does Anybody Want Energy Indicators?

The initial aim of the case study was to examine the extent to which the ESIs had contributed to the observed shift in (1) the priorities in energy policy in favor of energy security and to the detriment of climate change mitigation and (2) the policy style, which again returned to the earlier authoritarianism after a brief interlude of participatory policy making in the early 2000s (MacKerron 2009). However, this research objective had to be abandoned as evidence about the very modest role of these indicators in UK energy policy began to accumulate. The ESIs can, indeed, be considered as a prime example of nonuse of indicators. The UK department responsible for energy policy[13] published these indicators in its annual reports on the implementation of the white paper's conclusions and recommendations. However, not only were even many energy policy insiders unaware of the existence of the ESIs, but a clear target group of indicator users seemed not to have been identified prior to the introduction of the indicator set. According to the civil servants responsible for the ESIs, these indicators were produced because the Department of Energy had a legal obligation to do so. As in the case of the SDI-Cs, these indicators were essentially supply-driven.

The origin of the ESIs can ultimately be traced back to the evidence-based policy agenda introduced by the New Labour government in 1997. Many interviewees evoked the need to strengthen the government's accountability toward the public as the main function of the ESIs. However, energy indicators in general and ESIs in particular are not prominent among the types of evidence underpinning policy making in the UK energy sector. Time and again the interviewed energy sector authorities underlined that indicators were only a minor part of the broad evidence base used by government officials responsible for energy policy. The very limited response rate to our numerous requests for interviews and/or participation in our stakeholder workshop further attested to such a lack of interest,[14] as did the nearly complete absence of reference to the ESIs in the national press. The mere notion of indicators seemed to have only little resonance in the energy sector, and the interviewees held rather ambiguous and partly contradictory views on the nature of indicators. On the one hand, both government and private sector informants argued that core evidence for energy policy comes

from "raw" data, statistics, cost-benefit analyses, and scenarios[15]—not from indicators—yet they frequently equated the word indicator with data and statistics, or alternatively downplayed the importance of indicators, presumably perceiving them as an inferior and excessively subjective form of information. Implicitly, our informants usually adhered to the "science-driven" view of indicators as boundary objects (Rametsteiner et al. 2011), and saw the involvement of politics in indicator work as undesirable.

The energy sector authorities have sought to better match the supply with the demand for indicators, notably by opening up the indicator producer community to users/stakeholders, in response to recommendations by the National Statistics Authority's recent assessment of the ESIs (UKSA 2009). However, despite the explicit request expressed in the 2009 and 2010 ESI reports, no stakeholder comments and suggestions on the indicator set had been received by May 2011, which further indicates the lack of interest in the ESIs.

The Importance of Political Influence: ESIs as "Ammunition"

Despite the scarcity of active use of the ESIs in policy making, the set nevertheless generated influence, notably through the processes of indicator design. The cross-departmental Joint Energy Security of Supply working group (JESS), established in 2001, was influential in framing debates, building consensus, and creating networks among different authorities concerned with energy sector policy and indicators. The creation of the JESS group as such showed a heightened awareness of energy security challenges within the government. While the ESIs clearly did not drive policy, they were used by the government to justify changes in policy priorities and measures, notably in favor of energy security.

The interviewees usually could not identify clear instances of political use of the ESIs, but frequently referred to the use of indicators in general (not only the ESIs) by different policy protagonists to support their views. Often such use of knowledge to justify preestablished positions was portrayed as illegitimate manipulation. To a modest degree, ESIs were used as political ammunition. Environmental action groups used the CO_2 and fuel poverty indicators to criticize the government for its failure to reach its own targets, whereas the government used the competitiveness indicator both domestically and internationally to promote and legitimize energy market liberalization.

Explaining the Lack of Direct Use and Influence

The most frequently evoked weaknesses in the indicator factors were lack of policy relevance and timeliness of the ESIs, including too high a level of aggregation (national instead of subnational level), lack of indicators to measure the cost-effectiveness of government policies, and long lead times in producing indicators. Instead of the usually backward-looking information provided by indicators, forward-looking scenarios and cost calculations were considered more useful forms of evidence. High quality of the indicators was not a necessary prerequisite for influence: for instance, the technical flaws in the fuel poverty headline indicator were recognized by many—including its designers—yet it was identified as among the strongest in generating policy debate and action.

