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Adaptive management intentions with a reality of evaluation: Getting science back into policy

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ABSTRACT

In Australia's Murray-Darling Basin water reform has been contentious as government attempts to reconcile historical over allocation of water to irrigation with the use of water for environmental outcomes. However, in many aspects, scientific knowledge of the environment is either imperfect, incomplete or environmental responses are unpredictable, with this uncertainty preventing definitive policy and closure of political arguments. In response to uncertainty and knowledge gaps, adaptive management has been written into the legislation, along with provisions for periodic evaluation.

This research ascertains how adaptive management is understood by policy makers, with this indicative of future implementation of adaptive management. The way in which adaptive management is constructed by policy makers is determined through legislation, public speeches, government reports and semi-structured interviews. The findings demonstrate that adaptive management has been subsumed by evaluation. The loss of adaptive management as a distinct concept is seen as a loss of science and discovery from the policy process, with the dominance of evaluation discussed as limiting innovation and reinforcing a 'muddling through' of policy.

1. Introduction

The complexity of the environment and ongoing, often unpredictable environmental and social responses to policy means that policy becomes continual experimentation with limited repeatability and replication (Folke et al., 2005; Pahl-Wostl, 2009). In response, the integration of knowledge from different sources and types is often advocated (see Nursey-Bray et al., 2014; Raymond et al., 2010; van der Molen et al., 2016 as recent examples), as is ongoing learning (see Folke et al., 2005; Pahl-Wostl, 2009). Adaptive management, with its participatory processes and knowledge discovery focus, is now widely accepted as a necessity in environmental management (Allan, 2009; Pahl-Wostl, 2009; Pahl-Wostl et al., 2013). Adaptive management gathers knowledge from across an environment's stakeholders to plan for experimentation as part of policy development (Walters and Holling, 1990); applying a paradigm of scientific problem solving within the policy process.

Despite widespread support for adaptive management, examples of successful adaptive management have remained scarce (Eberhard et al., 2009; Wilhere, 2002; Allen and Gunderson, 2011). Challenges with stakeholder engagement and acceptance of results, the complexity of the science and resourcing issues, both time and funding have been noted elsewhere (Allen and Gunderson, 2011). It has been suggested that legislated prescription of adaptive management is needed to overcome these challenges and ensure it actually occurs (Lee, 1993).

In 2012 adaptive management became a defined term in Australian water legislation in the Murray-Darling Basin Plan (Commonwealth of Australia, 2012), providing a fit case to test these arguments for prescription in legislation. First, a brief literature review of adaptive management and evaluation is provided, followed by a description of the method used and an introduction to the case. Legislation, policy documentation and semi-structured interviews are analysed to determine the social construction of adaptive management by government. The results demonstrate that the true barrier to adaptive management is not the absence of legal requirement, but conflation of adaptive management with evaluation. The implications to water reform and more broadly, the role of science in policy are discussed.

2. Literature review

Regardless of its source (local or scientific) or type (tacit or implicit), the integration of knowledge in the policy decision making process remains at a tricky juncture with politics. Others have looked at this from the perspective of epistemology (Sanderson, 2002), discourse (Nursey-Bray et al., 2014) and communication barriers between scientists and policy makers (Laing and Wallis, 2016). The role of science in adaptive management, and policy making more broadly, introduces debate on the relationship between science and societal outcomes. To

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some there is an 'inherently intractable' problem with the unpredictable utility of research findings, whilst others assert that 'contingency, complexity and non-linearity (i.e., in the relations between science policy decisions and societal outcomes) are obstacles to accurate predictions, but they need not prevent decision-making' (Sarewitz and Pielke, 2007, p 6).

This research considers adaptive management and evaluation as two forums in which knowledge holders can seek an audience. These are opportune times in the policy process when new knowledge can come to the fore and be considered. Adaptive management, as initially conceived (see Holling, 1978), provides an opportunity for science to be integrated at policy planning, with the design of experiments to address uncertainties and gain new knowledge across a social and ecological system. This includes a wide array of scientific disciplines, from ecology and hydrology through to economics and sociology. In comparison, evaluation as a reflective process offers potential for knowledge gains on the response to policy to come to light and for this to iteratively improve policy. However, it remains the interpretation of adaptive management and evaluation by policy makers that affects how in practice, each provides potential for knowledge integration in the policy decision making process.

2.1. Adaptive management

The meaning of adaptive management has been debated over time, with adaptive management referred to as 'experimental management' (Walters, 1997), 'learning by doing' (for example, see Schreiber et al., 2004) and 'structured decision making' (Allen and Gunderson, 2011; Gunderson and Light, 2006). Across these views, there remains a consistent tenet of embedding research into policy at the time of policy development, so that policy includes experimentation that can resolve uncertainties and subsequently improve policy. Forms or types of adaptive management distinguish between active adaptive management, with multiple hypothesis testing, statistically designed experimentation and technical modelling; and passive adaptive management that monitors the response to single treatments (Hasselman, 2017; Lee, 1999; Walters and Holling, 1990).

