



Innovative Applications of O.R.

## DPSIR = A Problem Structuring Method? An exploration from the “Imagine” approach

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### ARTICLE INFO

#### Article history:

Received 1 August 2011

Accepted 24 April 2012

Available online 11 May 2012

#### Keywords:

DPSIR

PSM (Problem Structuring Method)

Imagine

Coastal sustainability

### ABSTRACT

The Drivers, Pressures, State, Impact and Response or DPSIR framework has been with us for over a decade now and it is widely used as a means to assess and measure and, eventually provide a guide to managing the environment. With its repertoire of diagnostic and analytical components the DPSIR can be argued to be a Problem Structuring Method or PSM. Criticisms of the framework abound but it has a resilience which is noteworthy. Some argue that DPSIR, by its nature, is a narrowly formulated, engineering device, incompatible with the multiple perspectives which human interaction in global ecology requires. Is there a value in DPSIR being more flexible in expression and experience of users? In this article it is shown how the DPSIR framework was applied within a multi-methodology approach called Imagine in a number of coastal management projects around the Mediterranean and in other contexts. The article argues that DPSIR, whilst admittedly limited in its scope and approach can, if applied in a participatory and systemic multi-methodology, combine with other tools and help to create outcomes of value to local populations.

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### 1. Background: The DPSIR and PSMs

To make informed decisions relevant information is needed and multiple views and interpretations are helpful in order to gain balance and insight. Information is often held in the form of indicators; so, it might be expected that decision making would include the use of indicators? Building on this and looking for guidance of good practice, the first place to look for evidence of the inclusion of indicators in decision making might be in authoritative books on use of Problem Structuring Methods (PSMs)? Looking in Rosenhead and Mingers' highly quoted book (Rosenhead and Mingers, 2001) for mention of indicators or more specifically, arguably, the most used Environmental Indicator framework: DPSIR (Drivers, Pressures, State, Impact and Response) resulted in a blank (although, it needs to be mentioned here that this paper owes a debt of gratitude both in terms of domain content and inspiration for the as yet unpublished work: “A Problem Structuring Method for Ecosystem-Based Management: The DPSIR Modelling Process” by (Gregory, 2012). I was grateful to receive a pre-published version of this paper and it has been profoundly influential to my subsequent thinking).

Before progressing further it might be useful to be clear about what DPSIR is? Smeets and Weterings (1999) suggested that the DPSIR framework acts as a form of typology:

“it is becoming more and more difficult for policy-makers to grab the relevance and meaning of the existing environmental indicators, given the number and diversity of indicators presently in use. And new sets of environmental indicators are still to be expected. Therefore, some means of structuring and analysing indicators and related environment/society inter-connections is needed” (Smeets and Weterings, 1999, p. 4).

The challenge for DPSIR is to be both a precise PSM and of wider use to stakeholders. If it can be so managed DPSIR shows great flexibility and usefulness. The purpose of this paper is to show how this can be accomplished using Imagine. Emerging from this comment, DPSIR can be seen as a ‘means’ for structuring and analysing; indeed a sense making device for a policy aiding tool – environmental indicators. DPSIR is not without criticism. It has been argued to be very limited when it comes to sustainability research (for example see the discussions in Carr et al. (2007) and Wiek et al. (2011)).

In the Operational Research literature the issue of indicator use emerges on a regular basis (for an eclectic mix of various uses see: Foxon et al., 1999; Andranik, 2007; Bellotti and Crook, 2009; Choi and Bae, 2009; Medhurst et al., 2009; Ness et al., 2010; Ülengin et al., 2010). However, the collective use of indicators as a Problem Structuring Method within the DPSIR model devised by the European Environmental Agency (EEA, 1999) is, as with Rosenhead and Mingers, much less well documented.

The near invisibility of DPSIR in the Operational Research literature is not reflected more widely. The use of indicators in the

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DPSIR framework is well noted and in diverse fields (for a diverse selection from various journals see: Petit et al., 2001; Casazza et al., 2002; Elliott, 2002; Simon, 2004; Green et al., 2005; Stem et al., 2005; Mace and Baillie, 2007; Benjaminsen and Svarstad, 2008; Brenner et al., 2008; Svarstad et al., 2008; Maxim et al., 2009; Atkins et al., 2011). But, maybe an assumption is incorrect in this thesis. Can indicators, applied in a framework, be considered to be a Problem Structuring Method?

Rosenhead and Mingers say that Problem Structuring Methods (PSMs): “provide a repertoire of methods for making progress with ill-structured problem situations” (Rosenhead and Mingers, 2001, p. 9). However, they also distinguish ‘traditional’ operations research approaches and PSMs of an alternative form such as Soft Systems Methodology (Checkland, 1981; Checkland and Scholes, 1990) and SODA (Ackermann, 1996). Simplistically, the traditional methods tend to quantification, whereas, as Rosenhead and Mingers say, the ‘alternative paradigm’: “use methods or models (often in the plural, and with little or no quantification). . .” (Rosenhead and Mingers, 2001, p. 1). More tellingly, the two forms are compared and contrasted. Table 1 provides an overview of this comparison.