The role of the user factors can best be seen as coupled with the general institutional

and political context. First, there is an apparent absence of an "indicator culture" within the UK energy sector, and many of our informants downplayed the importance of indicators as evidence, contrasting indicators with data, scenarios, and cost-benefit analysis. The portrayal of indicators as neutral data or "science" on one hand but an inferior and simplified form of evidence on the other appeared surprising in view of the evidence-based policy culture and rhetoric in the UK (Hood 2007). This may in part result from the dominance of engineers and economists in the UK energy sector: in these professional communities, hard data and statistics tend to occupy a privileged position as evidence. The long-standing "market fundamentalism" characterizing the UK energy policy (Rutledge and Wright 2011), with mainstream economics as its dominant analytical framework and statistical "raw" data as its preferred form of evidence, probably further undermined the potential of indicators to influence policy.[16] The organizational short-termism of the British civil service was also evoked, as the quick turnover of civil servants (two to three years at the same post) effectively prevents the emergence of "indicator champions" that would actively foster the adoption and use of indicators within their organization.

Especially the government interviewees underlined repeatedly, and without being prompted by the interviewer, the neutrality and objectivity of governmental indicators and statistics. This can be understood against the background of the widespread mistrust in government institutions and especially its use of evidence (Bickerstaff et al. 2008), shaped by the country's analytical yet adversarial policy style (Greenaway et al. 1992: 59). In an adversarial policy context the legitimacy of policy arguments depends on the ability of policy actors to present persuasive analytical evidence, probably making strategic and political use of indicators and statistics more likely than in a more consensual and "holistic" (Gambetta 1998) policy culture. Furthermore, given the late arrival of the evidence-based movement in the UK energy sector, the government officials are probably keen to shed the still-prevailing reputation of a sector dominated by strong lobby groups and ideology rather than evidence-based policy.[17]

As for the characteristics of the policy issues at stake, some of our informants suggested that the rapid changes in climate and energy science and policy quickly render indicators obsolete. Moreover, it seems that the "process use" tends to decline as the degree of consensus on the issue at hand increases. Fuel poverty and energy security indicators probably benefited from the lack of consensus on the terminology: the continuous contestation over the definition of fuel poverty throughout the years[18] can be seen as an essential part of "process use", whereas the increasing priority of energy security on the policy agenda probably fuelled discussions among experts on the appropriate definition and indicators of energy security.

Finally, the all-encompassing role of performance measurement systems within the UK government contrasted with the weak direct influence from the ESIs, and highlights the importance of financial and legal incentives: in the absence of tangible consequences from performance measurement on the policy actors, the indicator is unlikely to generate effects.

Table 4 summarizes the results from the UK case study.

	Instrumental	***Conceptual***	***Political***
Indicator factors	Lack of timeliness, relevance; too high a level of spatial aggregation	Framing effects from indicator development processes	Poor-quality indicators (e.g fuel poverty) used politically
User factors	Low awareness of indicators among potential users; absence of 'indicator culture'	Ambiguous perceptions of indicators: 'objective data' vs. inferior, subjective information	Political use seen as illegitimate 'politicking'
Policy factors	UK adversarial and analytical policy culture Rapid changes in climate and energy policy objectives: indicators quickly obsolete Lack of sanctions for non-compliance	Rising importance of energy security on the UK energy policy agenda	UK energy sector's "market fundamentalism" UK adversarial and analytic policy culture

Table 4: Summary of factors explaining the use and influence of the UK ESIs.

Discussion: Toward Pathways between Indicator Use and Influence?

Despite their differences in nature, objectives, and intended uses, the indicators examined in our two cases demonstrated a rather surprising degree of similarity. Table 5 combines observations from both case studies. Indicator factors played a role secondary to the user and policy factors in explaining use and influence. Indicator use was enhanced when the repertoires embodied in the indicators matched user repertoires, whereas mismatch between the indicator and the dominant repertoires strengthened political influence.