Active and passive adaptive management both emphasise systematic and planned hypothesis testing, involve stakeholders working across knowledge disciplines, and remain strongly motivated by the need to gain knowledge of ecosystem function and address uncertainty (Hasselman, 2017). However, there are three broadly recognised types of uncertainty and the differences between them have important implications. This includes uncertainty that results from imperfect knowledge (undiscovered science), incomplete knowledge (knowledge that cannot be held individually but is collectively held across stakeholders), and unpredictability (unforeseeable futures with unknown society and environmental responses) (Brugnach et al., 2011, 2008; Pahl-Wostl, 2007). In addition to these three types of uncertainty, Pagan and Crase (2005) also note unforeseen changes to community preferences and government objectives over time.

Active adaptive management seeks to reduce imperfect knowledge with experimentation to discover new knowledge and determine the optimal solution (Walters and Holling, 1990), viewing knowledge as absolute and uncertainty as something to remove. In comparison, passive adaptive management seeks responsiveness to unpredictability. Each policy is seen as a single experiment accepting unpredictability as unresolvable, with this necessitating a responsiveness and ongoing adjustment of policy (Berkes, 2007; Brugnach et al., 2008; Huitema et al., 2009).

The context to which adaptive management is applied is important; particularly the types of uncertainty that are present in each specific case. There may also be unspoken differences in underlying epistemology that affects its interpretation (Hasselman, 2017). In this case, adaptive management is considered as a science-based activity that increases collectively held knowledge (imperfect and incomplete) and experience (unpredictability), in order to make better management decisions. The ability to change decisions based on new information is just as critical to adaptive management as the ability to gain new knowledge or bring together knowledge.

2.2. Evaluation

Evaluation also plays a significant role in policy implementation and development, supporting evidenced based policy making (Sanderson, 2002). Evaluation involves evidence collection, often referred to as monitoring, and a process of applying judgement to an evaluand; or the subject of the evaluation. As such, evaluation has been described as an appraisal or systematic assessment of merit and/or worth (Guba and Lincoln, 2001). It has variably been seen as providing for performance improvement, organisational learning, accountability for results, learning about persistent social problems and how to address them, informed decision making and democratised decision making (Alkin, 2013; Greene, 2013; Sanderson, 2002). Scriven (2013, p 169, original italics) argues that a widely held misunderstanding is "that the difference between evaluation and research is that *research* is aimed at the acquisition of new knowledge whereas *evaluation* is aimed at developing information for decision making." Scriven (2013) also draws a distinction between evaluative research and non-evaluative research, based on the distinction of value judgements that are used in evaluation to assess merit.

In Australia, evaluation has been shaped by public administration reforms in the 1980s, including the 1988 Evaluation Strategy (Rogers and Davidson, 2013). Australian evaluations have been described as concentrated to ongoing management of programs, commonly using theory driven approaches such as program theory or program logic, with emphasis on stakeholder participation (Rogers and Davidson, 2013). These program theory and logic approaches use causal pathways that articulate how policy and program activities lead to achievement of desired outcomes, with these in turn leading to achievement of objectives (Funnell, 2000). Assumptions underpinning the causal relationships may be stated, with monitoring and evaluation seeking to confirm these assumptions. In the confirmation of assumptions, causal pathways are also confirmed, achievement or contribution to achievement of outcomes is deduced, and eventually objectives are reasoned as being met. Evaluation most commonly occurs after a policy has been implemented, to test the achievement of policy (Rogers and Davidson, 2013).

In 2014 the Murray-Darling Basin Authority (MDBA) published a framework for the evaluation of the Basin Plan in which evaluation is defined as "*a systematic process in which the particular objectives and outcomes being sought guide the development of a series of evaluation questions to be asked. In this case, what will we need to know to assess if the Basin Plan is on track?*" (Murray-Darling Basin Authority, 2016 p. 6). This definition upholds a performance improvement and accountability view of evaluation, with evaluation serving a political and managerial mandate; demonstration of the intended outcomes provides accountability and validates the use of public resources.

In this context Scriven's (2013) distinction between evaluation and research is particularly pertinent as it relates to the types of uncertainty that may be resolved or identified. The main purpose of a performance and management oriented evaluation is to assess progress, through a causal pathway of outcomes, towards stated objectives. This essentially narrows the scope of investigation to testing environmental and social response to policy, or unpredictability. In this way, policy and programs remain a sequential testing of single hypothesis and evaluation is aligned with passive adaptive management. The relationships between adaptive management, uncertainty and evaluation are shown in Fig. 1.