



Measuring countries' environmental sustainability performance—The development of a nation-specific indicator set



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ABSTRACT

The complicated task of measuring environmental sustainability has often led to comparative evaluations of national performance using ranking lists and generic policy targets. In this paper, a set of national environmental indicators is determined through the deployment of a five-stage methodology, which includes the use of focus group research and formation of an expert team to guide the process, selection of an initial pool of pre-existing indicators, establishment of criteria to guide the selection process, and setting of appropriate policy or trend-based targets given the nation-specific context. The nations of Iceland and Norway are used as case studies to demonstrate an effective means of communicating indicator outcomes over time. National performance is first evaluated on an indicator-by-indicator basis and then summarised overall through a system of traffic lights and radar charts for trend and target-based indicators respectively. Via this analytical process, it also becomes clear that data shortages partially constrain the extent to which a nation's environmental sustainability performance can be deciphered. Improved data collection is necessary connected to the measurement of several environmental issues on a national scale, particularly the sustainability of fisheries, soil erosion and biodiversity.

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1. Introduction

Measuring environmental sustainability and considering progress towards or away from related policy objectives is a complex operation. The comprehensive review by Olafsson et al. (2014) concluded that environmental sustainability indices, such as the EPI, EF and HPI, are currently only a starting point on the road to measuring a country's environmental sustainability performance. Use of expert judgment and incorporation of nation-specific analysis (including the setting of target standards) is always necessary to supplement the information contained within existing environmental indices, as this enables a holistic assessment to be formed (Moldan et al., 2012).

Improvements to the evaluation of environmental sustainability can be achieved through the creation of a set of indicators partic-

ular to similar nations or regions. Olafsson et al. (2014) discussed the formation of a set of environmental sustainability indicators suitable for nation-state analysis. Briefly, in the discussion section of their paper, the authors sketched out the framework for such an indicator set, bracketing indicators according to the six environmental sustainability themes of (1) energy performance; (2) waste management; (3) air quality and pollution; (4) water quality and pollution; (5) land use, agriculture and fisheries; and (6) biodiversity, forests and soil degradation.

Following on from the work of Olafsson et al. (2014), the aim of this paper is to communicate in detail an easily understood and transparent methodology for selecting indicators of environmental sustainability that can be applied to any country, leading, ultimately, to the formation of a comprehensive assessment of their environmental sustainability performance. This paper first reviews the usefulness of a pool of existing environmental sustainability indicators, considering their suitability with regards to the criteria of policy relevance, utility, soundness and data availability. Next, for each selected indicator and where recognised national or international target standards exist, these are determined for

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the two case study nations of Iceland and Norway.¹ These two Nordic nations are chosen for analysis due to their apparent environmental commonalities – both generate a very high proportion of electricity from renewable energy sources, while, at the same time, they are still transitioning towards an economy less reliant on fossil fuel consumption, particularly in the fisheries and transport sectors (Ingebritsen, 2012). However, the case studies will reveal considerable variations in environmental sustainability performance and provide an evidence base in support of the use of differentiated indicator targets to ensure each indicator is given a nation-specific rather than generic, regional context. In so doing, this paper's method will maintain the political relevance of the chosen indicator set, acting as a potential trigger for the instigation of improved policy initiatives for more environmentally sustainable outcomes in the future.

This paper is organised as follows. Section 2 begins by providing an overview concerning environmental sustainability and the role of indicators. Building on these initial understandings, Section 3 outlines the methodological approach and rationale for this paper's choice of certain indicators, target standards, and evaluative techniques. Section 4 details the available data and outcomes pertaining to the case studies of Iceland and Norway. The approach to the analysis in these case studies is succinct and largely illustrative of the practical application of the methodology, aiming to merely sketch out a brief commentary. In Section 5, the summary and discussion appraises the environmental sustainability performance of Iceland and Norway using two evaluative techniques: radar charts and a system of traffic-lights. Thereafter, the strengths and current practical limitations of the methodology are reflected upon.