	Instrumental	*Conceptual*	*Political*
Indicator factors	Unspecified demand for indicators	Data quality of modest importance	Data quality of modest importance: lack of a consistent indicator framework; political use of poor-quality indicators
User factors	Poor identification of target groups for indicators Low awareness of indicators among users	Use when repertoires match; influence when repertoires mismatch; process of indicator development important Indicators serve to confirm existing frameworks of thought when their visions match the policy context	Lack of trust in producers Indicators are potentially disruptive and transformative when there is a mismatch between indicator framings and actor repertoires
Policy factors	Changing policy agendas render indicators obsolete and irrelevant	Shifting policy priorities (rise of well-being & energy security; relative decline of SD and climate)	Adversarial and analytical policy style fosters strategic and political use Strength of key policy ideas in policy debates as a determinant of indicators' political influence

Table 5: Summary of findings from the two case studies.

Mismatch Between Demand and Supply: Modest Instrumental Use and "Irrelevance" of Indicator Factors

Especially indicator producers and specialists felt widespread frustration for the lack of significant instrumental use and influence of indicators. The lack of clear demand explained the weakness of instrumental influence in both cases, while especially SDI-Cs and headline indicators were poorly suited to instrumental use.

The relative insignificance of the indicator factors, that is, the type and quality of the indicators, was exemplified, for instance, by the fact that the fuel poverty headline indicator in the ESI set and the Ecological Footprint were criticized for their poor quality, but were among the politically most influential of the examined indicators. Yet, key user groups considered high technical and scientific quality as a prerequisite for the acceptance and hence the use of indicators.

"Process Use" and the Legitimacy of Indicator Producers

SDI-Cs and ESIs differed with regard to their "process use". Both were produced through highly expert-led processes, failing to generate influence beyond expert circles. However, the development of some indicators that were subsequently integrated into the ESI set (especially the fuel poverty and energy security indicators) significantly enhanced shared understandings. The SDI-Cs, in turn, were designed by groups of experts dedicated to shaping problem framings, conceptual frameworks, belief systems, and policy agendas. In doing so, these indicators likewise served political persuasion and advocacy for specific worldviews and political visions.

The credibility of the indicators crucially depended on the reputation of their producer, as demonstrated by the distrust felt by the potential users of SDI-Cs toward the "midlevel actors" as indicator producers. In the UK case, legitimacy appeared significant to the extent that the erosion of trust in traditional scientific and technical expertise—a prime driver behind the evidence-based policy movement in the UK—prompted the relevant government officials to vigorously defend the independence and objectivity of the indicators. However, such persuasion may prove counterproductive: the more forcefully the government stresses the point, the more suspicious the public may grow concerning that very objectivity.

Conceptual and Political Role(s) of Indicators: The Virtues of Justification and Controversy

The use of indicators as "ammunition" in political debates was among the most visible of the various indirect pathways toward influence. Many of the SDI-Cs were designed for political advocacy, persuasion, justification, and critique, while the four "headline" indicators within the UK ESI set served a similar function. Together with the increasing abundance of indicators, this may help policy makers "cherry-pick" only those indicators that suit their own interests. However, some of the examples of indicators as "ammunition" illustrated the systematic downplaying of the normative dimensions of indicator work, as conflicts between worldviews were hidden in debates on methodology. Intended to shape and advocate worldviews and framings, both the SDI-Cs and the UK ESI headline indicators reflected the "norm-creation" perspective of Rametsteiner et al. (2011). And yet, the great emphasis that indicator experts placed on the need to isolate indicator production from any political "interference"—that is, political use of indicators—demonstrated the dominance of the "knowledge-production" perspective. Such an apolitical reading of indicators tends to limit the capacity of conflict and controversy to enhance the robustness of evidence (Chateauraynaud 2011). From this perspective, strategic and political use of indicators, manipulation, and even abuse of indicators constitute essential elements in the production of valid and reliable evidence.

