Science of the Total Environment 485–486 (2014) 23–30

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Models of science–policy interaction: Exploring approaches to Bisphenol A management in the EU

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HIGHLIGHTS

- Investigates science–policy interactions under conditions of uncertainty.
- Highlights limitations of this model under conditions of uncertainty.
- Explores alternative models, showing their limitations argues for a rethinking of the relationship between science, policy, and management.

ARTICLE INFO

Article history:
Received 5 February 2014
Received in revised form 7 March 2014
Accepted 7 March 2014
Available online 1 April 2014

Editor: D. Barcelo

Keywords:
Uncertainty
Precautionary
Participatory
Modern model

ABSTRACT

This study investigated science–policy interaction models and their limitations under conditions of uncertainty. In detail, it looked at the management of the suspected endocrine-disrupting chemical Bisphenol A (BPA). Despite growing evidence that BPA is hazardous to human and environmental health, the level of scientific uncertainty is still high and, as a result, there is significant disagreement on the actual extent and type of risk. Analysis of decision-making processes at different regulatory levels (EU, Sweden, and the Swedish municipality of Gothenburg) exposed chemicals risk management and associated science–policy interaction under uncertainty. The results of the study show that chemicals management and associated science–policy interaction follow the modern model of science–policy interaction, where science is assumed to 'speak truth to policy' and highlights existing limitations of this model under conditions of uncertainty. The study not only explores alternative models (precautionary, consensus, science–policy demarcation. and extended participation) but also shows their limitations. The study concludes that all models come with their particular underlying assumptions, strengths, and limitations. At the same time, by exposing serious limitations of the modern model, the study calls for a rethinking of the relationship between science, policy, and management.

1. Introduction

Environmental and human health decision making is often based on information or evidence provided by science (Kriebel et al., 2001). However, for many issues, information and knowledge are largely missing. For example, in the case of industrial chemicals, there is very limited knowledge about the toxicity and ecotoxicity of many substances and mixtures, or the number of chemicals in use and levels of them found in the environment (Rudén and Gilek, 2010; Karlsson et al., 2011).

Despite these well-known problems, management of many environmental and human health risks (including chemicals) is often based on scientific knowledge generated, for example, through risk assessments, cost–benefit analyses, and modelling (Merkhofer, 1987; Russell and Gruber, 1987; Kiker et al., 2005). From this view, a linear science–policy model is derived. In this 'modern' model, science is seen to be capable of 'speaking truth to power' by delivering value-free, objective input to rational political decision making (Funtowicz and Strand, 2007).

Whilst looking at the literature in the area of science–policy interaction, several alternatives to the modern model have been developed (Bäckstrand, 2003; Funtowicz and Strand, 2007; Pielke, 2007; Stirling, 2007; Van den Hove, 2007; Renn, 2008; De Santo, 2010). For example, nowadays it is rather common to argue for a precautionary model of science–policy interaction in chemicals management (Karlsson, 2006). Furthermore, there are several other models of science–policy interaction: Funtowicz and Strand (2007) classified them as models of consensus, demarcation, and extended participation. However, with the precautionary model as a well-studied exception, it is not known to

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http://dx.doi.org/10.1016/j.scitotenv.2014.03.046
0048-9697/

what extent and in which ways these models are used in practice, especially in the area of chemicals management.

To further investigate science–policy (risk assessment–risk management) interaction under uncertainty in practice, I selected a specific case, characterized by uncertainty and controversies — a disputed endocrine-disrupting substance: Bisphenol A (BPA) (Vandenberg et al., 2013). BPA is used in products such as plastic bottles, food can linings, plastic cups, and sealants. Exposure to BPA has been shown in studies to cause adverse health effects in animals, but clear epidemiological evidence of health effects in humans is missing (Vandenberg et al., 2013). Despite a growing flora of publications linking BPA to several toxic effects in animals, e.g. physical and neurological problems, development problems, obesity, and cancer (Maffini et al., 2006; Sekizawa, 2008), it is still debated which animal studies can be trusted as relevant and reliable for assessing risks to humans (Beronius et al., 2010). Consequently, some reports claim no concern for human health and environmental effects (Ryan et al., 2010) whilst others state the opposite (Beronius et al., 2010).

There are several reasons behind this disagreement, such as epistemic uncertainty (described, for example, in Udovyk and Gilek, 2013) on the non-monotonic dose–response curves for BPA, and on potentially sensitive windows of exposure of human infants (Gierthy, 2002; Flint et al., 2012). However, the central disagreement has been stated to mainly depend on a different type of uncertainty, connected to the risk assessor's divergent views on the reliability and relevance of non-standardized studies on the endocrine-related effects of BPA at low doses (Beronius et al., 2010). This type of uncertainty is described by Udovyk and Gilek (2013) as uncertainty in a knowledge relationship, and by Walker et al. (2003) in terms of 'too much knowledge or too different knowledge'.