Rosenhead and Mingers’ types may be thought of as ideal types, representing extreme versions of two traditions but it could be argued that the traditional application of indicators in problem solving is top down, quantitative and therefore tending to the left hand column. To explore the landscape of this more fully it is useful to ask, what is the purpose of indicator based problem structuring? Smeets and Weterings suggest that environmental indicators have three purposes:

- “1. to supply information on environmental problems, in order to enable policy-makers to value their seriousness;
  2. to support policy development and priority setting, by identifying key factors that cause pressure on the environment;
  3. to monitor the effects of policy responses”
- (Smeets and Weterings, 1999, p. 5).

This tends to confirm the view that the indicators are in the left hand column of Rosenhead and Mingers’ table being intended for single decision makers, etc. What is the DPSIR framework which Smeets and Weterings describe? On p. 6 of their book Smeets and Weterings provide a ‘systems analysis’ view of DPSIR and describe it as follows (Fig. 1):

“According to this systems analysis view, social and economic developments exert Pressure on the environment and, as a consequence, the State of the environment changes, such as the provision of adequate conditions for health, resources availability and biodiversity. Finally, this leads to Impacts on human health, ecosystems and materials that may elicit a societal

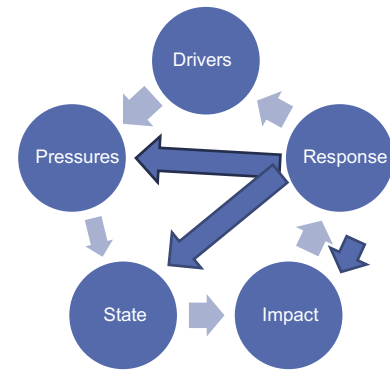


Fig. 1. The DPSIR framework.

Response that feeds back on the Driving forces, or on the state or impacts directly, through adaptation or curative action” (Smeets and Weterings, 1999, p. 6).

Such a clear definition is represented in other practice literature (three interesting applications from diverse fields of application are: Kristensen, 2004; Borja et al., 2006; Jago-on et al., 2009). But, even for a traditional view of problem solving, Smeets and Weterings’ is a simplified explanation which the authors recognise. However, their primary point is the value of DPSIR to policy makers. They argue:

“from the policy point of view, there is a need for clear and specific information on  
 (i) Driving forces and  
 (ii) the resulting environmental Pressures, on  
 (iii) the State of the Environment and  
 (iv) Impacts resulting from changes in environmental quality and on  
 (v) the societal Response to these changes in the environment”

(Smeets and Weterings, 1999, p. 6).

Thus, it can be interpreted that policy makers require information in the form of simplified indicators which come pre-labelled to denote the characteristics which they are assessing – be this a pressure on resources, a measurement of a response policy already in place, etc. The value of pre-categorising and labelling indicators does not stop at DPSIR. Smeets and Weterings also divide DPSIR indicators into types which denote descriptive, performance, efficiency and welfare characteristics – a framework within a framework. This view of a reductive tendency to reformulate the world in terms of measurable, pre-determined categories might be thought to confirm the view that indicators are a ‘traditional’ approach, dealing with data and for the consumption of experts for high level policy making. But, maybe this is a simplification? The DPSIR literature and application have evolved and extended in the last 10 years.

Reading on into the DPSIR literature a sense of greater social awareness and practicality at an operational level emerges. Elliott in his application of DPSIR to the marine ecosystem suggest six tenets for environmental management:

“Our actions have to be:  
 environmentally sustainable (i.e. good for nature now and in the future);  
 technologically feasible (i.e. with appropriate methods and equipment);  
 economically viable (i.e. at a reasonable and tolerable cost);  
 socially desirable (i.e. wanted by our societies);  
 legally permissible (i.e. within our defined laws at national and international level);

Table 1

Traditional and alternative paradigm PSMs compared.

Traditional approaches to problem solving	Alternative paradigm PSMs
Problem formulation in term of a single object and optimization	Non-optimizing; seeks alternative solutions which are acceptable
Overwhelming data demand	Reduced data demand
Scientization and depoliticization, assumed consensus	Simplicity and transparency, aimed at clarifying the terms of conflict
People are treated as passive objects	Conceptualizes people as active subjects
Assumption of a single decision taker	Facilitates planning from the bottom up
Attempt to abolish future uncertainty	Accepts uncertainty

Adapted from Rosenhead and Mingers, p. 11.

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