Conclusions

As "boundary objects", indicators constantly renegotiate and reposition themselves against policy contexts, repertoires of users and producers, and robustness of data. Indicator influence usually results from the interaction of indicator, user, and policy factors, rather than from any one of the three factors in isolation. Describing what indicators "do" and why, using terms such as "use", "influence", and "factors", therefore does not allow one to identify overarching and general patterns that would explain the roles of indicators in various policy situations. Searching for generic "indicator pathways", that is, systematic mechanisms that link use and influence with policy, indicator, and user factors, seems futile and may hide rather than illuminate the context-dependent dynamics at play. By implication, developing a prescriptive theory of indicator success, that is, a set of rules that would maximize the likelihood of policy uptake of indicators, would go against the lessons from research on the role of knowledge in policy making.

However, the call for caution with regard to attempts at "engineering" the policy uptake of indicators does not warrant inaction. Instead, it should lead to constant negotiation among the policy actors in the spirit of "reflexive governance" (Beck 2006; Newig et al. 2008), which entails the idea that "thinking and acting with respect to an object of steering also affects the subject and its ability to steer" (Voss and Kemp 2006: 4). Enhancing the policy uptake of indicators would imply "politics of policy indicators", that is, doing not only politics with indicators, but explicitly addressing the politics inherent in the processes of indicator development, use, and influence.[19]

Such "politics of policy indicators" would also call into question the view, implicitly or explicitly endorsed by many of our informants, of reduction of ambiguity as an overarching objective for indicator work. In our case studies, indicators frequently failed as boundary objects, largely because of the mismatch between the different "repertoires". However, this draws attention to another recurrent problem in indicator work, namely, the systematic tendency of policy actors to drive toward closure of policy problems and framings instead of opening up perspectives and policy options (Stirling 2006). If boundary objects draw their strength precisely from their sufficiently vague and ambiguous identity, the reduction of ambiguity seems misguided, as it would indeed drive toward the "closing down" of decisions and perspectives by providing unambiguous answers to inherently intractable and multifaceted problems, thereby confining indicators to one and a single disciplinary perspective or "social world". Enhancing reflexivity would require opening up the debates and perspectives, highlighting the ambiguities, trade-offs, uncertainties, and conflicts between different perspectives and worldviews, and explicating rather than suppressing controversy as a distinct approach to "boundary work", helping make explicit the usually taken-for-granted framings underpinning the indicators in question.

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Appendix A: The 28 Supporting Indicators of the UK ESI Set, as Presented in the First ESI Publication (DTI 2004)

Low Carbon Economy	1.1. Carbon dioxide emissions on an IPCC basis and measurement toward targets 1.2. Final energy consumption by sector 1.3. Carbon dioxide emissions per unit of GDP 1.4. The energy ratio 1.5. Share of fuels contributing to primary energy supply, fossil fuel dependency 1.6. Proportion of electricity generated by renewables 1.7. Utilization of CHP capacity 1.8. Energy consumption (intensity) 1.9. Energy intensities for road passengers and freight 1.10. Specific energy consumption for households 1.11. Average new CO_2 emissions
Reliability	2.1. Electricity-generating capacity, average load factor, and simultaneous max load met for major power producers 2.2. Gas capacity—maximum supply, maximum demand, and peak 1 in 20 winter estimated demand 2.3. Security and availability of electricity supply for the average customer 2.4. Shares and diversity of fuels used for electricity generation 2.5. Diversity of primary energy supply 2.6. Diversity of oil imports 2.7. Diversity of supply of primary fuels
Competitiveness	3.1. Changes in the productivity of the energy industries 3.2. Percentage of gross value added accounted for by energy expenditure 3.3. Fuel prices indices for the industrial sector 3.4. Industrial gas prices within the EU and G7 3.5. Industrial electricity prices in the EU and G7
Fuel Poverty	4.1. Total number of households in fuel poverty 4.2. Trends in fuel poverty by severity 4.3. SAP rating of households in the lowest 30 percent of income groups and average SAP rating for England 4.4. Fuel prices indices for the domestic sector 4.5. Fuel expenditure as a percentage of total expenditure by income group

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Notes

[1] POINT received funding from the EU 7th Framework Programme on research under the grant agreement number 217207. For more information, see http://www.point-eufp7.info.