2. Overview

2.1. Defining environmental sustainability

Often sustainable development has been interpreted as social and economic development that should also be environmentally sustainable (Brundtland Commission, 1987; Bina, 2013), but in recent years there has also been growing recognition that environmental sustainability has its own merits as a concept of importance (Goodland, 1995; WRI, 1995; OECD, 2001; Esty et al., 2005; Jordan and Lenschow, 2009; Dahl, 2012; Moldan et al., 2012). This paper adopts the widely cited definition of environmental sustainability espoused by Goodland (1995). Environmental sustainability is described as the endeavours society makes to “improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans” (Goodland, 1995, p. 3).

2.2. Introduction to indicators of environmental sustainability

The publication of various environmental indicators at the national scale is nowadays widespread (Bell and Morse, 2008; Hák et al., 2012), and they are included within annually updated publications, such as those compiled by the European Environment Agency (EEA), International Energy Agency (IEA), OECD, and World Resources Institute (WRI). The examples of Canada, which uses environmental sustainability indicators to measure progress towards their Federal Sustainable Development Strategy (ECCC,

¹ The spatial boundaries for the case studies are set by the jurisdictional boundaries of maritime states, as defined by the United Nations Convention on the Law of the Sea. Wherever data is available, the case studies analyse performance over the entire period of 1990–2011. In some cases the evaluation is less detailed due to a lack of data availability.

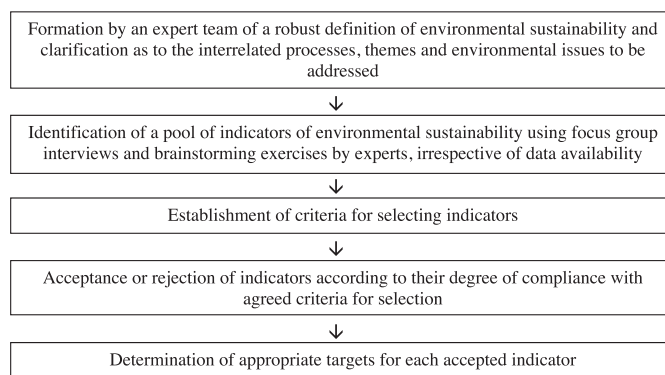


Fig. 1. Process of indicator selection.

2013), and Ireland's Key Environmental Indicators (EPAI, 2012), typify the popularity of developing indicator sets dedicated to measuring the state of the environment on a nation-specific scale.

Environmental indicators are attractive to policy-makers as they enable the formation of a transparent and easily understood way of comprehending the state of the environment (Heink and Kowarik, 2010; Dobbie and Dail, 2013). The academic literature communicates a range of arguments favouring the use of environmental indicators, including the monitoring of progress and portrayal of progress over time (Lehane et al., 1997; Olafsson et al., 2014) and provision of simplified data that clearly identifies national performance (Puig et al., 2014).

Indicators can play a central role in evaluating the effectiveness of policies implemented by measuring progress towards specific targets (DEFRA, 2003). They can also establish a basis for the setting of future policy objectives (DANTES, 2003) and communicate early-warning information concerning the changing state of the environment, indicating risk before serious harm has occurred (EPCEM, 2003). The use of environmental indicators can also increase public and political awareness of specific environmental issues (Gautam and Singh, 2010).

2.3. Selecting indicators of environmental sustainability

The selection of environmental indicators is a complex process due to their multifunctional and broad nature (Kurtz et al., 2001). Several methods exist for selecting such indicators, generally involving either a bottom-up or top-down approach. A bottom-up approach involves compiling the final set(s) of indicators after integrating the perceptions of various stakeholders, including the public (Chamaret et al., 2007). The top-down approach has certain advantages over bottom-up techniques as the insights of experts make it easier to directly link indicators to existing target standards (UNEP, 2006).

Puig et al. (2014, p. 125) argue for the use of “a rigorous validation process” when choosing indicators. This paper adopts a five-stage process to indicator selection which is closely akin to the US Environmental Protection Agency's recommended approach (EPA, 1996), commencing with the formation of a comprehensive definition of environmental sustainability, proceeding to accept or reject indicators from a large pool of options, before finally determining appropriate targets for accepted indicators. This process is summarised in the following flow diagram (Fig. 1) and described fully in Sections 2.3 and 2.4.

2.4. Importance of boundaries and target setting

The importance of boundaries or target thresholds to evaluate environmental performance has been the focus of the Planetary

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