A general reaction to the divergent findings from toxicity studies investigating BPA has been concerns about the suitability of using BPA in consumer products (Scruggs, 2012), as well as concerns about its further presence in the environment (Flint et al., 2012). In response to these concerns, regulations have been adopted by a number of countries and at the international level (e.g. Canada, France, and the EU). However, regulatory responses are rather heterogeneous and, in general, there is no globally agreed regulatory strategy regarding BPA.

Since management of chemicals occurs at different geopolitical levels (e.g. international, EU, national, local municipality), it is clear that management approaches and associated science–policy interactions can play out differently at the various levels. This diversity gives more opportunities to observe alternative models of science–policy interaction. In practical terms, this study zooms in on chemicals management in a particular region of Europe: Sweden, specifically the municipality of Gothenburg.

Consequently, by exploring BPA management in the region, the study aims, first, to improve the understanding of chemicals risk management and associated science–policy (risk assessment–risk management) interaction under uncertainty, contributing to the academic discourse on management under uncertainty. Second, it aims to provide food for thought and reflection on models of science–policy interaction and their limitations under uncertainty in decision making on chemicals risk in general and BPA in particular.

2. Analytical framework and methods

Chemicals management in Europe simultaneously occurs at various interconnected geopolitical levels (Udovyk et al., 2010) (see Table 1). To operationalize the research questions, I selected one particular region in Europe (EU – Sweden – the Swedish municipality of Gothenburg; see the description in Table 1). The region is a relevant case, as the governing system for environmental and health risks has been depicted as a policy pioneer (Feistel et al., 2008; Kern and Löffelsend, 2008). Consequently, the results of this study may reveal important lessons not only for chemicals management in the region, but also for other regions in Europe and elsewhere.

By describing and analysing decision-making processes linked to the BPA risk at these different levels, the study explored the science–policy interfaces. One approach to this kind of analysis is to use theoretical models of science–policy interaction (Table 2). These ideal types or models were introduced by Funtowicz (2006) to diagnose fundamental problems in the current practices of interfacing the science and policy of complex issues. However, a number of scholars from the science, technology, and society (STS) community, and from environmental and social sciences, risk research, and similar fields were engaged in developing elements of these models in their work even earlier (Bäckstrand, 2003; Funtowicz and Strand, 2007; Pielke, 2007; Stirling, 2007; Van den Hove, 2007; Renn, 2008; De Santo, 2010). Whilst developing these models or elements of them in theory, scholars identified positive as well as problematic aspects, especially under conditions of uncertainty (Bäckstrand, 2003; Funtowicz and Strand, 2007; Pielke, 2007; Stirling, 2007; Van den Hove, 2007; Renn, 2008; De Santo, 2010). At the same time, it is important to note that the models are not mutually exclusive and, thus, elements of these models can be found in combination.

In the present study, I first analysed regulatory documents to obtain basic information about management approaches to BPA as well as the institutional/structural arrangements behind science–policy interaction in the selected region. Second, I used interview results to allow for in-depth analysis of the science–policy interaction associated with various models of science–policy interaction. In parallel, I examined research publications and relevant reports.

2.1. Document study

I analysed the main BPA-related decision documents (e.g. EU decisions regarding BPA) to obtain basic information about management decisions taken regarding BPA at different levels (Table 3). The documents were retrieved from the official government web portals. At the same time, the background documents (e.g. risk assessment results)

Table 1
Geopolitical levels of chemicals management in the Baltic Sea region and key regulatory characteristics relevant to the study.

Level	Case	Key characteristics relevant to the study
EU	EU	EU regulations are always legally binding on EU Member States. Industrial chemicals fall under the REACH regulation. It obliges industries to collect or generate data and contains provisions for the registration, evaluation, authorisation, and restrictions of substances. At the same time, sectoral directives focus on particular groups of chemicals (e.g. pharmaceuticals and toys).
National	Sweden	Sweden became a member of the European Union in 1995. This obliged Sweden to fully harmonise its chemicals law with the European Union. Since then, most provisions in the various EU chemicals directives have been implemented in Swedish law. The Swedish government and authorities are continually working to achieve one of the 16 parliamentary environmental quality objectives – a non-toxic environment – and they foster national measures in addition to those agreed at the EU level.
Local	Gothenburg	Gothenburg is the second largest city in Sweden. Although many aspects of chemical policy are decided at an international or national level, Swedish municipalities often define their own local environmental objectives. For several years, the City of Gothenburg has prioritized the national goal of a non-toxic environment and implements it through Gothenburg's local environmental objectives and environmental programme.