[2] Examples of such perceptions of indicators as objective measurement tools are easy to find in the literature. For instance, the developers of the Environmental Sustainability Index (ESI) argue that

"[t]he ESI moves us toward a more analytically *rigorous and data driven* approach to environmental decision making" (*YaleNews* 2002).

[3] Influence is therefore close to the concept of *portée* (in English, "reach" or "extension"), which Chateauraynaud (2011) employs to describe the role, status, and the actual strength of an argument in a public controversy.

[4] Weiss (1999, 471) defines enlightenment as "the percolation of new information, ideas and perspectives into the arenas in which decisions are made."

[5] Including in particular the conventional determinants of the quality of scientific information such as *validity*, *reliability*, *specificity*, and s*ensitivity* to changes, but also more broadly aspects relating to the structuring of data, selection of the variables, weighting schemes, timeliness, robustness of the methodology, availability of accurate and appropriate data sources, methods of communication, construction, aggregation, and presentation of indicators.

[6] The term "user" hence denotes in our framework the full range of actors involved in the production and use of indicators, and not only the intended users.

[7] Twenty-four interviews were conducted within the direction of the European Environmental Agency, the Environmental Commission, DG officers (DG Environment, DG Research, DG Education, DG Internal market), and EUROSTAT experts.

[8] Such as the Sustainable Development Indicators working group within EUROSTAT (Luxemburg, 2009–2010); the OECD World Forum (Korea, 2009); the conference on Beyond GDP and Ecological Footprint (Brussels, 2009); and the EPIGOV (Environmental Policy Integration and Multi-Level Governance) final conference (Brussels, 2009).

[9] EU's growth strategy Europe 2020 (http://ec.europa.eu/europe2020/index_en.htm); EU Sustainable Development Strategy (http://ec.europa.eu/environment/eussd/); EU's Beyond GDP initiative (http://ec.europa.eu/environment/beyond_gdp/background_en.html); indicators of the European Environmental Agency (http://www.eea.europa.eu/data-and-maps/indicators#c5=&c7=all&c0=10&b_start=0); and the EU environment-related indicators (http://ec.europa.eu/environment/indicators/index_en.htm).

[10] As one interviewee put it, these steps in the indicator production and diffusion chain would be a "matter of choice made by one particular actor at one particular moment in time for no particular reason."

[11] In the area of composite indicators, the "Stiglitz report" (Stiglitz et al. 2010) certainly contributed to this tendency.

[12] Including the EU Sustainable Development Strategy, EU 2020, the Lisbon strategy, and the DG Environment indicators.

[13] Until 2007 the Department for Trade and Industry (DTI); from 2007 to 2008 the Department for Business, Enterprise, and Regulatory Reform (BERR); and from October 2008, the Department of Energy and Climate Change (DECC).

[14] About 115 individuals were contacted through e-mail, and a second and a third invitation were sent when necessary. The personal contacts of the Sussex Energy Group researchers were mobilized in order to maximize the likelihood of positive responses. Finally, only thirteen individuals participated in our workshop.

[15] Perhaps the main way in which some actors (e.g., fuel poverty action groups) use the ESIs is as background material for their own specific indicators, for project proposals, presentations, and the like. However, the actors usually update and adapt the government indicators for their own needs, instead of using them unmodified.

[16] For instance, according to some interviewees, indicators would not be needed in areas such as competitiveness, since price signals would provide sufficient information.

[17] The existence of such a reputation was confirmed by a key energy sector advisor in an interview conducted as part of this study.

[18] The government is therefore currently in a process of redefining the concept.

[19] Similar calls have been made in the recent past on similar policy tools, for instance, toward a "politics of evaluative public policy instruments" (Turnpenny et al. 2009) and of evidence-based policy making in general (Pawson 2006).

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